

Total quality management (TQM) implementation among ISO 9001 registered construction companies in South Africa.

A research report submitted by:

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DECLARATION

I declare that this research report is my own original work. It is being submitted for the Degree of Master of Science (Building) at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

Mokopi Petrus Morumudi (The above declaration is acknowledged)

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ABSTRACT

Purpose: There has been much assertion about how ISO 9001 facilitates TQM implementation among ISO 9001 registered construction companies. However, the success rate of TQM implementation among ISO 9001 registered companies varies. The aim of this study was to investigate TQM implementation among ISO 9001 registered construction companies in South Africa. Three objectives were also established to aid in achieving the aim.

Methodology: A cross-sectional survey design using structured questionnaire to collect quantitative and qualitative data was adopted. Respondents were purposively sampled among ISO 9001 registered construction companies in South Africa. 70 completed questionnaires were obtained from the target of 100. Text-based (i.e., qualitative) data were analysed using qualitative content analysis while quantitative data were analysed descriptively.

Findings: The main three findings include: (1) the prevalence of defining quality as meeting clients' expectations and assessing quality through internal inspection; (2) highest level of agreement on TQM being implemented through checking design conformance to standards and lowest level of agreement on formal training on TQM; and (3) customer feedback exercises and supplier relationship were indicated as being the least implemented ISO 9001 principles.

Implications: The main practical implication of this study is identifying how TQM is being implemented among ISO 9001 registered construction companies in South Africa and the challenges they face. The main theoretical implication is being able to add to the existing studies validating ISO 9001 registered construction companies can and should implement TQM across their processes.

Limitations: The main limitation has been restricted to not collecting data on the professional backgrounds and years of experience of the study participants. A finding during the pilot testing necessitated the preference to indicate job roles as against professional backgrounds.

Key words: Construction Industry, Customer Satisfaction, ISO 9001, South Africa, TQM Implementation.

DEFINITION OF TERMS

Quality is the totality of features and characteristics of a product or services that bear on its ability to satisfy implied or stated needs (American National Standards Institute/American Society for Quality Control (ANSI/ASQC), 1987). It has also defined by the three experts on quality (i.e., Crosby, Deming, and Juran) as “conformance to requirements”, “by the customer”, and “fitness for purpose”, respectively (Suárez, 1992: 2-4).

Quality management (QM) is what an organization does to ensure that its products conform to the customer’s requirements. It is the process of identifying and administering the activities needed to achieve the quality objectives of an organization (Stupak and Leitner, 2001).

Total quality management (TQM) is a set of systematic activities carried out by the entire organization to effectively and efficiently achieve the organization’s objectives so as to provide products and services with a level of quality that satisfies customers, at the appropriate time and price (Union of Japanese Scientists and Engineers (JUSE) (2017).

ISO 9001 is an international standard that specifies requirements for a quality management system (QMS). Organizations use the standard to demonstrate the ability to consistently provide products and services that meet customer and regulatory requirements. It is the most popular standard in the ISO 9000 series and the only standard in the series to which organizations can certify (American Society for Quality (ASQ), 2015).

LIST OF ABBREVIATIONS

ANSI	American National Standards Institute
ASQ	American Society for Quality
ASQC	American Society for Quality Control
ASTM	American Society for Testing and Materials
BSI	British Standard Institution
CIDB	Construction Industry Development Board
IMS	Integrated Management System
ISO	International Organization for Standardization
JUSE	Union of Japanese Scientists and Engineers
MSS	Management Systems Standards
QM	Quality Management
QMS	Quality Management Systems
SABS	South African Bureau of Standards
SACEM	South African Construction Excellence Model
TQC	Total Quality Control
TQM	Total Quality Management

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CHAPTER 1: INTRODUCTION

1.1 Background Information

The International Organization for Standardization (ISO) develops voluntary, consensus-based, market relevant international standards that support innovation and provide solutions to global challenges. As of 2017, ISO has developed over 21,700 international standards covering almost every industry from information technology to health care (ISO, 2017a). A standard is a measure devised by general consent as a basis for comparison, against which judgments might be made as to the levels of acceptability (Crawford, 2007, 2013). Similarly, the British Standards Institution (BSI, 2017), which has also developed over 30,000 standards as of 2017, views a standard as an agreed way of doing something, including a product, a process, or a service.

