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VALIDATING THE 'SOFT' ASPECTS OF TQM FOR ISO-9001 CERTIFIED CONSTRUCTION FIRMS IN SOUTH AFRICA

By

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A research report to the submitted to the

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in partial fulfilment of the requirements for the award of

MASTER OF SCIENCE (BUILDING) DEGREE
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August 2018

DECLARATION

I hereby declare that this research report is mine. It is being submitted for the Master of Science (Building): Project Management in Construction at the University of the Witwatersrand, Johannesburg.

It has not been submitted before for any degree or examination at any other University.



Mr. Sugendran Naicker

Signed on **August 2018** at **Johannesburg.**

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ABSTRACT

Total quality management (TQM) is often termed a journey, not a destination (Burati and Oswald, 1993). TQM is a revolutionary approach to effective management as its aimed at continuously improving the quality of products and processes by involving management, employees and suppliers to achieve customer satisfaction (Ahire et al., 1995). The question arises that, are the firm's management adept on the practice of TQM? The aim of this study was to explore the extent to which quality management representatives (QMR's) in ISO-9001 certified construction firms in South Africa are practicing the 'soft' aspects of TQM at their respective firms. TQM is associated with an entire organisation or firm with the goal of improving the firm's performance and ultimate success. The co-operation of everyone in the entire firm is targeted at delivering the needs and expectations of its clients. These aspects could be the management concepts and principles of the firm (Psychogios & Priporas, 2007). These soft aspects of TQM could assist a South African construction firm in building a "good name" reputation in the industry. Such a reputation is penned on repeat work from satisfied clients, negotiated work, preferred bidder status with numerous clients, non-adversarial approach to managing work, completion within budget and time and the like (Harrington & Wiggin, 2012).

A comprehensive review was conducted on the existing available literature to identify the 'soft' aspects of TQM principles, as documented by various authors and leading academics in the field of quality management. Ten 'soft' aspects of TQM principles were identified from the literature review. Based on the literature review and prior studies on TQM principles, a research instrument was designed. Structured interviews were then conducted with fifteen (15) quality management representatives (QMR's) at fifteen (15) ISO-certified construction firms in Gauteng, South Africa. The collected data was then analysed using descriptive statistical analysis. Firstly, such analysis used the form of averages, percentages, and graphs

for the attribute data of the respondents. Secondly, for the constructs and indicators, the measure of central tendency (i.e. the mean, standard deviation and coefficient of variation) was computed.

The main findings of this study were that of the eight valid and reliable ‘soft’ aspects of TQM principles in this study, only five ‘soft’ aspects of TQM principles were being practised by QMR’s and three ‘soft’ aspects of TQM principles were not being practised by QMR’s at their ISO-9001 certified construction firms. The study concludes that the level of agreement by the QMR’s for the identified ‘soft’ aspects of TQM principles was not deemed to be significant. Based on the findings of this study, that despite the QMR’s being cognisant of the identified ‘soft’ aspects of the TQM principles, the practice of these ‘soft’ aspects TQM principals in the ISO 9001 certified construction firms is irregular and cursory amongst QMR’s, as the level of agreement by the QMR’s for the identified ‘soft’ aspects of TQM principles was not deemed to be significant.

Keywords: TQM, Construction, South Africa, QMR, ISO-certified

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LIST OF ABBREVIATIONS

BM	-	Benchmarking
CF	-	Customer Focus
CI	-	Continuous Improvement
CIDB	-	Construction Industry Development Board
EE	-	Employee Empowerment
EI	-	Employee Involvement
ET	-	Education and Training
ISO	-	International Organisation for Standardisation
PS	-	Product/Service Quality
QMR's	-	Quality Management Representatives
RR	-	Reward and Recognition
SQ	-	Supplier Quality Management
TM	-	Top Management Commitment
TQM	-	Total Quality Management

CHAPTER 1 - INTRODUCTION

This chapter provides the background to the study. It introduces the problem statement, the research aim, objectives and methodology used in the study. The study focuses on validating the soft aspects of total quality management (TQM) for ISO-9001 certified construction firms in South Africa.

1.1 Problem Statement

Ahire et al., (1995) stated that total quality management (TQM) is the building of quality into products and processes and making quality a concern and responsibility for everyone in a firm. This responsibility spreads from leadership all the way to the employees of the firm. Therefore, commitment of management and employees in a firm are critical for the success of TQM practices in a firm. Management is a 'key driver' of TQM practice by establishing values, goals and systems to satisfy customers requirements Ahire et al., (1995). Therefore, the message of quality and TQM practice for a firm begins with firms' management and this message is then relayed through the firm. The question arises that, are the firm's management adept on the practice of TQM?

Although the principles of TQM may be known by quality management representatives (QMR's) in ISO-9001 certified construction firms in South Africa, actual practice of the 'soft' aspects of TQM by QMR's is cursory and as such QMR's tend to have a weak understanding of these 'soft' aspects. This forms the major argument of the study. Consequently, the following research questions were derived;

i. *What are the 'soft' aspects of TQM principles that are applicable for construction firms in South Africa?*
ii. *Do designated quality management representatives (QMR's) in ISO-certified construction firms in South Africa practise the 'soft' aspects of TQM principles?*

1.2 Research Aim and Objectives

The aim of the study was to explore the extent to which quality management representatives (QMR's) in ISO-9001 certified construction firms in South Africa are practicing the soft aspects of TQM at their respective firms.

The objectives of the study are to:

1) Validate the 'soft' aspects of TQM principles,

2) To study the designated quality management representatives (QMR's) in construction firms in extent of practising the soft aspects of TQM.

1.3 Significance of the study

For a firm to be more successful in both the domestic and global environments, a firm needs to set itself apart from the competition (Low & Teo, 2004). This is indeed applicable for South African construction firms competing in the South Africa's construction industry. A South African construction firm is required to build a "good name" reputation in the industry. Such a reputation is penned on repeat work from satisfied clients, negotiated work, preferred bidder status with numerous clients, non-adversarial approach to managing work, completion within budget and time and the like (Harrington & Wiggin, 2012). To attain this reputation, a construction firm is required to provide a suite of high quality products and

services that consistently satisfies its clients' expectations. Such goal/s demands that a continuous improvement process be established within the company to provide quality management. Recently continuous improvement has been referred to as total quality management (TQM) (Agha, 2014).

(Harrington & Wiggin, 2012) asserts that a need for change becomes inevitable to improve the quality objectives in of the construction industry. In addition, Nesan and Holt (1998), Love and Li (2000) affirms that quality related problems in the construction industry will remain until personnel at their respective firms in the procurement supply chain begins to take the responsibility for initiating changes within their own firm. Such changes by personnel can be initiated through the effective implementations of a total quality management (TQM) system.

The study is an attempt to address the practice of TQM amongst quality management representatives in construction firms in South Africa.

1.4 Research Methodology

The primary quantitative data was collected from respondents through structured interviews. The population identified for this research was thirty eight (38) ISO 9001 certified construction firms that are based in Gauteng, South Africa. The sample for the study was fifteen (15) quality management representatives (QMR's) at fifteen (15) ISO-certified construction firms in Gauteng, South Africa. Based on the literature review and prior studies on TQM principles, a research instrument i.e. an interview schedule was designed for this study. Structured interviews were then conducted with fifteen (15) quality management representatives (QMR's) at fifteen (15) ISO-certified construction firms in Gauteng, South Africa. The collected data was then analysed using statistical analysis.

The secondary qualitative and quantitative data was collected from the literature review of the existing published work in the field of the total quality management (TQM) by various authors. The literature review adopted in this study has been primarily based on articles from the following scholarly and research journals i.e. bodies of knowledge; the *TQM Magazine/Journal (Emerald Insight)*, the *TQM & Business Excellence (Taylor & Francis)* and the *International Journal of Project Management (Elsevier).*

1.5 Structure of the Report

This chapter introduced the problem statement as well as the aim, objectives and approach of this research study.
The rest of this research report is structured into the following chapters:

- **Chapter 1-Introduction:**
  This chapter introduced the background of the study and it focused on the problem statement, research aim, objectives and significance of the study.

- **Chapter 2 - Literature Review:**
  This chapter focuses on the review and summary of the existing literature by key researchers and bodies of knowledge in the soft aspects of total quality management.

- **Chapter 3 - Research Design and Methods:**
  This chapter describes the research design and methods that addresses the problem statement, research question, aim and objectives of the study.

- **Chapter 4 - Discussion of results**
  The focus of this chapter is on the presentation, interpretation and analysis of the data collected from the conducted interviews. This

chapter further discusses the findings and results of this study. The results are compared against that of the existing literature.

- **Chapter 5 - Conclusion and Recommendation**
  This chapter concludes the research report and summarises the main findings of the study. Further, limitations of this study and recommendations for further research are highlighted.

CHAPTER 2 - LITERATURE REVIEW

The previous chapter provided the background of this study. This chapter provides the theoretical context for this study via a review of the existing literature on total quality management (TQM) and particularly the key “soft” aspects of TQM principles.

The literature review adopted in this study has been primarily based on articles from the following scholarly and research journals such as; the *TQM Magazine/Journal (Emerald Insight)*, the *TQM & Business Excellence (Taylor & Francis)* and the *International Journal of Project Management (Elsevier),* amongst others.

The following topics are covered in the literature review:

- Total quality management: definitions, background of TQM, TQM principles, TQM in practises around the world, TQM principles and TQM constructs.
- South Africa’s construction industry: importance to the economy, a summary of ISO 9001 certification.

2.1 Background of TQM

Total quality management (TQM) is often termed a journey, not a destination (Burati & Oswald, 1993). TQM is a revolutionary approach to effective management as its aimed at continuously improving the quality of products and processes by involving management, employees and suppliers to achieve customer satisfaction (Ahire et al., 1995). Further research by Ahire et al., (1996) pointed out the performance gap between TQM and non-TQM firms and as such iterated the importance of TQM in continuously improving the firms’ performance. TQM is a long-term, ongoing

management programme that will yield returns many years after TQM being implemented (Ahire et al., 1996).

There is no universal definition of TQM (Zhang, 1999). Several authors have contributed their respective opinions on the philosophy of TQM over the last few decades. Such opinions are given below.

> *"TQM consciously focuses all parties to the common goal of systematically identifying and meeting the customer's requirements as the superordinate goal"* (Low, 1996).

> *"TQM is the mutual co-operation of everyone in an organisation and associated business processes to produce products and services, which meet and, hopefully, exceed the needs and expectations of customers. TQM is both a philosophy and a set of management guiding principles for managing an organisation"* (Dale, 1999).

> *"TQM can be viewed as a company-wide, holistic management philosophy that covers all the business operations and seeks to continuously improve them, from resource procurement and acquisition all the way up to the provision of customer support and after sale service"* (Kaynak, 2003; Yunis et al., 2013).

> *"The management approach of an organization centred on quality, based on the participation of all of its members and aiming at long-term success through customer satisfaction and benefits to all members of the organization and to society* - International Academy of the American Society, cited in Harrington and Hal (2012).

The common theme emanating from these definitions is that the key principles of TQM implementation involves everyone in the value chain i.e. from employees and management of a firm to the customers of the firm.

Low and Teo (2004) believes that the single most important determinant of the success an organisation in implementing TQM is its ability to translate, integrate, and ultimately institutionalise TQM behaviours into everyday practice on the job. Further, TQM is a way of thinking about goals, organisation, processes, and people to ensure that the right things are done right the first time.

Motwani (2001) expresses that implementing TQM is a major organisational change that requires a transformation in the culture, process, strategic priorities and beliefs of an organization.

As per the research conducted by the various authors as listed above, the definition of TQM for this study was:

> *"The management approach of an organisation centred on quality, based on the participation of all of its members and aiming at long-term success through client satisfaction and benefits to all members of the organisation and to society."*

This definition was cited in the International Academy for Quality (2016). This definition suggests that TQM is associated with an entire organisation or firm with the goal of improving the firm's performance and ultimate success. The co-operation of everyone in the entire firm is targeted at delivering the needs and expectations of its clients. These aspects could be the management concepts and principles of the firm (Psychogios & Priporas, 2007). This all-encompassing definition of TQM was established to be the working definition of TQM that is applicable for this study.

2.2 TQM practice

From the existing literature, it was noted that the development of the TQM philosophy originally took place in the manufacturing industry. Successful organisations within the manufacturing industry have embraced TQM and as such has reached excellence in their respective industry. It was also noted in the literature that TQM practice is dependent on what quality objectives or programme the organisation aims to achieve. (Mazumder et al., 2014) cites that “the pursuit of quality is being approached through the TQM philosophy”.

Various authors in the existing literature predominately referred to TQM implementation across the globe in the geographic areas of South East Asia, North American and Europe. Many studies in the TQM field were done for the various industries in many countries. Some of these studies are briefly described below.

Ahmad and Yusuf (2010) researched that Japanese companies are very successful because of the adoption and implementation of TQM principles expounded by quality gurus such as Deming, Juran, Taguchi and others.

Also, Zhang (1999) noted that Chinese firms implement TQM from 1978 onwards. However, the progress had been satisfactory, and companies experienced difficulties in TQM implementation.

Similarly, Low and Teo (2004) examined how TQM could be applied more actively in the construction industry of Singapore. They recommended a framework for TQM implementation. Figure 2.1 depicts important considerations for TQM implementation. This framework suggest that an understanding of TQM requirements is required. These requirements extend to customer involvement,

cotinous improvement, top management commitment, a review of education and empowerment plans, provision of ample budget and resources, teamwork, training and timely feedback. Low and Teo (2004) concluded their study by stating that TQM “embraces the philosophy, principles, procedures and practices necessary for providing customer satisfaction as well as achieving productivity and business performance in the construction industry. Commitment and perseverance are necessary when embarking on this journey”.

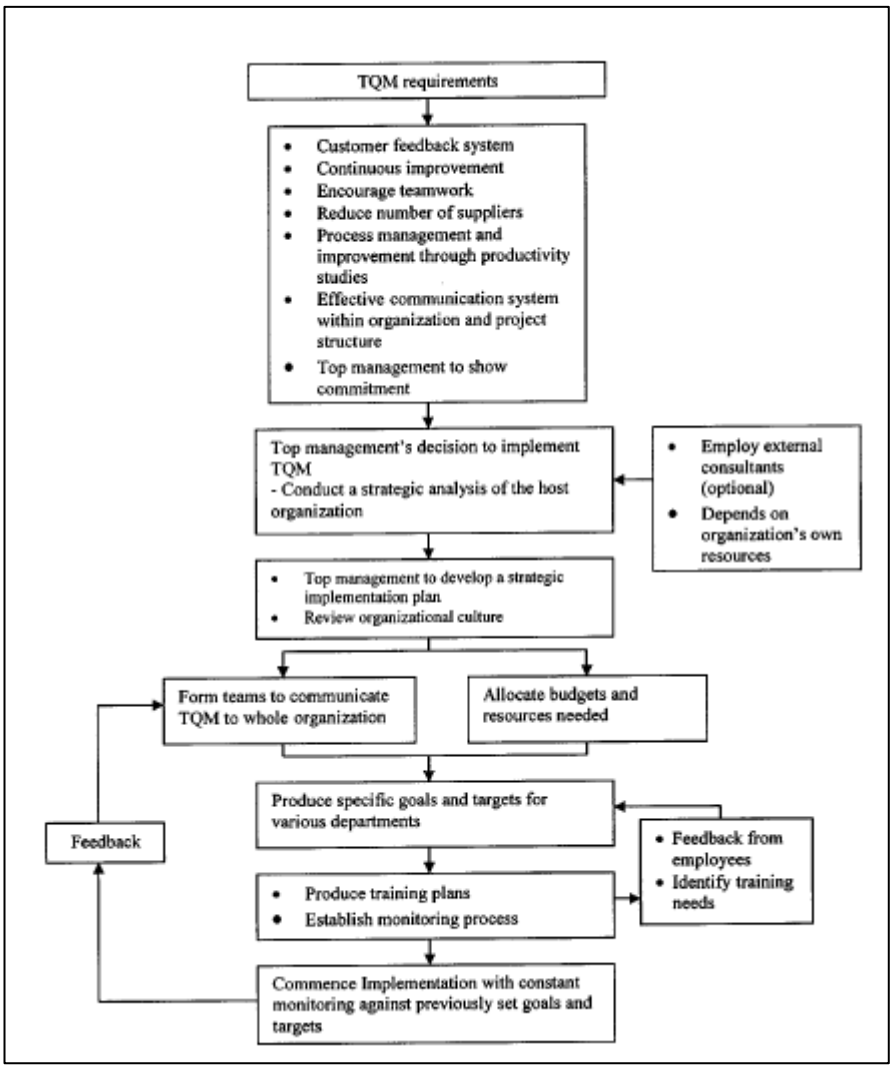

Figure 2.1 Framework for implementing TQM (Low & Teo, 2004)

The survey findings of a study conducted by Lau et al., (2016) for the consulting engineering industry in Hong Kong suggested that the

principles of top management leadership and supplier management is a short-term need. For the long term, firms should focus on organisational learning and people management.

Furthermore, Bardoel and Sohal (1999) reported the 'benefits achieved adopting TQM in seven Australian construction organisations based on case study research. The reported benefits were; better control of processes resulting in consistency from design through to delivery, reduced construction cycle time, a reduction in the quantity of goods damaged in transit and construction, reduced delivery time to the site, decreased fallout of chemicals, increased measurement of performance and improvement in customer perceptions of the company.' Cited from Harrington et al (2012).

In Serbia, it was stated that to accomplish all the regulatory authority's objectives, one possible approach was to implement TQM.

Sinha et al., (2016) study concluded that small to medium enterprises in India must implement the key principles of TQM to improve performance and enhance global competitiveness.

Finally, Thiagarajan et al., (2001) stated that the 'knowledge of TQM, in developing countries, is almost wholly lacking'. It was also reflected in Zakuan et al., (2010) that whilst there are many articles on TQM research for developed countries, there has been very minimal TQM studies in developing countries.

Construction firms across the globe undertake projects on behalf of their clients or customers. Firms need to continually satisfy their respective customers' expectations and objectives and is key for the survival of the business and for its long-term success (Low and Peh, 1996). This is very pertinent for the construction industry.

2.3 Shortcomings of TQM

Low & Teo (2004) listed problems that construction firms may face during the implementation phase of TQM. Such problems they identified were the following:

i. Quality management representatives fail to understand the concept and philosophy of TQM;
ii. Construction firms are more inclined towards making profits rather than focusing on TQM methodologies. Firms would generally focus on the minimum quality requirements;
iii. The initial costs of implementing TQM are perceived to be excessive;
iv. TQM, in its entirety, has yet to be proven in the construction industry;
v. TQM may not be feasible for small to medium size firms;
vi. Employees within a firm tend to be resistant to change which makes TQM education and awareness problematic.

Low & Teo (2004) concluded their study by stating that “in spite of these problems, TQM embraces the philosophy, principles, procedures, and practices necessary for providing customer satisfaction as well as achieving productivity and business performance in the construction industry.” This statement could not be more pertinent for South Africa’s construction industry.

2.4 South Africa’s construction industry

The construction industry of South Africa is the spine of the country’s infrastructure delivery programmes (Statistics South Africa, 2015). The local construction industry in South Africa contributes approximately three percent (3%) to the South African economy and is a significant enabler of

economic and social development (Statistics South Africa, 2015). The Government Ministry of Public Works created the Construction Industry Development Board (CIDB), a Schedule 3A agency, under an Act of Parliament (Act 38 of 2000) (CIDB, 2017). The mandate of the CIDB is to focus on; improved industry performance and best practice, enhanced value to clients/customers and society, uniformity in procurement, skills development and employment, amongst others.

In order for a firm to conduct business with the public-sector customer base, it is compulsory for such a firm have a valid CIDB certificate. Such a certificate is issued to the firm based on the firm being a legal entity in terms of the South African Companies Act, registered with the South African Revenue Service (SARS), financially sound and having a project track record for the specific registration category. Registration with the CIDB is voluntary for a firm, should the firm wish to undertake work in the private sector only.

For the private sector market in the construction industry, construction firms are subjected to the private sector clients' requirements and firms need not be registered with the CIDB. Instead firms may elect to register with representative bodies like SAFCEC (South African Federation of Civil Engineering Contractors), MBA (Master Builders Association) and the like.

For most construction projects in South Africa, the public and private sector customers do not strictly request for a firm to have any international or local quality standard certification, for e.g. ISO 9001 certificates. Such certificates are issued by an accreditation agency that's is licensed to do so under a licence agreement with the International Organisation for Standardisation (ISO).

ISO 9001 is a set of principles that outlines a firm's quality management system (QMS) requirements (ISO, 2015). The latest published version is the

ISO 9001:2015 document. This is an internationally recognised quality standard. ISO 9001 comprises seven quality management principles; *customer focus, leadership, engagement of people, process approach, improvement, evidence-based decision making and relationship management.*

With ISO 9001 certification not being a core requirement for the construction firms in South Africa, firms tend not to pursue for such certification. However, there are firms in South African's construction who are ISO 9001 certified. The rationale for opting to be ISO 9001 certified is due to, amongst others; key private sector client requirements, improve customer satisfaction, gain a competitive advantage, management's vision and programme, gain market access in other countries, improve product/service quality, enhanced reputation, reduce costs and the like (ISO, 2015).

To et al., (2012) mentions that ISO 9001 is the preferred standard when firms decide to implement quality management system standards. Oliveira et al., (2017) commented that any formal quality system can be greatly benefited when a firm applies the discipline and proper procedures as prescribed in ISO 9001 requirements.

The ISO 9001 certification provides the building blocks for a successful TQM implementation (Quazi & Padibjo, 1998; Rahman, 2001). The ISO 9001 certification process, as the first step to TQM journey, contributes to ensuring employees training, commitment, and responsibility on quality issues (Prajogo & Brown, 2006). As reported in Babatunde and Low (2015), 'ISO 9001's alignment with TQM, starting from the ISO 9001: 2000 version, justifies it as a stepping stone to TQM implementation'.

It is therefore based on the above research that ISO 9001 certified construction firms in South Africa was chosen as the sample for this study. As the researcher was of the opinion that ISO 9001 certified construction

firms in Gauteng have commenced their TQM journey. Psychogios & Priporas (2007) identified two important aspects that comprise TQM. These two aspects are; firstly, the *management tools and techniques* and secondly, the *management concepts and principles*. In their study, the authors described the first aspect as the "hard" aspects of TQM and the second aspect was described as the "soft" aspects of TQM. As mentioned in Chapter 1, the focus of this study is on the "soft" aspects of TQM.

2.5 'Soft' aspects of TQM

As revealed earlier in this chapter, the definition of TQM varies and there is no universal definition of TQM and or its principles. Further, Zhang et al (1999) further states that authors differ on the primary constructs and principles of TQM. The level of differences by the various authors on the primary constructs of TQM is listed in Table 2.1. This table lists the various ten principles of TQM and then lists the authors that promote that respective principle of TQM. As a result, it can be seen that there is no uniform view among key authors on the soft aspects of TQM.

Most quality practitioners have come out with several TQM principles (Baoteng-Okrah and Fening, 2012). In studies conducted by Wilkinson (1992), Powell (1995), Rahman and Bullock (2005), as cited in Sinha et al (2014), TQM factors may be classified as 'soft' and 'hard' aspects. This was also stated by Psychogios & Priporas (2007). These authors suggested that the principles and management concepts of TQM are referred to as the 'soft' aspects while the tools and techniques are referred to as the 'hard' aspects of TQM. Some of the key empirical studies undertaken on these "soft" aspects of TQM are briefly reported on further in this sub-section.

Motwani (2001) conducted a study to identify the key TQM principles based on a survey and synthesis of the six empirical studies by; Saraph et al., (1989), Flynn et al., (1994), Powell (1995), Ahire et al., (1996), Black and

Porter (1996) and Zeitz et al., (1997). From this study of Motwani (2001), the predominant management principles were that of; *top management commitment, customer focus, supplier quality management, design quality management, benchmarking, internal quality information usage, employee involvement, employee training, employee empowerment and product quality*. Motwani (2001) concluded his study with the following description:

> "We visualize TQM as constructing a house. First, we recommend putting *top management commitment* to TQM as the base or foundation. Without a strong foundation, the house will never stand. Once the foundation is in place, attention should be given to *employee training and empowerment*, *quality measurement and benchmarking, process management, and customer involvement and satisfaction*. These factors can be viewed as the four pillars of a house. Once the pillars are being put in place and enriched, we feel it is time to incorporate the factors of *vendor (supplier) quality management* and *product design*. These are the final elements to achieving TQM."

Each of these principles as concluded by Motwani (2001) of *top management commitment*, *employee training and empowerment*, *quality measurement and benchmarking, process management, customer involvement and satisfaction, vendor (supplier) quality management* and *product design* are briefly described in the following paragraphs.

Top management commitment

According to Ahire and O'Shaughnessy (1998), companies with high *top management commitment* can produce high quality products, in contrast with firms with low top management support. Grover et al., (2006) states that no discussion on TQM is complete without considering the principle of top management involvement. Top

management therefore plays an important role in leading quality programmes and providing direction within an organisation. Top management commitment is a key TQM principle and is cited in most literature sources.