While international standards are designed for voluntary use, they are naturally accepted (Murphy and Yates, 2009) because they level the playing field and shape innovation (Allen and Sriram, 2000; Zoo *et al.*, 2017). The American Society for Testing and Materials (ASTM, 2017) has established more than 1,300 standards to support safe, economic, and quality construction. Central to this study, the South African Bureau of Standards (SABS, 2017) maintains different standards covering the demands of the building and construction industry, from quality management systems to test methods for specific materials or parts. South Africa's Construction Industry Development Board (CIDB, 2017) also maintains some standards.

The increasing acceptance of standards is supported by its upward trend based on ISO's yearly survey of companies registered to its standards (see ISO, 2017b). The survey also validates that of all the ISO standards, ISO 9001 and ISO 14001 standards have enjoyed the most global adoption (Casadesus *et al.*, 2008; Viadiu *et al.*, 2006). The benefits of these two standards (Tari *et al.*, 2012) make for an integrated implementation among construction firms (Zeng *et al.*, 2005) and increasingly, to complete the most common triad, with OHSAS 18001 (Low and Goh, 2005). Integrating standards typifies integrated management systems (IMS) or management systems standards (MSS) (Heras-Saizarbitoria and Boiral, 2013; Ivanova *et al.*, 2014).

Starting from ISO 9001 standard, because of its influence on IMS or MSS (Wilkinson and Dale, 2002) and, comparatively, highest diffusion across many sectors (Llach *et al.*, 2011), attaining MSS is a continuous improvement effort, which underpins total quality management (TQM) (Salah *et al.*, 2009). As such, ISO 9000 series is regarded as a stepping stone to TQM (Farooqui and Ahmed, 2009; Lakhal, 2014; Quazi and Padibjo, 1997) and TQM, in turn, considered a journey (Lam *et al.*, 2008; Maguerez, 1997). Consequently, while ISO 9000 and TQM are complementary (Magd and Curry, 2003; Martínez -Lorente and Martínez -Costa, 2004), TQM is a systematic organization-wide approach to satisfying the customer (JUSE, 2017).

This organization-wide approach supports Japan's original concept of total quality control (TQC) before the U.S. propagated TQC as TQM (ASQ, 2017a; Chiarini, 2011; Dale, 1993; Martínez -Lorente *et al.*, 1998). TQM pervades the other management techniques, notably lean production and six sigma (Dahlgard and Dahlgard-Park, 2006; Majstorovic and Sibalija, 2015); as such, applied to the construction industry (Harrington *et al.*, 2012; Low and Teo, 2004). However, despite the claim of and for TQM implementation among ISO 9001 registered construction companies (Babatunde and Low, 2015; Oliveira *et al.*, 2017), the results have been mixed, being success (Gharakhani *et al.*, 2013) and failure (Mosadeghrad, 2014).

While there are barriers and benefits to quality management in the construction industry (Hoonakker *et al.*, 2010), TQM should not be more difficult to implement than other organization-wide changes (Cândido and Santos, 2011). TQM implementation problems can be attributed to defining and assessing quality in construction projects (Delgado-Hernandez and Aspinwall, 2008, 2010), ISO 9001 implementation among registered construction companies (Willar *et al.*, 2015), and embodying the critical success factors towards TQM (Aquilani *et al.*, 2017). On the African continent, South Africa leads in ISO 9001 registration (ISO, 2017b) and is one of the four countries with excellence/business awards (Mohammad *et al.*, 2011). However, South Africa's construction industry still grapples with unsatisfactory quality of services for the client (CIDB, 2011), despite the existence of a framework for ensuring construction excellence (Dlungwana *et al.*, 2002) and client satisfaction (Mbachu and Nkado, 2006).