Customer focus and satisfaction

Das et al., (2008) reported that *customer focus and satisfaction* is the ultimate measure of a firm's performance as it predicts the success or failure of a firm. The study by Das et al., (2008) goes on and states that firms must be able to understand their customers' requirements and satisfy those requirements by providing the required product or service. Psychogios & Priporas (2007) reported that customer satisfaction is a driving force for a firm to improve its performance. Harington et al (2012) states that customer satisfaction in the construction industry can be achieved by implementing the following steps: make the customer (internal and external) aware of the firm's quality management initiative, determine customer expectations, measure the customer's degree of satisfaction and take action to improve satisfaction. In studies conducted by Motwani (2001), the author stated that firms should maintain a customer service programme of where customers should be provided with timely information, quick responsiveness to complaints and overall to reduce the amount of customer complaints. It is further suggested by Motwani (2001) that customer surveys should be conducted to measure customer satisfaction.

Supplier quality management

Zhang et al., (1999) suggests that firms that implement TQM should; build long term relationships and partnerships with suppliers, participate in supplier quality activities, provide regular feedback on

suppliers' products and services. This should form part of the firm's *supplier quality management* principle. Construction firms tend to use an array of suppliers and service providers in the various stages of construction.

Benchmarking

Das et al., (2008) reports that firms should use *benchmarking* to compare the firm's products and services to that of competitors in the market to improve performance objectives. In order to meet customers' requirements continuously, firms need to benchmark their products and processes by analysing their leading competitors in the same industry or other industries using similar processes (Das et al., 2008).

Employee involvement

Das et al., (2008) suggests that firms must develop formal systems to encourage, track and reward *employee involvement* in quality management programmes. Employees should be encouraged to submit suggestions and ideas for quality improvement. Their involvement will help to change negative attitudes and make them more committed to the success of the firm (Das et al., 2008).

Reward and recognition

Dale (1999) suggests that *reward and recognition* for improved performance by employees is an important element/principle of quality management. Brown et al., (1994) states that firms should develop formal compensation systems to encourage, evaluate, reward and recognise efforts made by human resources towards quality enhancement and customers satisfaction. management.

Education and training

Education and training in the quality concepts, tools, and techniques is essential for employees to understand quality-related issues (Ahire et al., 1996). Several studies concluded that education and training is one of the most important factors for successful TQM implementation (Das et al., 2008) and firms should regard employees as valuable, long-term resources worthy of receiving education and training throughout their career. The participation of employees and managers in training sessions will enhance the quality of the immediate sessions and help to reduce the "gaps among the ranks" (Das et al., 2008). This will create an atmosphere for teamwork and involvement in the quality system implementation.

Empowerment of employees

Psychogios & Priporas (2007) reported that 'TQM offers ways in which *empowerment of employees* can support a firms' efforts not only in quality improvement, but in empowerment as well. Its approach places the responsibility for a firm's processes in the hands of those who know these processes best and helps them to participate directly in the firms' mission or purpose. They further state that while 'employers seek the commitment and empowerment of their employees, increased control over the work process is a cornerstone of TQM'.

Continuous improvement

Research conducted by Goetsch and Davis (1994), Ho and Fung (1994) and Dale (1996), as cited in Psychogios and Priporas (2007) suggests that the best way to improve a firms' output is to continually improve performance. Further, as cited from Das et al., (2008),

‘continuous improvement is the philosophy of improvement initiatives that increases success and reduces failure’. Continuous improvement is an important aspect of quality management and should be adopted as a TQM principle (Das et al., 2008). However, various other authors (Prajogo, 2005; Sit et al., 2009; Ooi et al., 2011) differ and believe that continuous improvement is embedded in the other TQM principles. Harrington et al (2012) states that “improvement processes never end and no true destination is ever reached” and therefore states that “management under TQM must be supportive to the advancement of technology and management techniques”. In Deming’s book, *Out of the Crisis* (2000), the author stated that a “plan-do-check-act (PDCA) cycle is a systematic procedure for improving methods and procedures by focusing on correcting and preventing defects”, as cited in Harrington et al., (2012).

All the above TQM principles are quality improvement strategies that are aimed at improving the quality of a firm’s product or service. Therefore *product/service quality* is an outcome-based TQM principle and product/service quality has the following attributes; performance, perceived quality, reliability and durability amongst others (Das et al, 2008). However, the dimensions of product/service quality vary depending on the industry (Harrington et al, 2012). Brah et al (2002) states this TQM principle measures the product/service quality of a firm and should be benchmarked to that in the industry.

After a comprehensive review of the existing TQM literature mentioned above, the following ten principles have been identified as the most predominant soft aspects of TQM:

i. top management commitment,
ii. customer focus,

iii. supplier quality management,
iv. benchmarking,
v. employee involvement,
vi. employee training,
vii. employee empowerment,
viii. reward and recognition,
ix. continuous improvement and
x. product quality.

The researcher adopted this summary reporting method for the existing literature review of this study. As such the “soft” aspects of TQM that are applicable to this research, are represented in Table 2.1 below.

Table 2.1: Summary of research on the soft aspects of TQM

#	TQM Principles	Authors
1	**Top management commitment**	Saraph et al (1989), Flynn et al (1994), Powell (1995), Ahire et al (1995), Ahire et al (1996), Black & Porter (1996), Zeitz et al (1997), Ahire and O'Shaughnessy (1998), Torrington and Hall (1998), Brah et al (2002), Kaynak (2003), Grover et al. (2006), Psychogios & Priporas (2007), Das et al (2008), Harrington et al (2012), Oliveira et al (2017), Aquilani et al (2017)
2	**Customer focus**	Saraph et al (1989), Flynn et al (1994), Ahire et al (1995), Ahire et al (1996), Black & Porter (1996), Zeitz et al (1997), Psychogios & Priporas (2007), Das et al (2008), Harrington et al (2012), Oliveira et al (2017), Aquilani et al (2017)
3	**Continuous improvement**	Ho & Fung (1994), Goetsch & Davis (1994), Ahire et al (1995), Ahire et al (1996), Dale (1996), Sit, Ooi, Lin, & Chong (2009), Prajogo (2005), Psychogios & Priporas (2007), Das et al (2008), Ooi, Lin, Tan, & Chong (2011), Harrington et al (2012), Oliveira et al (2017), Aquilani et al (2017)
4	**Supplier quality management**	Saraph et al (1989), Flynn et al (1994), Ahire et al (1995), Ahire et al (1996), Black & Porter (1996), Zeitz et al (1997), Zhang et al (1999), Psychogios & Priporas (2007), Das et al (2008), Oliveira et al (2017)
5	**Benchmarking**	Saraph et al (1989), Flynn et al (1994), Ahire et al (1995), Ahire et al (1996), Black & Porter (1996), Zeitz et al (1997), Psychogios & Priporas (2007), Das et al (2008)
6	**Employee involvement**	Saraph et al (1989), Flynn et al (1994), Ahire et al (1995), Ahire et al (1996), Black & Porter (1996), Psychogios & Priporas (2007), Das et al (2008), Harrington et al (2012), Oliveira et al (2017), Aquilani et al (2017)
7	**Reward and recognition**	Ahire et al (1995), Ahire et al (1996), Dale (1999), Psychogios & Priporas (2007), Das et al (2008)
8	**Education and training**	Saraph et al (1989), Flynn et al (1994), Ahire et al (1995), Ahire et al (1996), Black & Porter (1996), Psychogios & Priporas (2007), Das et al (2008), Harrington et al (2012), Aquilani et al (2017)
9	**Employee empowerment**	Saraph et al (1989), Flynn et al (1994), Ahire et al (1995), Ahire et al (1996), Black & Porter (1996), Psychogios & Priporas (2007), Das et al (2008), Harrington et al (2012)
10	**Product/service quality**	Ahire et al (1995), Ahire et al (1996), Psychogios & Priporas (2007), Das et al (2008)

2.6 TQM constructs

Based on the above TQM principles, as listed in Table 2.1, by the various authors, Das et al., (2008) developed ten (10) TQM constructs. According to Das et al., (2008), constructs are a set of latent variables and they cannot be measured directly. Lund Research Ltd (2012) state that constructs vary

significantly in their complexity, which means the relative difficulty in understanding and measuring various constructs. The ten (10) identified constructs for the 'soft' aspects of TQM are given in Table 2.2 below.

Table 2.2: Constructs for the 'soft' aspects of TQM

#	Construct ID	TQM Construct
1	TM	Top Management Commitment
2	CF	Customer Focus
3	CI	Continuous Improvement
4	SQ	Supplier Quality Management
5	BM	Benchmarking
6	EI	Employee Involvement
7	RR	Reward and Recognition
8	ET	Education and Training
9	EE	Employee Empowerment
10	PS	Product/Service Quality

In summary, Table 2.2 lists all the TQM constructs and the associated questions/statements related to the 'soft' aspects of TQM. These 'soft' aspects of TQM occurred the most frequently in the existing literature.

2.7 Gaps in the literature

There are numerous studies and available literature for regions such as North America, South East Asia and Europe, of which was briefly documented in this chapter. Zakuan et al., (2010) suggest that 'despite the number of publications and quantity of research on TQM, there is actually little empirical work that has been carried out in the developing countries'. As such, previous studies in the TQM field have been limited for the African continent at large (Abusa & Gibson, 2013) including South Africa. Figure

2.2 graphically depicts the extent of TQM studies that were done in various countries across the world. Researchers from developing countries have basically applied and adopted studies and research from developed countries into their respective industries in their countries. There are also very limited published articles on TQM in South Africa.

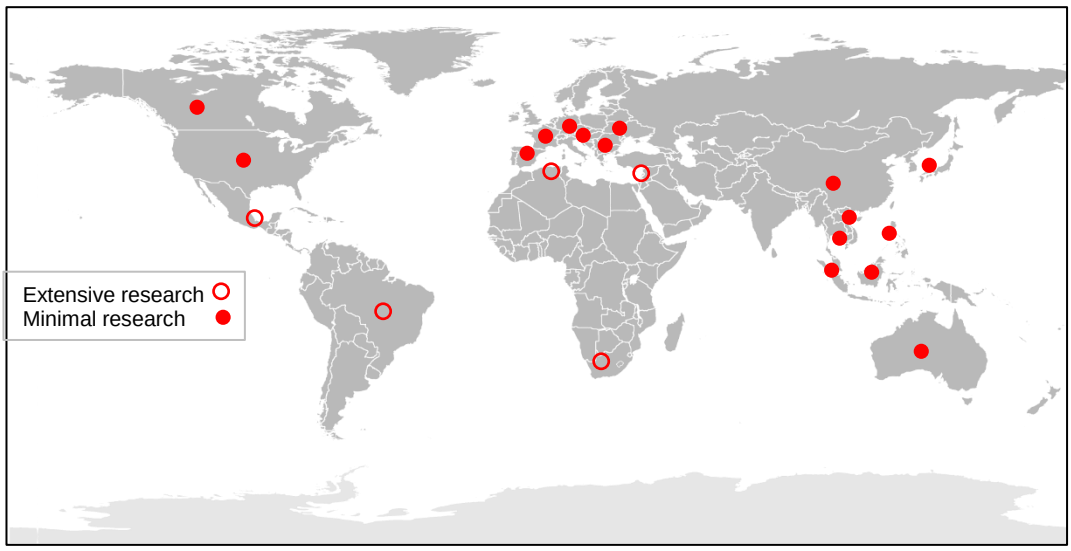

Figure 2.2 Extent of TQM studies done in various countries across the world.

While there is a consensus that by implementing TQM, the overall effectiveness and performance of a firm can be improved (Das et al, 2008), there seems to be no uniform view on the principles and or concept of TQM (Harrington and Hal Wiggin, 2008). Authors tend to differ on the key principles of TQM. As such, the application of TQM in the market varies from industry to another and from one firm to another (Motwani, 2001).

Further, recent studies on TQM implementation is based on the old principles of TQM as document by the following authors, namely; Saraph et al (1989), Flynn et al (1994), Ahire (1995), Powell (1995), Ahire (1996), Balcka and Porter (1996), Zeitz et al (1997). These are the principles that are listed in Table 2.1

The above has been identified as the major gaps in the existing literature. The figure 2.1 below gives an indication of the studies of TQM across the world.

2.8 Summary

Based on the literature review and identified research gaps, the constructs for the ‘soft’ aspects of TQM were validated in Chapter 3.

CHAPTER 3 - RESEARCH DESIGN AND METHODS

3.1 Introduction

This chapter explains in detail the design of the research to answer the research questions. This chapter outlines in detail the sampling techniques, sample size, data collection techniques, research method, design of the research instrument and the data analysis conducted for this study.

3.2 Sampling Population

The population identified for this research was ISO 9001 certified construction firms that are based in Gauteng, South Africa.

According to Fellows and Liu (2003), “the objective of sampling is to provide a practical means of enabling the data collection and processing components of research to be carried out whilst ensuring that the sample provides a good representation of the population”. Non-probability sampling was adopted for this study. The reason for this technique was, firstly, there being no readily available list for the population being studied and secondly, the scope that could be done was inexpensive and within the resources of the researcher.

“A core characteristic of non-probability sampling techniques is that samples are selected based on the subjective judgement of the researcher” (Lund Research Ltd, 2012).
Fellow and Liu (2003) iterates that the sampling technique that is chosen must ensure that the sample provides a fair representation of the population. The researcher used the following types of non-probability sampling techniques; purposive sampling and snowball sampling techniques to ensure representation and therefore generate a suitable sample size for this study.

Purposive sampling was the key sampling technique that was adopted to identify respondents for this study. Saunders et al., (2009) states that purposive sampling is about using one's judgement to select a sample for a study. The researcher searched for ISO 9001 certified construction firms in Gauteng via multiple sources i.e. internet search engines, an ISO accreditation agency, a professional networking platform and existing industry contacts. Through these sources, the researcher was able to get into contact with the designated quality management representative (QMR) at each of the ISO 9001 certified construction firms. As such, the sample was homogenous in nature as all respondents were QMR's at their respective firms.

By establishing contact through the purposive sampling technique, the researcher then took the opportunity through snowball sampling by requesting for referrals from the identified QMR's for QMR's at other ISO 9001 certified construction firms. This expanded the sample.

3.3 Sample size

ISO 9001 certified construction firms in Gauteng were identified as the population of the study. Enquiries were made to quality management representatives (QMR's) at these construction firms of whom were each employed at thirty-eight (38) different ISO 9001 certified construction firms across Gauteng. Therefore, the population for this study was thirty-eight (38) different ISO 9001 certified construction firms across Gauteng. Of the thirty-eight (38) enquires made, fifteen (15) respondents agreed to participate in the study. Therefore, the final sample comprised of fifteen (15) respondents.

The fifteen (15) respondents were all employed as QMR's at their respective ISO 9001 certified construction firm. There was one respondent per firm. The interviewed respondents were the personnel employed to manage the

firms' quality management systems and its implementation. The firms were located in the greater Johannesburg and Pretoria metropolitan areas of Gauteng. Guest et al., (2006) recommends that for a homogenous sample, a minimum of twelve (12) in-depth interviews should be sufficient. Therefore, for this study, the sample of fifteen (15) respondents was deemed to be adequate.

3.4 Research method

3.4.1 Primary Data collection

The primary quantitative data was collected from respondents through structured interviews. Saunders et al., (2009) states structured interviews are a standardised set of questions on a standardised interview schedule with 'pre-coded answers'. These questions are posed to the respondents and each response is then recorded against a rating scale. Saunders et al., (2009) further mentions that 'structured interviews are used to collect quantifiable data and they are also referred to as *quantitative research interviews'*. The design of the interview schedule is given in sub-section 3.4.3.

The structured interviews were conducted during the period between August 2017 and February 2018. The thirty-eight respondents were contacted via telephone and email to schedule for a date and time for the interview. All thirty-eight respondents were emailed a consent letter, participant information sheet and the interview schedule prior to the date of the interview. The consent letter and participant information sheet briefly outlined the scope of the study, the confidentiality of all information and the respondent's anonymity in the participation of this study. Approximately two to three reminders had to be made with the thirty-eight respondents before a date and time was eventually agreed upon for the interview. The researcher experienced extreme difficulty in making appointments with the

respondents. Of the thirty-eight identified firms, respondents at fifteen different firms agreed to meet with the researcher.

The interviews were conducted at the workplace of the respondents across the metropolitan areas of Johannesburg and Pretoria. In the interview the items in the consent form and participation information sheet was explained with the respondents. The researcher then asked the questions from the interview schedule (see sub-section 3.4.3) and consequently recorded the responses accordingly. The interviews with the respondents lasted about 20-25 minutes.

3.4.2 Secondary Data collection

The secondary qualitative and quantitative data was collected from the literature review of the existing published work in the field of the total quality management (TQM) by various authors. The literature review adopted in this study has been primarily based on articles from the following scholarly and research journals i.e. bodies of knowledge; the *TQM Magazine/Journal (Emerald Insight)*, the *TQM & Business Excellence (Taylor & Francis)* and the *International Journal of Project Management (Elsevier).* The reason for using these three sources was that they are the most thorough and to up-to-date on research trends in the field of total quality management. International experts and academics who specialise in the field of TQM continuously contribute articles to these journals.

3.4.3 Design of the research instrument

The interview schedule was the chosen research instrument for the structured interviews of this study. Only one research instrument was designed for this study. This interview schedule was adopted and adapted from similar studies in the existing TQM literature. Saunders et al., (2009) suggests that ‘adopting or adapting questions may be necessary if a

researcher wishes to replicate or to compare the findings with another study'. It is also more efficient than developing one's own questions, if one can still collect the data one needs to answer one's research question(s) and to meet one's research objectives (Saunders et al., 2009).

The design of the interview guide was based on the literature and verified by the researcher's supervisor. The questions in the interview guide were predominantly that of closed questions i.e. the respondents were required to select an applicable answer from a list of answers. The interview guide made us of the following type of closed questions; *category* and *rating questions*. The interview schedule comprised of two (2) sections.

The first section (section A) of the interview schedule comprised of category and quantity questions which focused on the respondents' profiles. For the category questions, the respondents' answer could only fit one category. The aim of the quantity questions was to collect attribute data of the respondents and their firms. The questions were related to the;

- *profile of the respondent* i.e. job title, educational qualifications, length of experience in quality management and age group (five questions) and
- *the profile of the firm* i.e. age of firm, number of employees, quality management system and ISO certification (six questions).

The second section (section B) of the interview schedule was used to collect the opinions of the respondents on the identified soft aspects of TQM. This section of the interview schedule comprised of rating questions. Saunders et al., (2009) states that rating questions uses Likert-style rating scale for most scenarios. This scale profiles the respondent's level of agreement to the TQM statements. The Likert-scale questions in the interview schedule required the respondents to indicate their opinions on how strongly they agree or disagree with the TQM statements/questions. As such, A five-point

agreement Likert rating scale was used for this study. Saunders et al., (2009) outlines the order for such a type of rating scale. The five categories for an agreement rating scale shall be strongly disagree, disagree, neutral/uncertain, agree and strongly agree. This scale was used to measure the responses from the respondents aligned to the TQM constructs. The neutral or uncertain category is the midpoint of the 5-point scale. This was given a rating of three. The five-point scale is given in the Table 3.1 below.

Table 3.1: Five-point Likert scale.

Scale	Description
1	Strongly disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly agree

As mentioned the soft aspects of TQM was derived from the literature. There were ten (10) identified core aspects, and these were *top management commitment, employee involvement, education and training, employee empowerment, reward and recognition, continuous improvement, benchmarking, customer focus, supplier quality management and product/service quality*. These soft aspects of TQM served as the TQM constructs for this study.

Based on these ten TQM constructs, there were a total of fifty (50) TQM related questions in the interview schedule. The breakdown per TQM construct is given below:

- eight (8) questions related to top management commitment,
- four (4) questions related to employee involvement,
- five (5) questions related to education and training,
- four (4) questions related to employee empowerment,
- four (4) questions related to reward and recognition,
- nine (9) questions related to continuous improvement,

- four (4) questions related to benchmarking,
- five (5) questions related to customer focus,
- four (4) questions related to supplier quality management,
- three (3) questions related to product/service quality.

A sample of the interview schedule is attached in Appendix A.

3.5 Analysis of data

3.5.1 Descriptive statistics

Agresti and Franklin (2007) suggest that descriptive statistics, which is a method for summarizing data in the form of averages, percentages, and graphs, are used for data analysis. This form of analysis was used to determine the attribute data of the respondents and their firms, as recorded in section A of the interview schedule.

For section B of the interview schedule, the researcher also used descriptive statistics in Microsoft Excel for the statistical analysis. The first technique that was used was that of the measure of central tendency i.e. calculation of the *mean* and *standard deviation* for the respective ten TQM constructs and fifty indicators. The respondents answered to the 50 indicators based on the five-point Likert scale, as per Table 3.1 (from 1=strongly disagree to 5=strongly agree). The mean score (MS) and standard deviation was calculated for each of the indicators and then for each construct. As such, the mean scores ranged from a minimum score of one (1) to a maximum score of five (5) for this study. The mean was then ranked from highest to lowest for the TQM constructs and for the TQM indicators and then for both collectively.

Secondly, once the mean and the standard deviation were computed for each construct and indicator, the coefficient of variation was computed.

According to Kumar et al., (2009), the coefficient of variation confirms the existence of a true mean amongst the sample and should be less than 0.3. The coefficient of variation is calculated as a ratio of the standard deviation to the mean.

3.5.2 Reliability

According to Henson (2001), there are a variety of reliability tests but the most common is the internal consistency method, as this method requires only one administration of the research instrument. As the internal consistency method is most common, it has been adopted for this study.

The most widely used measure of reliability of an instrument is Cronbach's alpha (α), of which is a test within the internal consistency method (Tavakol and Dennick, 2011). Alpha was developed by Lee Cronbach in 1951 to provide a measure of the internal consistency of a test or scale; it is expressed as a number between 0 and 1 (Tavakol and Dennick, 2011). The threshold for Cronbach's alpha is 0.7 but a measure of 0.8 or more is considered reliable and significant (as cited in Das et al., 2008). It was stated in Henson (2001) that as per Nunnally's second edition the exploratory standard for instrument development was 0.7. Further, Gliem & Gliem (2003) reported that "the closer Cronbach's alpha coefficient is to 1.0, the greater the internal consistency of the items in the scale." The above authors further stated the following scale; "$\alpha > 0.9$ = excellent, $\alpha > 0.8$ = good, $\alpha > 0.7$ = acceptable, $\alpha > 0.6$ = questionable, $\alpha > 0.5$ = poor, and $\alpha < 0.5$ = unacceptable". Zhang (1999) states that "internal consistency reliability is the most commonly used psychometric measure in assessing survey instruments and scales. Internal consistency is an indicator of how well the different items measures the same concept". Zhang (1999) further states that "Cronbach's alpha measures internal consistency reliability among a group of items combined to form a single scale. It is a statistic that reflects the homogeneity of the scale".

Therefore based on the above studies, the threshold for Cronbach's alpha was determined at 0.7 for this study.

The Cronbach's alpha was calculated for each TQM construct to assess for reliability. An overall Cronbach's alpha was then computed for all ten TQM constructs to assess for reliability of the constructs.

CHAPTER 4 – DISCUSSION OF RESULTS

4.1 Introduction

This chapter first presents the analysis and results of the survey as was conducted during the fieldwork phase. Secondly, this chapter discusses the results of the study. These results are compared against the literature review and objectives of the study. Finally, the results are compared against the objectives and research questions.

4.2 Response rate

Enquiries were made to quality management representatives of whom were each employed at thirty-eight (38) ISO 9001 certified construction firms across Gauteng. Of the thirty-eight (38) enquires made, only fifteen (15) structured interviews were conducted at the end of the fieldwork phase. This gave a response rate of thirty-nine point five percent (39.5%).

Therefore, the research sample comprised of fifteen (15) quality management representatives from fifteen (15) different ISO 9001 certified firms (hereinafter termed, respondents), of which this study is based upon.

4.2.1 Efforts made to improve the response rate

Fincham (2008) states that a *"lack of response to the questionnaire by potential respondents in a sample or population is referred to as non-response bias*". The non-response bias for this study was calculated as sixty-point five percent (60.5%). Some of the reasons received from the quality management representatives which contributed to the non-response bias was that of; *being too busy to participate*, *refusal to participate*, *offered to participate but not responding* and *no responses* were received from many.

Some of the efforts made to improve the response rate included that of;

i. providing a consent letter and participant information sheet assuring the potential respondents of their confidentiality,
ii. using a succinct structured interview guide of where questions were kept to a minimum,
iii. continually sending polite email reminders on a weekly basis.

Despite these efforts, only fifteen (15) quality management representatives responded.

Rindfuss et al., (2015) states that response rates in studies are declining in developed countries and that low response rates do not necessarily lead to biased results in multiple variable/construct relationships.

4.3 Results

The results from the two (2) sections of the interview guide are discussed separately here. The first section (Section A) of the interview guide focuses on the profile of the respondent's and their respective firms while the second section (Section B) focuses on the TQM constructs. Section A of the interview guide is discussed in the following sub-section 4.3.1, while section B of the interview guide is discussed in sub-section 4.3.2.

According to Oliviera et al., (2017) data validation is a key step in the research development phase. As such, two techniques were used for the data validation of the TQM constructs.

Firstly, the 'soft' aspects of the ten TQM constructs were derived from a comprehensive review of the existing TQM literature, as discussed in Chapter 2. The researcher converged on the 10 TQM constructs based on

conceptual and empirical studies that were conducted in the field of TQM over the last 3 decades (Bajaj et al., 2018).

Secondly, as a measure of reliability, the overall Cronbach's α for the research instrument and for the individual constructs was measured against the threshold of 0.7, as was determined as the threshold of reliability for this study.