1.2 Statement of the Problem

Since TQM is an organization-wide approach, TQM implementation challenges experienced among the different parties involved on construction projects are affecting the construction quality for clients in South Africa. As such, the effectiveness of the South African construction excellence model (SACEM) (Dlungwana *et al.*, 2002) is being weakened by the back-end view of the challenges of TQM implementation on construction sites (Haupt and Whiteman, 2004), precluding the more holistic view involving the entire participants (Leung *et al.*, 2004).

To substantiate, If TQM is about client's satisfaction through an organization-wide continuous improvement approach (JUSE, 2017) then there is the need to consider the challenges that the different construction project team members face in their different capacities implementing TQM. The value of this more holistic view among South African construction team members is the ability to devise strategies to improve the effectiveness of SACEM, which can ultimately lead to improved satisfaction on construction projects (Nzekwe-Excel, 2012).

1.3 Research Aim

The aim of this study is to investigate TQM implementation among ISO 9001 registered construction firms in South Africa using the conceptual framework of their efforts at achieving continuous improvement.

1.4 Research Objectives

The three objectives of this study include:

1. To analyze how construction quality is defined and assessed among the construction companies;
2. To evaluate how TQM/ continuous improvement is being achieved among the construction companies; and
3. To identify the main challenge facing TQM implementation among the construction companies.

1.5 Research Questions

In investigating TQM implementation among ISO 9001 registered construction companies in South Africa, three research questions were developed to guide the process of data collection and analysis. These questions have been framed directly from the preceding objectives of the research. The research questions developed include:

1. How do ISO 9001 registered construction companies in South Africa define and assess quality?
2. How is continuous improvement being achieved among ISO 9001 registered construction companies in South Africa?
3. What is the main challenge against TQM implementation among the construction companies in South Africa?

1.6 Research Assumptions

Four assumptions underpinned this study. Firstly, ISO 9001 registration is a launch pad for TQM implementation (see Bradley, 1994; Martínez-Lorente and Martínez-Costa, 2004; Martínez-Costa *et al.*, 2009). Secondly, with the ISO 9000 series gradually losing its lustre (Karapetrovic *et al.*, 2010), the sustained route to TQM implementation lies in self-initiated continuous improvement programs (see Bhuiyan and Baghel, 2005; Davenport, 1993; Jung and Wang, 2006; Jung *et al.*, 2009; Shortell *et al.*, 1995). Thirdly, TQM is the management tool to keep improving customer satisfaction (Kristiano *et al.*, 2012) because it is premised on continuous improvement and, as such, inherent in the other management techniques (see Andersson *et al.*, 2006; Cua *et al.*, 2001; Kannan and Tan, 2005). Lastly, TQM can be measured based on observable practices as supported by existing studies; notably, Kaynak (2003), Martínez-Lorente and Martínez-Costa (2004), Bou-Llusar *et al.* (2009), and ASQ (2017b).

1.7 Research Scope and Delineations

The scope entailed observable continuous improvement practices of ISO 9001 registered construction companies in South Africa as a proxy for measuring the progress on TQM implementation. No delineation has been made among ISO 9001:2000, ISO 9001:2008 and, most recently, ISO 9001:2015 because TQM has been embedded in ISO 9001 from the 2000

version. TQM has been delineated as a management technique that is based on continuous improvement as discussed in the immediate preceding section. Small- and medium-sized ISO 9001 certified construction companies in the Mpumalanga and Gauteng provinces of South Africa were the focus of this study.

1.8 Research Methodology

Based on the aim and objectives of this study, quantitative and qualitative methods of data collection were adopted. Survey design was adopted for a target population of employees working with ISO 9001 registered construction companies (consultancy and contracting) in South Africa, using face-to-face structured questionnaires to improve response rate. Purposive sampling technique was initially used to approach employees of known ISO 9001 registered construction companies who were then able to refer to employees of other ISO 9001 registered construction companies; hence, snowballing technique.