4.3.1 Profile of respondents

The structured interviews were conducted with respondents that were responsible for the operations of the quality management systems at their respective firms. The respondents were the firm's quality management representatives (QMR's).

There was a range of job titles amongst the fifteen respondents. Some of the job titles, amongst others, were group SHEQ manager, quality manager, QA/QC manager. The spread of job titles is given in Figure 4.1 below. All of the respondents were at management level and highly responsible for quality management at their respective firms.

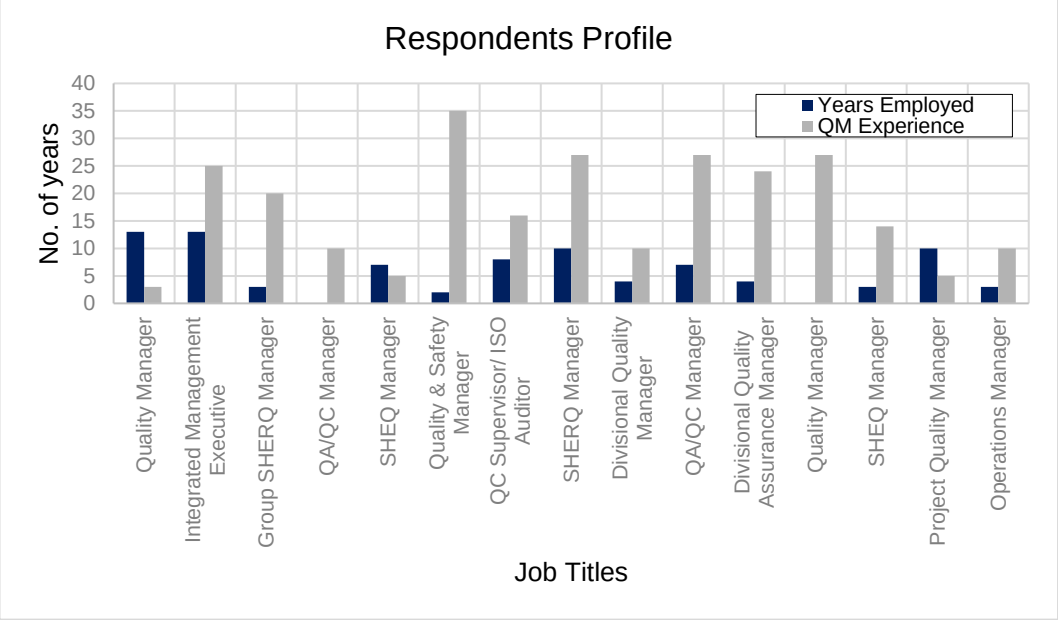

Figure 4.1 Bar chart showing the profile of the respondents

The length of employment at the firms ranged from one (1) year to thirteen (13) years. The mean score (MS) for the number of years the respondents were employed at their respective firms was six (6) years. The range for the number years employed is given in Figure 4.1.

The respondents experience in the field of quality management ranges from three (3) years to thirty-five (35) years. The mean score (MS) for the respondents' experience in the field of quality management was seventeen (17) years. The range for the number years employed is given in Figure 4.1.

The highest formal educational qualification amongst the respondents was that of a Diploma (67%), *other qualifications* was at thirteen percent (13%) while MSc, BTech and PostGrad diploma was at seven percent (7%) each. Figure 4.2 depicts the qualifications of the respondents. This suggests that most of the respondents had a tertiary qualification in the form of a Diploma at an undergraduate level. As such the respondents had acquired the academic knowledge to develop further skills and competence in their respective job roles. This could bode well for their firms they work in, as the respondents could make a positive and beneficial contribution to their firms.

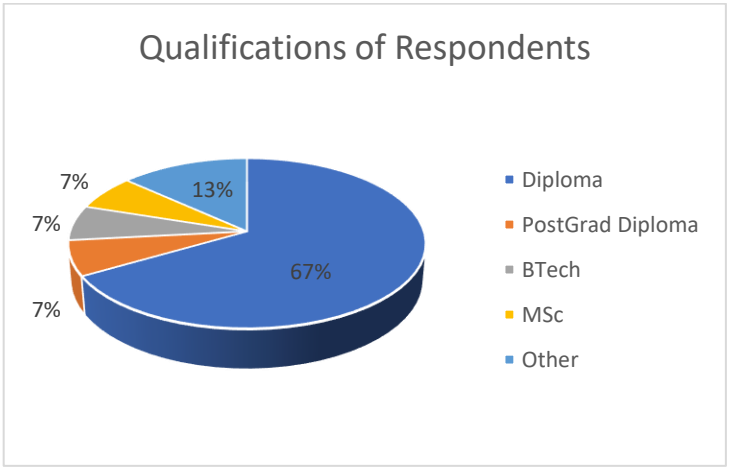

Figure 4.2 Pie chart showing the qualifications of the respondents

The age profile of the respondents extended from thirty to thirty-nine years to over fifty years, as shown in Figure 4.3. Most of the respondents were over fifty years (40%), thirty three percent (33%) was in the forty to forty-nine group, while twenty seven percent (27%) was in the thirty to thirty-nine age group. No respondents were in the twenty to twenty-nine age group. This suggests that the respondents have had many years of work experience and have been part of the workforce for many years. As such, it is of the view of this study that the respondents have developed their skill set and technical competence over the years of working.

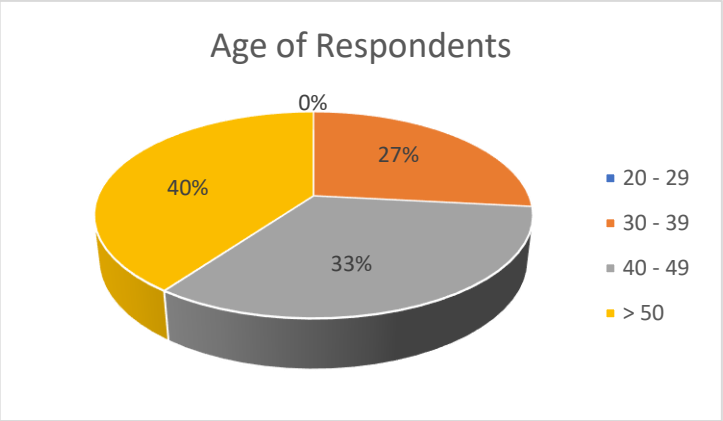

Figure 4.3 Pie chart showing the age profile of the respondents

Amongst the responses, sixty percent (60%) of the respondents' firms have been in existence for over twenty (20) years, thirty three percent (33%) for eleven (11) to twenty (20) years and seven percent (7%) for less than ten (10) years. This is shown in figure 4.4 below.

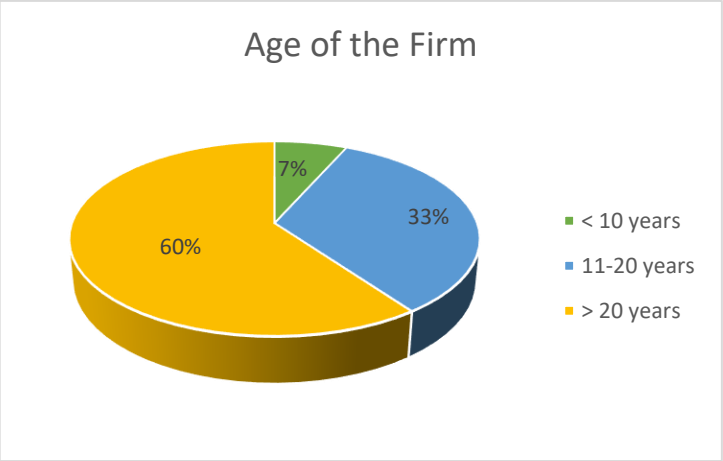

Figure 4.4 Pie chart showing the age of the respondents' firms

Of these firms, sixty percent (60%) have more than two hundred (200) employees, thirty three percent (33%) have fifty-one (51) to two hundred (200) employees and seven percent (7%) had less than fifty (50) employees. This is shown in figure 4.5 below.

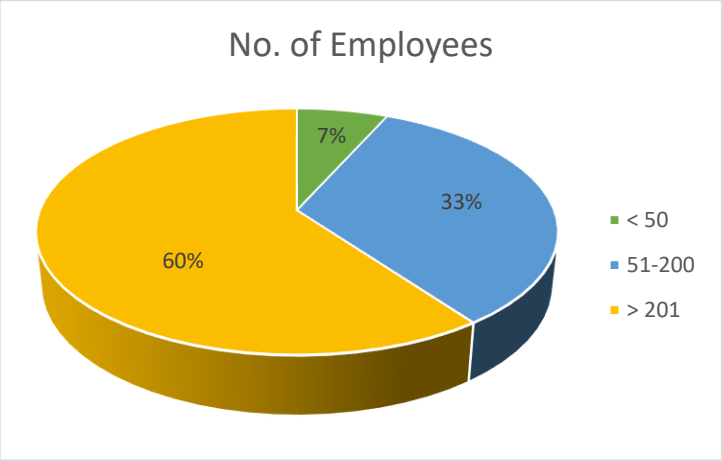

Figure 4.5 Pie chart showing the number of employees at the respondents' firms

All fifteen (15) respondents responded 'yes' with reference to the question relating to their firm having a quality management system (QMS) in place.

Further, all fifteen (15) respondents also responded 'yes' with reference to the question relating to the firm being ISO 9001 certified.

As shown in Figure 4.6 twenty seven percent (27%) of the respondents' firms have been ISO 9001 certified for six to ten years, twenty percent (20%) for sixteen to twenty years, twenty percent (20%) for eleven to fifteen years, twenty percent (20%) for less than five years and thirteen percent (13%) for more than 20 years. The mean score (MS) for the number of years the respondents' firms have been ISO 9001 certified was twelve and a half (12.5) years.

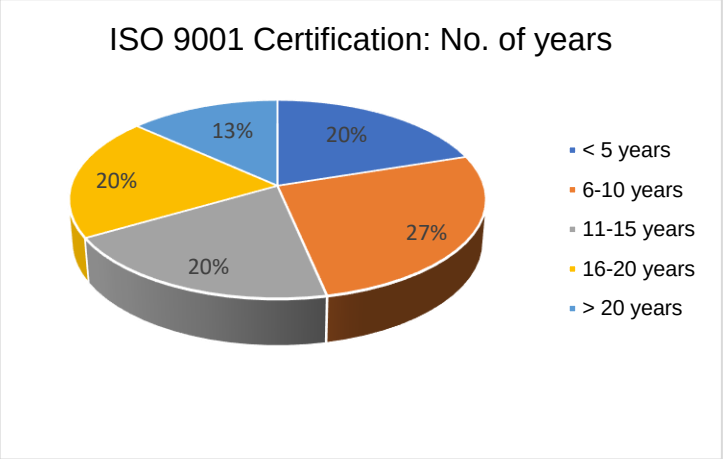

Figure 4.6 Pie chart showing the number of years the respondents' firms has been ISO 9001 certified

Sixty percent (60%) of the respondents' firms had its major customers from the private sector while forty percent (40%) of the respondents' firms' major customers were from the public sector.

The profile of the respondents for this study was thus summarised as follows:

i. Forty percent of the respondents were over 50 years of age

ii. The respondents had been working in the field of quality management on average of 17 years.
iii. Sixty seven percent (67%) of the respondents had a Diploma as their last formal education.
iv. All the respondent's firms were ISO-9001 certified construction firms and have been ISO-certified for 13 years on average.
v. Sixty percent of the respondents' firms conducted work in the private sector.

From the above inferences, it was interpreted that the respondents were well qualified and well experienced to participate in this study.

4.3.2 TQM constructs

This sub-section focuses on the section B of the interview guide. The ten (10) core TQM categories in the interview guide were adopted from the existing literature as reported by researchers in the field of TQM. In total, the interview guide comprised of fifty (50) TQM indicators.

Given the descriptive nature of the TQM data, the use of hierarchy noted with interval data was considered appropriate for presenting the results for section B of the interview guide. The Likert-scale type questions were discussed based upon measurement scales indicated in Table 3.1 (5=strongly agree, 4=agree, 3=neutral, 2=disagree, 1=strongly disagree).

As discussed in Chapter 2, the core ten (10) TQM constructs of which the interview schedule was based upon were *top management commitment, employee involvement, education and training, employee empowerment, reward and recognition, continuous improvement, benchmarking, customer focus, supplier quality management* and *product/service quality*. A copy of the interview schedule is in Appendix A of this report. In total, there were fifty (50) TQM indicators related to the ten (10) core TQM constructs.

Table 4.1 depicts the ten TQM constructs and the number of related indicators. Each of the ten core constructs was given a two-letter construct identification (ID). The fifteen (15) respondents answered to all fifty (50) TQM indicators.

The summary of all the responses as received from the respondents is listed in Appendix B. Figure 4.7 summarises the responses received per TQM construct. The responses were categorised as per the 5-point Likert scale of this study.

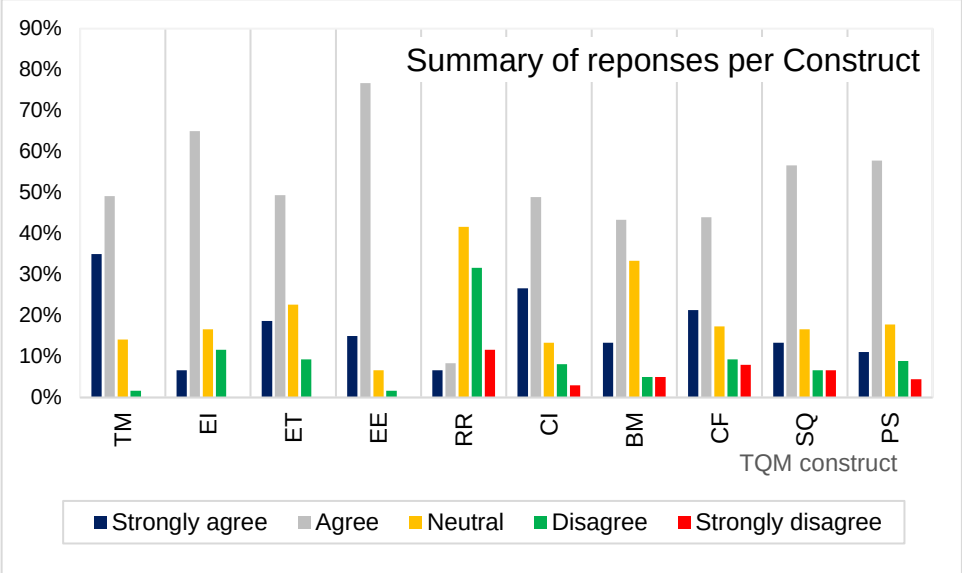

Figure 4.7 Bar chart showing the summary of responses for the ten TQM construct.

From Table 4.1 it is noted that nine (9) out of ten (10) mean scores (MS) were above the midpoint mean score of three (3.0). The value range of the scores were from a minimum of 1 to a maximum of 5.

The nine TQM constructs that had a MS above three (3) were top management commitment (TM), employee empowerment (EE), continuous improvement (CI), education and training (ET), employee involvement (EI),

supplier quality management (SQ), customer focus (CF), product/service quality (PS), benchmarking (BM). The TQM construct of reward and recognition (RR) had a mean score under 3.

Top management commitment (TM) had a MS of 4.18 out a maximum 5 and was ranked first amongst the constructs. Employee empowerment (EE) was ranked second with a MS of 4.05, followed by continuous improvement (CI) with a MS of 3.88. Supplier quality management (SQ), education and training (ET), employee involvement (EI), customer focus (CF), product/service quality (PS) and benchmarking (BM) all had a MS above 3. The lowest ranked MS was that of reward and recognition (RR) at 2.67. The MS and the rank for the ten constructs are given in Table 4.1.

Table 4.1: TQM core constructs.

Construct ID	Rank (MS)	Constructs	No. of indicators	Mean Score (MS)	Standard deviation	Cronbach's α	Validity
TM	1	Top management commitment	8	4.18	0.729	0.872	Valid
EE	*2*	*Employee empowerment*	*4*	*4.05*	*0.534*	*0.145*	*Invalid*
CI	3	Continuous improvement	9	3.88	0.993	0.880	Valid
ET	4	Education and training	5	3.77	0.863	0.763	Valid
EI	*5*	*Employee involvement*	*4*	*3.67*	*0.774*	*0.636*	*Invalid*
SQ	6	Supplier quality management	4	3.63	1.025	0.940	Valid
PS	7	Product/service quality	3	3.62	0.960	0.869	Valid
CF	8	Customer focus	5	3.61	1.161	0.843	Valid
BM	9	Benchmarking	4	3.55	0.964	0.907	Valid
RR	10	Reward and recognition	4	2.67	1.020	0.868	Valid
10		**Overall**	**42**	**3.61**		**0.952**	**Valid**

N=15.

Table 4.1 also summarises the Cronbach's α for each of the ten constructs and for the overall constructs. Cronbach's α was used to calculate the reliability of the constructs for this study. The overall Cronbach's α for this

study was calculated as 0.952, which was greater than threshold of 0.7. This meant that the instrument was highly reliable. The Cronbach's α for the 10 TQM constructs ranged from 0.145 to 0.940. The results of 2 constructs of EE (α =0.145 and EI (α =0.636) had a Cronbach α less than the threshold of 0.7 and did not have internal consistency. The two constructs of EE and EI have therefore been omitted from the analysis of this study. For the constructs of TM, CI, ET, RR, BM, CF, SQ and PS, the Cronbach's α ranged from 0.763 to 0.940, which was greater than threshold of 0.7. The Cronbach α of these eight constructs were higher than 0.7 and have relatively internal consistency.

In a study by Zhang (1999), the author developed an instrument to test the validity and reliability of eleven TQM constructs for Chinese firms. The author tested for internal consistency using Cronbach's alpha. Zhang (1999) stated that Cronbach's alpha of 0.7 or more was considered good. Based on this study, the eleven TQM constructs ranged from 0.83 to 0.91.

In another study conducted by Das et al., (2008), the authors undertook a study to develop valid and reliable instrument for ten TQM constructs for firms in Thailand. The authors stated that the threshold for Cronbach's alpha should be a threshold of 0.7 with a Cronbach alpha of 0.8 or more being significant and reliable. Based on this study, the ten TQM constructs ranged from 0.84 to 0.95.

The mean scores (MS) for seven of the eight constructs were above the midpoint of 3, which suggests that the respondents' agreed with the TQM statements made. The 7 TQM constructs that were above the midpoint were that of TM, CI, ET, SQ, PS, CF and BM. The construct that was below the midpoint was that of RR, which suggests that the respondents did not agree with the TQM statements made.

The overall mean score of 3.61 out of a maximum of 5 (73%) indicates that the level of practice of the eight TQM principles by the construction firms in the sample is moderately high. The individual mean scores for the TQM constructs were as follows; TM had a MS of 4.18 (84%), followed by CI with a MS of 3.88 (78%), followed by ET with a MS of 3.77 (75%), followed by SQ with a MS of 3.63 (73%), followed by PS with a MS of 3.62 (72%), followed by CF with a MS of 3.61 (72%), followed by BM with a MS of 3.55 (71%), followed by RR with a MS of 2.67 (53%).

The results for *each* of the ten constructs and its indicators are described further in this section.

Top Management Commitment (TM)

TM had the highest ranked mean score (MS) amongst the ten constructs. There were eight indicators under TM (i.e. TM1, TM2, TM3, TM4, TM5, TM6, TM7 and TM8). All the mean scores (MS) for the TM indicators were above the midpoint mean score of 3. All the TM mean scores were greater than or equal to a MS of 4.0. The overall MS for TM was 4.18 out of a maximum 5, with a coefficient of variance of 0.175. The Cronbach's α for TM was calculated at 0.872, which was greater than threshold of 0.7. Table 4.2 summarises the TM indicators.

It was noted that TM6-*we have clear quality goals identified by top management*, achieved a MS of 4.60 (92%) and was therefore ranked first amongst the TM indicators. This was followed by TM5- *our company has a clear long-term vision statement that encourages employees' commitment to quality improvement,* with a MS of 4.27 (86%). The lowest ranked score amongst the TM indicators was 4.0 (80%).

Table 4.2: Top management commitment construct and indicators.

Indicator /Construct ID	Rank (MS)	Indicator	Mean Score (MS)	Standard deviation	Coefficient of variation
TM6	1	We have clear quality goals identified by top management.	4.60	0.632	0.137
TM5	2	Our company has a clear long-term vision statement that encourages employees' commitment to quality improvement.	4.27	0.704	0.165
TM3	3	Top management strongly encourages employee involvement in quality management and improvement activities.	4.20	0.676	0.205
TM1		Top management communicates the company's philosophy to the employees	4.20	0.862	0.161
TM2	4	Top management actively develops one integrated quality plan to meet business objectives	4.13	0.915	0.221
TM4	5	Top management arranges adequate resources for employee education and training.	4.00	0.535	0.134
TM8		Employees are encouraged to achieve their objectives.	4.00	0.655	0.189
TM7		Our company has an effective quality improvement plan.	4.00	0.756	0.164
TM		**Top management commitment**	**4.18**	**0.729**	**0.175**

Cronbach's α = 0.872

As outlined in the literature review, top management commitment plays a fundamental role in TQM implementation and is a key 'soft' aspect amongst the TQM principles. The management of a firm initiates drives the TQM programme of a firm and therefore management should thoroughly understand TQM (Grover et al., 2006; Harrington et al., 2012; Aquilani et al., 2017). Based on the findings of this study, top management commitment in the construction firms was ranked highest amongst the TQM constructs. Further the TM indicators (TM1 to TM8) all had a MS of greater than or equal to 4 out of a maximum 5. This suggests that the respondents in the sample had agreed with the statements. This study, therefore, states that top management in the firms in this sample set the quality vision, goals and objectives and management further communicates this philosophy such to the employees. Top management encourages employee involvement in quality programmes and activities. As such, top management is committed to the quality management of the firm. It is therefore concluded that 'top

management commitment' is a 'soft' aspect of TQM that is being practiced by QMR's in this sample at their construction firms.

Employee Empowerment (EE)

The mean score (MS) of EE was ranked second amongst the ten constructs. There were four indicators under EE (i.e. EE1, EE2, EE3 and EE4). All the mean scores (MS) for the EE indicators were above the midpoint mean score of 3. The EE MS's ranged from 3.93 to 4.13. The overall MS for EE was 4.05 (81%) out of a maximum 5, with a coefficient of variance of 0.132. The Cronbach's α for EE was calculated at 0.145, which was below the threshold of 0.7. Table 4.3 summarises the EE indicators.

It was noted that EE2- *employees are encouraged to find and fix problems* and *EE4- technical assistance and support is given to employees for solving problems*, achieved a MS of 4.13 (83%) and was therefore jointly ranked first amongst the EE indicators. This was followed by EE1- *employees are encouraged inspect the quality of their own work,* with a MS of 4.00 (80%). The lowest ranked score amongst the EE indicators was 3.93 (79%).

Table 4.3: Employee empowerment construct and indicators.

Indicator /Construct ID	Rank (MS)	Indicator	Mean Score (MS)	Standard deviation	Coefficient of variation
EE2	1	Employees are encouraged to find and fix problems.	4.13	0.352	0.085
EE4		Technical assistance and support is given to employees for solving problems.	4.13	0.640	0.155
EE1	2	Employees are encouraged inspect the quality of their own work.	4.00	0.378	0.094
EE3	3	Employees are given the necessary resources to fix problems.	3.93	0.704	0.179
EE		**Employee Empowerment**	**4.05**	**0.530**	**0.132**

Cronbach's α = 0.145

The construct of *employee empowerment* was omitted from the analysis of the study. As discussed earlier, the reason for the omission was due to low internal consistency of this construct, based on the research sample of this

study. While this ‘soft’ aspect of the TQM principles is omitted from this study, this construct should definitely be considered for future studies.

Continuous Improvement (CI)

The mean score (MS) of continuous improvement (CI) was ranked third amongst the ten constructs. There were nine (9) indicators under CI (i.e. CI1, CI2, CI3, CI4, CI5, CI6, CI7, CI8 and CI9). All the mean scores (MS) for the CI indicators were above the midpoint mean score of 3. The CI MS’s ranged from 3.27 to 4.33. The overall MS for CI was 3.88 (78%) out of a maximum 5, with a coefficient of variance of 0.256. The Cronbach’s α for CI was calculated at 0.880, which was above the threshold of 0.7. Table 4.4 summarises the CI indicators.

It was noted that CI1- *our company has clear working instructions*, achieved a MS of 4.33 (87%) and was therefore ranked first amongst the CI indicators. This was followed by CI7- *our company uses quality control (QC) tools extensively for process control and improvement,* with a MS of 4.27. The lowest ranked score amongst the CI indicators was 3.27 (65%).

Table 4.4: Continuous improvement construct and indicators.