1.9 Significance of the Study

With South Africa's leading role in ISO 9001 registration on the continent (ISO, 2017b) and its having developed excellence/business awards (Mohammad *et al.*, 2011), this study is important in providing insights into challenges against TQM implementation among ISO 9001 registered South African construction companies. Coupled with findings from existing studies on inhibiting factors for TQM implementation on construction sites in South Africa (Haupt and Whiteman, 2004), this study can bring to the fore areas to be addressed in the construction value chain to create better meet the needs of the South African client (CIDB, 2011). Lastly, it can steer further TQM-based research projects to improve effectiveness of SACEM (Dlungwana *et al.*, 2002) towards improving the overall building development process (Mbachu and Nkado, 2006).

1.10 Ethical Considerations

Ethics are the standards of behaviour guiding a researcher's conduct in relation to the rights of the subjects of the study (Saunders *et al.*, 2016: 239). Since ethical concerns encompass designing, planning, and executing the research, ethical considerations were adhered throughout for research governance (Slowther *et al.*, 2006). The University of Witwatersrand's

human (non-medical) subjects' research ethics policy was followed to obtain an ethical clearance for this study through the School of Construction Economics and Management's research ethics committee. The stipulations of the ethical clearance were, subsequently, followed throughout the research project (Benatar, 2002; Guillemin and Gillam, 2004; Keith-Spiegel *et al.*, 2006; Pich *et al.*, 2003).

1.11 Report Structure

This current Chapter 1 introduces the study; including the problem statement, research aim, research objectives, and research questions. Chapter 2 reviews literature on the concepts central to this study, including TQM and its benefits and challenges among ISO 9001 registered companies. Chapter 3 discusses the methodology adopted for this research while Chapter 4 discusses how the data were analysed. Chapter 5 discusses the findings, implications, limitations, recommendations and conclusion for the study.

1.12 Chapter Summary

This introductory chapter has established the importance of TQM implementation in the construction industry and, in particular, among the ISO 9001 registered construction companies in South Africa as supported by SCAEM. On the other hand, it has underscored the effectiveness of SACEM is being weakened by the back-end view of the challenges of TQM implementation on construction sites. Consequently, it has established the aim of investigating TQM implementation among ISO 9001 registered construction firms in South Africa using their continuous improvement efforts. This has been backed by four assumptions which also form part of review under the next Chapter.

CHAPTER 2 LITERATURE REVIEW

2.1 Overview

This chapter reviews the relevant literature is a bid to identify the gap in the existing studies which this present study can fill as well as adopt and/or adapt findings from the existing studies as a basis for this present study, which is focused on South Africa. An integrative literature review (Callahan, 2010; Torraco, 2005, 2016) has been adopted. The goal of an integrative literature review as a distinct form of research is to stream existing literature to reveal new insight and meaningful knowledge (Yorks, 2008). Employing techniques of mixed method or qualitative research to this process has the potential to decrease bias and error (Whittemore and Knafl, 2005). The integrative literature review has also been used in the built environment research to address an emerging topic and present a holistic conceptualisation of the literature (Haigh and Amaratunga, 2010; Sexton and Barrett, 2003).

2.2 Evolution of Total Quality Control (TQC)

Quality control has evolved over the years (Dahlggaard-Park, 2011; Giacco *et al.*, 2013; Maguad, 2006; Weckermann *et al.*, 2015). It can be traced back to 1900 when 'craftsman' quality was considered an important aspect up to the end of the 19th century (Gehani, 1993; Feigenbaum 1991). At the time, only a few 'craftsmen' were responsible for the manufacturing of a complete product. As such, each concentrated on the quality of their individual works. During the industrial revolution, 'foreman' quality evolved through grouping of 'craftsmen' performing a similar task and appointing a 'foreman' to assume the responsibility of ensuring the quality of their work (Tang *et al.* 2005) Complexity of manufacturing systems in the First World War influenced the emergence of inspection quality control (Dahlggaard *et al.*, 2008). Since there were many 'craftsmen' reporting to a single 'foreman', fulltime supervisors were appointed, a precursor to total quality control (Duffin, 1995), for increasing efficiency among large organisations between 1920s and 1930s (ASQ, 2017a; Martínez-Lorente *et al.*, 1998).