Indicator /Construct ID	Rank (MS)	Indicator	Mean Score (MS)	Standard deviation	Coefficient of variation
CI1	1	Our company has clear working instructions.	4.33	0.617	0.142
CI7	2	Our company uses quality control (QC) tools extensively for process control and improvement.	4.27	0.458	0.107
CI6	3	Our company implements various inspections effectively.	4.13	0.834	0.202
CI5	4	Production equipment is maintained well according to maintenance plan.	3.87	1.060	0.274
CI2		Our company has an accurate and efficient database that provides information on internal operation.	3.87	1.125	0.291
CI3		Our company has an accurate and efficient database that provides information on its costs and finances.	3.87	1.187	0.307
CI9	5	Our company uses plan-do-check-act (PDCA) cycle extensively for process control and improvement.	3.67	1.047	0.285
CI4		The aim of employee performance evaluation is for improvement, not for criticism.	3.67	1.234	0.337
CI8	6	Our company uses statistical process control extensively for process control and improvement.	3.27	0.884	0.271
CI		**Continuous improvement**	**3.88**	**0.993**	**0.256**

Cronbach's α = 0.880

"TQM is often termed a journey, not a destination" (Burati & Oswald, 1993), and as such the leadership and management of construction firms "must be supportive to the advancement of technology and management techniques", Harrington et al (2012). Based on the findings of this study, the principle of continuous improvement in the sample was ranked second amongst the TQM constructs. Further, the CI indicators (CI1 to CI9) all had a MS range of 3.67 to 4.33 out of a maximum 5. This suggests that CI was an important consideration for QMR's in their respective firms. Therefore, the QMR's and employees in the firms used PDCA cycles and quality control tools extensively for the improvement of processes within the firms. Further, the firms implemented quality inspections on an ongoing basis. All quality management practices and processes were maintained in an internal database.

It can be concluded that the QMR's at the firms in the sample are continuously evaluating their internal processes and quality management practices. The study, therefore, agrees with the literature of where continuous improvement is fundamental in a firm's TQM journey. It is therefore concluded that 'continuous improvement is a 'soft' aspect of TQM that is being practiced by QMR's in this sample at their construction firms.

Education and Training (ET)

The mean score (MS) of ET was ranked fourth amongst the ten constructs. There were five (5) indicators under ET (i.e. ET1, ET2, ET3, ET4 and ET5). All the mean scores (MS) for the ET indicators were above the midpoint mean score of 3. The ET MS's ranged from 3.20 to 4.20. The overall MS for ET was 3.77 (75%) out of a maximum 5, with a coefficient of variance of 0.229. The Cronbach's α for ET was calculated at 0.763, which was above the threshold of 0.7. Table 4.5 summarises the ET indicators.

It was noted that ET1- *employees are encouraged to accept education and training in our company,* achieved a MS of 4.20 (84%) and was therefore ranked first amongst the ET indicators. This was followed by ET4- *employees are regarded as valuable, long-term resources worthy of receiving education and training throughout their career,* with a MS of 4.00 (80%). The lowest ranked score amongst the ET indicators was 3.2 (68%).

Table 4.5: Education and training construct and indicators.

Indicator /Construct ID	Rank (MS)	Indicator	Mean Score (MS)	Standard deviation	Coefficient of variation
ET1	1	Employees are encouraged to accept education and training in our company.	4.20	0.676	0.161
ET4	2	Employees are regarded as valuable, long-term resources worthy of receiving education and training throughout their career.	4.00	0.845	0.211
ET2	3	Resources are available for employee education and training in our company.	3.73	0.799	0.237
ET3		Most employees in our company are trained on how to use quality management methods and tools.	3.73	0.884	0.214
ET5	4	Most employees in our company are interested to attend quality seminars or training courses.	3.20	0.862	0.269
ET		**Education and training**	**3.77**	**0.863**	**0.229**

Cronbach's α = 0.763

As mention in Chapter 2, several studies stated that firms should look to invest in advancing the knowledge of their employees through training and education programmes. Das et al., (2008) stated that firms should regard employees as valuable, long-term resources worthy of receiving education and training throughout their career. Based on the findings of this study, the TQM principle of education and training in the sample was ranked third amongst the TQM constructs. Further, the ET indicators (ET1 to ET5) all had a MS range of 3.20 to 4.20 out of a maximum 5. Employees at firms are strongly encouraged by management to participate in education and training programmes. However, the results suggest that there is a low level of agreement for employees' interest to attend such educational initiatives.

The QMR's believed that employees are regarded as valuable resources and worthy of being further educated and trained during the career. The results also suggest that the firms have training resources available and employees are trained on how to use quality management tools. The study, therefore, primarily agrees with the literature of where education and training is encouraged for its employees. However, the level of interest from employees to participate in these initiatives could not be ascertained in this study. It is therefore concluded that 'education and training' is a 'soft' aspect

of TQM that is being practiced on an overall basis by QMR's in this sample at their construction firms.

Employee Involvement (EI)

The mean score (MS) of EI was ranked fifth amongst the ten constructs. There were four (4) indicators under EI (i.e. EI1, EI2, EI3 and EI4). All the mean scores (MS) for the EI indicators were above the midpoint mean score of 3. The EI MS's ranged from 3.27 to 4.07. The overall MS for EI was 3.67 (73%) out of a maximum 5, with a coefficient of variance of 0.211. The Cronbach's α for EI was calculated at 0.636, which was below the threshold of 0.7. Table 4.6 summarises the EI indicators.

It was noted that EI4- *employees are very committed to the success of our company,* achieved a MS of 4.07 (81%) and was therefore ranked first amongst the EI indicators. This was followed by *EI2- employees are actively involved in quality-related activities,* with a MS of 3.80 (76%). The lowest ranked score amongst the EI indicators was 3.27 (65%).

Table 4.6: Employee involvement construct and indicators.

Indicator /Construct ID	Rank (MS)	Indicator	Mean Score (MS)	Standard deviation	Coefficient of variation
EI4	1	Employees are very committed to the success of our company.	4.07	0.458	0.113
EI2	2	Employees are actively involved in quality-related activities.	3.80	0.561	0.148
EI3	3	Our company implements suggestion activities extensively.	3.53	0.834	0.236
EI1	4	Our company has cross-functional teams or quality circles.	3.27	0.961	0.294
EI		**Employee involvement**	**3.67**	**0.774**	**0.211**

Cronbach's α = 0.636

The construct of *employee involvement* was omitted from the analysis of the study. As discussed earlier, the reason for the omission was due to low internal consistency of this construct, based on the research sample of this study. While this 'soft' aspect of the TQM principles is omitted from this study, this construct should definitely be considered for future studies.

Supplier Quality Management (SQ)

The mean score (MS) of SQ was ranked sixth amongst the ten constructs. There were four (4) indicators under SQ (i.e. SQ1, SQ2, SQ3 and SQ4). All the mean scores (MS) for the SQ indicators were above the midpoint mean score of 3. The SQ MS's ranged from 3.33 to 3.93. The overall MS for SQ was 3.63 (73%) out of a maximum 5, with a coefficient of variance of 0.264. The Cronbach's α for SQ was calculated at 0.940, which was greater than the threshold of 0.7. Table 4.7 summarises the SQ indicators.

It was noted *that SQ1- our company has established long-term co-operative relations with suppliers,* achieved a MS of 3.93 (79%) and was therefore ranked first amongst the SQ indicators. This was followed by SQ4- *our supplier rating system considers the supplier's delivery performance.* The lowest ranked score amongst the SQ indicators was 3.33 (67%).

Table 4.7: Supplier quality management construct and indicators.

Indicator /Construct ID	Rank (MS)	Indicator	Mean Score (MS)	Standard deviation	Coefficient of variation
SQ1	1	Our company has established long-term co-operative relations with suppliers.	3.93	1.033	0.263
SQ4	2	Our supplier rating system considers the supplier's delivery performance.	3.73	0.884	0.237
SQ3	3	Our company is more interested in developing a long-term relationship with these suppliers than reducing prices.	3.53	1.187	0.337
SQ2	4	Our company gives feedback on the performance of suppliers' products/ services.	3.33	0.976	0.293
SQ		**Supplier quality management**	**3.73**	**0.985**	**0.264**

Cronbach's α = 0.940

A construction firm must ensure quality at all stages of the supply value chain i.e. sub-contractors, vendors, service providers and material suppliers. For the purposes of this study these were grouped as suppliers. In studies carried out by Zhang et al (2000) and Harington et al (2012), the authors suggested that firms maintain long-term, close relationships with suppliers. Further, firms should give regular feedback on supplier's

performance. This is very pertinent to the construction firms that regularly use an array of suppliers for their respective projects.

Based on the findings of this study, the TQM principle of supplier quality management in the sample was ranked fourth amongst the TQM constructs. Further, the SQ indicators (SQ1 to SQ4) all had a MS range of 3.33 to 3.93 out of a maximum 5. The QMR's firms were focused on building long-term relationships with their suppliers and do have long-term and co-operative relationships with their respective suppliers. The firms also had a supplier rating system that considered the supplier's delivery performance. However, giving feedback on suppliers' performance could not be ascertained in this study. It is therefore concluded that 'supplier quality management is a 'soft' aspect of TQM that is being practiced on an overall basis by QMR's in this sample at their construction firms.

Product/Service Quality (PS)

The mean score (MS) of PS was ranked seventh amongst the ten constructs. There were three (3) indicators under PS (i.e. PS1, PS2 and PS3). All the mean scores (MS) for the PS indicators were above the midpoint mean score of 3. The PS MS's ranged from 3.53 to 3.73. The overall MS for PS was 3.62 (72%) out of a maximum 5, with a coefficient of variance of 0.265. The Cronbach's α for PS was calculated at 0.869, which was greater than the threshold of 0.7. Table 4.8 summarises the PS indicators.

It was noted that PS1- *the performance of our primary service/product is regularly monitored,* achieved a MS of 3.73 (75%) and was therefore ranked first amongst the PS indicators. This was followed by PS2- *the reliability of our primary service/product is increasing,* with a MS of 3.60 (72%). The lowest ranked score amongst the PS indicators was 3.53 (71%).

Table 4.8: Product/service quality construct and indicators.

Indicator /Construct ID	Rank (MS)	Indicator	Mean Score (MS)	Standard deviation	Coefficient of variation
PS1	1	The performance of our primary service/product is regularly monitored.	3.73	1.033	0.277
PS2	2	The reliability of our primary service/product is increasing.	3.60	0.828	0.230
PS3	3	The defect rates of our primary service/product are decreasing.	3.53	1.060	0.300
PS		**Product/service quality**	**3.62**	**0.960**	**0.265**

Cronbach's α = 0.869

As discussed in Chapter 2, the TQM principle of product/service quality is a measure of the quality of a firm's product or service. Construction firms provides a service to its customers. The main aim of construction firms is to deliver a project to their customers satisfaction, standards and requirements (Low and Teo, 2004). Based on the findings of this study, the TQM principle of product/service quality in the sample was ranked fifth amongst the TQM constructs. Further, the PS indicators (PS1 to PS3) all had a MS range of 3.53 to 3.73 out of a maximum 5. The QMR's in this sample stated that they regularly monitor the performance of their service to their customers. The level of monitoring is discussed under the principle of benchmarking. Based on the results of this study, it can be concluded that QMR's are practicing the soft aspect of product/service quality in their firms on an overall basis.

Customer Focus (CF)

The mean score (MS) of CF was ranked eighth amongst the ten constructs. There were five (5) indicators under CF (i.e. CF1, CF2, CF3, CF4 and CF5). All the mean scores (MS) for the CF indicators were above the midpoint mean score of 3. The CF MS's ranged from 3.20 to 3.93. The overall MS for CF was 3.61 (72%) out of a maximum 5, with a coefficient of variance of 0.321. The Cronbach's α for CF was calculated at 0.843, which was greater than the threshold of 0.7. Table 4.9 summarises the CF indicators.

It was noted that CF3- *quality-related customer complaints are treated with top priority*, achieved a MS of 3.93 (79%) and was therefore ranked first

amongst the CF indicators. This was followed by CF4- *our company conducts a customer satisfaction survey every year,* with a MS of 3.90 (78%). The lowest ranked score amongst the CF indicators was 3.20 (64%).

Table 4.9: Customer focus construct and indicators.

Indicator /Construct ID	Rank (MS)	Indicator	Mean Score (MS)	Standard deviation	Coefficient of variation
CF3	1	Quality-related customer complaints are treated with top priority.	3.93	1.335	0.339
CF4	2	Our company conducts a customer satisfaction survey every year.	3.90	1.146	0.302
CF1	3	Our company has developed a program to maintain good customer communication.	3.67	1.175	0.320
CF2	4	Our company collects extensive data, complaint information from customers.	3.47	1.060	0.306
CF5	5	Our company always conducts market research for collecting suggestions for improving our products.	3.20	1.082	0.338
CF		**Customer focus**	**3.61**	**1.161**	**0.321**

Cronbach's α = 0.843

As stated Chapter 2, Motwani (2001) stated that firms should maintain a customer service programme of where customers should be provided with timely information, quick responsiveness to complaints and overall to reduce the amount of customer complaints. It was further suggested by Motwani (2001) that customer surveys should be conducted to measure customer satisfaction. Based on the findings of this study, the TQM principle of product/service quality in the sample was ranked sixth amongst the TQM constructs. Further, the CF indicators (CF1 to CF5) all had a MS range of 3.20 to 3.93 out of a maximum 5.

The QMR's in the sample stated that customer complaints are treated with top priority and there was a high level of agreement amongst the QMR's. The QMR's also stated that they conducted a customer satisfaction survey every year. The QMR's maintained that their firms maintain good communication with its customers. With customer satisfaction being a key driver for the success of construction firms, it was expected to be a higher ranked construct. As such, the coefficient of variation for each of the CF indicators was less than 0.3. This suggests that there is no existence of a

true mean among the sample (Kumar et al, 2009). It is therefore concluded that no firm evidence can provided from the study on whether the TQM principle of 'customer focus' is being practiced on an overall basis by QMR's in this sample at their construction firms.

Benchmarking (BM)

The mean score (MS) of BM was ranked ninth amongst the ten constructs. There were four (4) indicators under BM (i.e. BM1, BM2, BM3 and BM4). All the mean scores (MS) for the BM indicators were above the midpoint mean score of 3. The BM MS's ranged from 3.20 to 4.27. The overall MS for BM was 3.55 (71%) out of a maximum 5, with a coefficient of variance of 0.272. The Cronbach's α for BM was calculated at 0.907, which was greater than the threshold of 0.7. Table 4.10 summarises the BM indicators.

It was noted that BM4- *the quality system in our company is continuously improving,* achieved a MS of 4.27 (85%) and was therefore ranked first amongst the BM indicators. This was followed by BM1- *we are engaged in extensive benchmarking of competitors' products that are similar to our primary product,* with a MS of 3.40 (68%). The lowest ranked score amongst the BM indicators was 3.20 (64%).

Table 4.10: Benchmarking construct and indicators.

Indicator /Construct ID	Rank (MS)	Indicator	Mean Score (MS)	Standard deviation	Coefficient of variation
BM4	1	The quality system in our company is continuously improving.	4.27	0.594	0.139
BM1	2	We are engaged in extensive benchmarking of competitors' products that are similar to our primary product.	3.40	0.986	0.290
BM3	3	Benchmarking has helped improve our product.	3.33	0.900	0.270
BM2	4	We have engaged in extensive benchmarking of other companies' business processes in other industries.	3.20	1.014	0.317
BM		**Benchmarking**	**3.55**	**0.964**	**0.272**

Cronbach's α = 0.907

In order to continually satisfy their customers, firms should benchmark their processes against leading competitors (Ahire et al, 1996). Das et al (2008) suggests that firms compare its practices and services against peers in the industry to gauge its performance. Based on the findings of this study, the TQM principle of benchmarking in the sample was ranked seventh and second lowest amongst the TQM constructs. Further, the BM indicators (BM1 to BM4) all had a MS range of 3.20 to 4.27 out of a maximum 5. The QMR's in the sample highly agreed that their quality system in their firm was continuously improving. However, there was a lower level of agreement in terms of benchmarking the firms service to that of competitors in the industry. While the overall coefficient of variation was less than 0.3 and reflects a true mean amongst the sample (Kumar et al, 2009), the QMR's tend to remain closer to neutral in terms of benchmarking their firms service. It is therefore concluded that no firm evidence can provided from the study on whether the TQM principle of 'benchmarking is being practiced on an overall basis by QMR's in this sample at their construction firms.

Reward and Recognition (RR)

The mean score (MS) of RR was ranked tenth and therefore the lowest amongst the ten constructs. There were four (4) indicators under RR (i.e. RR1, RR2, RR3 and RR4). All the mean scores (MS) for the RR indicators were less than or equal to the midpoint mean score of 3. The RR MS's ranged from 2.47 to 3.00. The lowest mean scores were recorded for this construct as compared to the other nine constructs. The overall MS for RR was 2.67 (53%) out of a maximum 5, with a coefficient of variance of 0.382. The Cronbach's α for RR was calculated at 0.868, which was greater than the threshold of 0.7. Table 4.11 summarises the RR indicators.

It is noted that RR4- *recognition and reward activities effectively stimulate employee commitment to quality improvement,* achieved a MS of 3.00 (60%) and was therefore ranked first amongst the RR indicators. This was

followed by RR1- *our company has a salary promotion scheme for encouraging employee participation in quality improvement,* with a MS of 2.73 (55%). The lowest ranked MS amongst the BM indicators was 2.47 (49%) for RR3 and RR2.

Table 4.11: Reward and recognition construct and indicators.

Indicator /Construct ID	Rank (MS)	Indicator	Mean Score (MS)	Standard deviation	Coefficient of variation
RR4	1	Recognition and reward activities effectively stimulate employee commitment to quality improvement.	3.00	1.069	0.356
RR1	2	Our company has a salary promotion scheme for encouraging employee participation in quality improvement.	2.73	1.163	0.425
RR3	3	Employees' rewards and penalties are clear.	2.47	0.834	0.338
RR2		Excellent suggestions are financially rewarded.	2.47	0.990	0.402
RR		**Reward and recognition**	**2.67**	**1.020**	**0.382**

Cronbach's α = 0.868

The studies of Brown et al (1994) and Dale (1999) suggests that firms should develop formal compensation systems to encourage, evaluate, reward and recognise efforts made by employees towards quality enhancement. Based on the findings of this study, the mean score for the RR construct was ranked eight and therefore the lowest. This construct had the lowest MS with a score of 2.67. This MS was less than the midpoint of 3, which suggested that the respondents did not agree with the TQM statements made on RR. This suggests that the firms in this study sample do not have incentive or reward recognition schemes in place in order to encourage quality improvement practices at the firms.

A summary table of all results for the ten constructs and 50 indicators are detailed in Appendix C. The tables in Appendix C lists each TQM construct and its associated indicators. The mean score, standard deviation and ranking of all the TQM indicators are tabled.

4.4 Summary of key TQM indicators

The various indicators for the 8 constructs were outlined in Chapter 4. These forty-two (42) indicators were ranked in descending order based on their mean scores. This is tabulated in Appendix D. For observation purposes, the top indicators with a mean score greater than or equal to 4 are listed in table 5.2 below.

Table 4.12: Top TQM indicators.

Construct ID	Rank (MS)	Constructs	Mean Score (MS)	Standard deviation
TM6	1	We have clear quality goals identified by top management.	4.60	0.632
CI1	2	Our company has clear working instructions.	4.33	0.617
BM4	3	The quality system in our company is continuously improving.	4.27	0.594
CI7		Our company uses quality control (QC) tools extensively for process control and improvement.	4.27	0.458
TM5		Our company has a clear long-term vision statement that encourages employees' commitment to quality improvement.	4.27	0.704
ET1	4	Employees are encouraged to accept education and training in our company.	4.20	0.676
TM1		Top management communicates the company's philosophy to the employees	4.20	0.862
TM3		Top management strongly encourages employee involvement in quality management and improvement activities.	4.20	0.676
CI6	5	Our company implements various inspections effectively.	4.13	0.834
TM2		Top management actively develops one integrated quality plan to meet business objectives.	4.13	0.915
ET4	6	Employees are regarded as valuable, long-term resources worthy of receiving education and training throughout their career.	4.00	0.845
TM4		Top management arranges adequate resources for employee education and training.	4.00	0.535
TM7		Our company has an effective quality improvement plan.	4.00	0.756
TM8		Employees are encouraged to achieve their objectives.	4.00	0.655

Maximum score =5. Minimum score =1.

From Table 5.2, it is noticed that these TQM indicators had a mean score greater than or equal to 4. The maximum score was 5. Of the indicators that had a MS greater or equal to 4 were as follows; 8 TM indicators, 3 CI indicators, 2 ET indicators and 1 BM indicator. As an observation, the various indicators refer to the conceptual features as led by management from the firm. Top management commitment is highly evident as a practice being implemented amongst the construction firms in the sample. All the eight TM indicators scored greater than or equal to 4 out of a maximum of 5.

4.5 Summary of results

Table 5.3 displays the ten 'soft' aspects of the TQM principles, and outlines which soft aspects of TQM are being practiced and which are not being practiced by QMR's at construction firms.

Table 4.13: Practice of the 'soft' aspects of TQM principles

Construct ID	Rank (MS)	Constructs	No. of indicators	Mean Score (MS)	Being practiced by QMR's?
TM	1	Top management commitment	8	4.18	Yes
CI	2	Continuous improvement	9	3.88	Yes
ET	3	Education and training	5	3.77	Yes
SQ	4	Supplier quality management	4	3.63	Yes
PS	5	Product/service quality	3	3.62	Yes
CF	6	Customer focus	5	3.61	No
BM	7	Benchmarking	4	3.55	No
RR	8	Reward and recognition	4	2.67	No
EE	*Not ranked*	*Employee empowerment*			
EI	*Not ranked*	*Employee involvement*			

Of the eight 'soft' aspects of TQM principles in this study, only five 'soft' aspects of TQM principles were being practised by QMR's and three 'soft'

aspects of TQM principles were not being practised by QMR's at their ISO-9001 certified construction firms.

The five 'soft' aspects of TQM that were being practised by the QMR's were that of; top management commitment, continuous improvement, education and training, supplier quality management and product/service quality.

The three 'soft' aspects of TQM that were not being practised by the QMR's were that of customer focus, benchmarking and reward and recognition.

CHAPTER 6 - CONCLUSIONS AND RECOMMENDATIONS

This chapter re-visits the aim and objectives of the study and then summarises the main findings of this study. The recommendations for further research and limitations of this study are described.

6.1 Conclusion

The aim of the study was to explore the extent to which quality management representatives in ISO-9001 South African construction firms are practicing the soft aspects of TQM. The two objectives of the study were to; validate the 'soft' aspects of TQM principles and then to identify which of these 'soft' aspects were being practised by QMR's at their firms. Consequently, two research questions were asked; What are the 'soft' aspects of TQM principles that are applicable for construction firms in South Africa? Do designated quality management representatives (QMR's) in ISO-certified construction firms in South Africa practise the 'soft' aspects of TQM principles?

The aim and objectives of this study were achieved by comprehensively synthesising the existing available literature on the subject of TQM principles, as documented by various authors and leading academics. A survey was then conducted amongst QMR's at ISO-9001 construction firms in Gauteng to collect data for statistical analysis.

The findings of this study revealed that, of the ten principles and management concepts or 'soft' aspects that were extracted from the literature, only eight were reliable for this study. This was based on the descriptive statistical analysis that was applied to the TQM constructs. This study therefore reveals the following:

i. The ten ‘soft’ aspects TQM being; *top management commitment, employee involvement, education and training, employee empowerment, reward and recognition, continuous improvement, benchmarking, customer focus, supplier quality management* and *product/service quality,* are applicable for the practice of TQM in ISO 9001 certified South African construction firms. These ten principles had an associated 50 indicators. The principles were identified from a synthesis of the existing literature by various authors on the management concepts and principles of TQM.

ii. However, only eight of these ‘soft’ aspects of TQM were found to be valid and reliable for the sample of this study. These were the principles of top *management commitment, education and training, reward and recognition, continuous improvement, benchmarking, customer focus, supplier quality management* and *product/service quality.* Of these eight valid ‘soft’ aspects, only five ‘soft’ aspects of TQM principles were being practised and three ‘soft’ aspects of TQM principles were not being practised by QMR’s at their ISO 9001 certified construction firms.

iii. The five ‘soft’ aspects of TQM principles that were being practised by QMR’s at their ISO 9001 certified construction firms were that of *top management commitment, continuous improvement, education and training, supplier quality management* and *product/service quality.* These are the soft aspects of TQM that are applied in South African ISO 9001 certified construction firms.

iv. The three ‘soft’ aspects of TQM principles that were not being practised by QMR’s at their ISO 9001 certified construction firms were that of *customer focus, benchmarking* and *reward and recognition.*

Based on the findings of this study, that despite the QMR's being cognisant of the identified 'soft' aspects of the TQM principles, the practice of these 'soft' aspects TQM principals in the ISO 9001 certified construction firms is irregular and cursory amongst QMR's, as the level of agreement by the QMR's for the identified 'soft' aspects of TQM principles was not deemed to be significant.

6.2 Limitations and Recommendations for Future Research

The sample of this study was based on that of QMR's working for ISO 9001 certified construction firms based in Gauteng. There were two limitations in this. Firstly, the study was geographically limited to construction firms based in Gauteng. Similar studies should be expanded for construction firms based in the other provinces of South Africa. Secondly, whilst various authors in the literature commented that ISO 9001 is a building block for TQM, other quality management standards should be investigated as possible building blocks for TQM.

While the number of respondents was valid for this study, a larger sample size would improve the validity and reliability of the ten 'soft' aspects of TQM principles thereby strengthening the current findings.

The limited number of studies on TQM and even more so on the principles of TQM on the African continent including South Africa and other developing countries also proved to be a limitation for this study.

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APPENDICES

Appendix A – Interview Schedule

Appendix B – Summary of Responses

Appendix C – Summary of Results

Appendix D – Ranking of TQM indicators