During the Second World War, statistical quality control emerged because of the rising need for mass production (Clarke, 2005). Statistical quality control was meant to refine supervision in large-scale production companies. Sampling and control charts were introduced to aid the supervisors in their quality control activities. In the 1960s, total quality control (TQC) emerged in Japan (Duffin, 1995; Karatsu, 1988; Madu, 2012). A number of factors influenced TQC; notably, the growing demand for high quality products among the customers (Dale, 1993; Stuart *et al.*, 1996). Therefore, manufacturers were under pressure to provide quality products. In addition, organisations realised that statistical control was not enough to deliver the quality required by the customers (Hossain *et al.*, 2009). As such, a new concept of TQM, popularised by the US (ASQ, 2017a; Chiarini, 2011; Sasaoka, 1995), was adopted to ensure that quality of the product started from the design to when it was placed at the hands of the customers (Zairi, 2013). From the studies reviewed, the evolution of quality can be summarised in a diagram as presented in the ensuing Figure 2.2

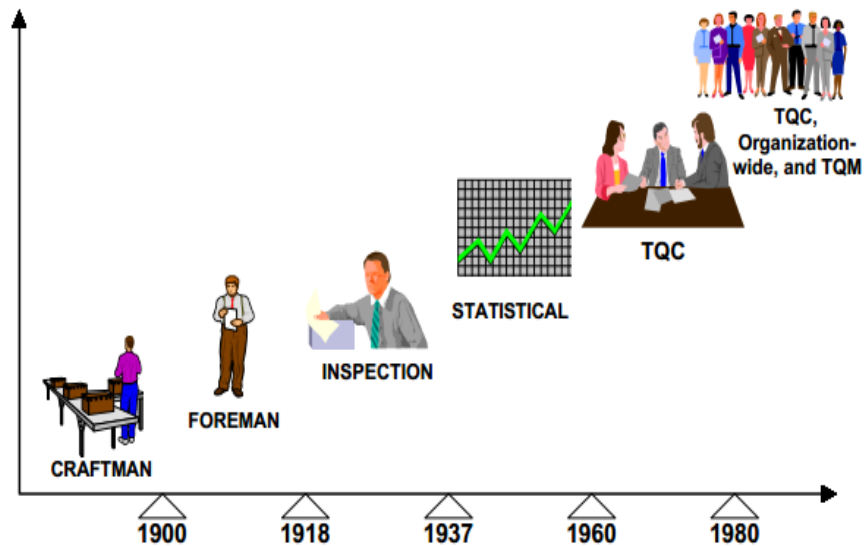


Figure 1.1: Evolution of Quality Control (Source: Feigenbaum 1991)

The evolution of TQC and TQM shows that quality improvement is a continuous process influenced by the emerging demands in the market (Ahire *et al.*, 1995; Bhuiyan and Baghel, 2005; Osayawe and McAndrew, 2005). The construction industry has also evolved over the years as the needs and demands of the customers keep on changing (Potts and Ankrah, 2014). Therefore, any construction company requires a well-defined model to guide in the quality

improvement process as Vaněk *et al.* (2015) have also been established for South Africa. Premised on continuous improvement or *Kaizen* as the Japanese refers to it (Paraschivescu, 2015), TQM is the best and the most sophisticated quality improvement model because it focuses on improving every aspect of the organisation by involving all the people (Kanji, 2012). As such, a construction company implementing TQM will benefit because the approach will facilitate a non-ending improvement of the products and services, which will result in competitive advantage and sustainable growth (Arditi and Gunaydin, 1997; Harrington *et al.*, 2012; Low and Teo, 2004; Joubert *et al.*, 2005; Yong and Low, 2008).

2.3 Conceptualizing Total Quality Management (TQM)

TQM encompasses TQC as a continuous improvement endeavour. According to American Society for Quality (ASQ, 2017b), TQM is a management approach aimed at enhancing customer satisfaction for long-term success. In this regard, a management that practices TQM engages all the employees in improving the products, services, processes, systems and the work culture. Charantimath (2011: 59) defines TQM as “a management approach that tries to achieve and sustain long-term organizational success by encouraging employee feedback and participation, satisfying customer needs and expectations, respecting societal values and beliefs and obeying governmental statutes and regulations”. Accordingly, Charantimath (2011) crystalized that the TQM philosophy evolved from the continuous improvement philosophy and expands beyond statistical control to embrace a wider scope of management activities surrounding people and organizations by focusing on the entire process and not just simple measurements. Upholding its tenet on continuous improvement, research projects on TQM practices have increased over the years (see Ngambi and Nkemkiafu, 2015; Nguyen and Chau, 2017; Oschman, 2017; Psomas *et al.*, 2017; Sanchez and Blanco, 2014), with authors also investigating TQM constructs (Ahire *et al.*, 1996; Das *et al.*, 2008; Morrow, 1997) and core concepts (ASQ 2017b; Bou-Llusar *et al.*, 2009).

2.3.1 Measuring TQM

Charantimath (2011) argues that there are five key pillars of TQM, namely product, process, people, system and leadership. Product and process are defined as hard aspects meant to

enhance effectiveness. On the other hand, people and leadership are defined as soft aspects meant to enhance suitability. The system, which is meant to enhance confluence, falls in between the hard and the soft aspects. Therefore, the key pillars of TQM can be represented diagrammatically as shown in the model presented in the ensuing Figure 2.1. Other studies that have delineated the aspects of TQM into hard and soft include, in chronological order, Rahman and Bullock (2005), Lewis *et al.* (2006), Fotopoulos and Psomas (2009a), van Kemenade (2012), Abdallah (2013), Calvo-Mora *et al.* (2013), Psomas *et al.* (2014), and Dubey and Gunasekaran (2015). It can be concluded that the realization of TQM hard and soft aspects has increased post-2010 as Aquilani *et al.*'s (2017) study has also given credence to.

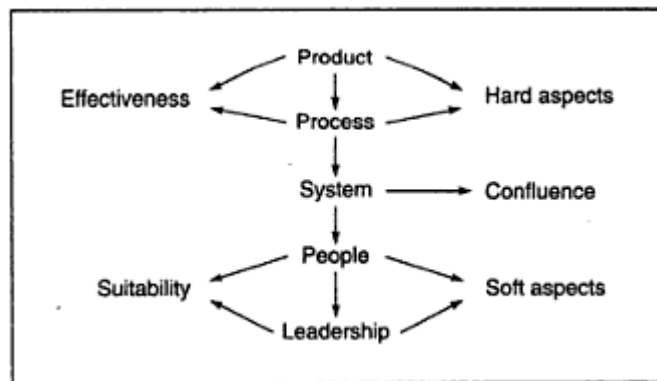


Figure 2.2: Five Pillars of TQM (Source: Charantimath, 2011: 59)

According to Hakes (1994), a person that agrees that an organisation can only provide quality goods and services if all the departments are determined to enhance quality understands TQM. Hakes (1994) did not only define TQM, it also explains how an organisation can implement it in the daily business and operation processes. Before implementing TQM, an organisation is required to understand the six key aspects that must be observed to enhance the realisation of the full benefits of TQM. These key aspects are inherent in the TQM practices expounded among the relevant existing studies (see ASQ, 2017b; Bou-Llusar *et al.*, 2009; Kaynak, 2003; Martínez-Lorente and Martínez-Costa, 2004).

2.3.2 Aspects of TQM

The first aspect is the customer. In this regard, successful organisations ensure that monitoring the performance to meet or exceed the expectations of the customers is an important element in quality management (Praeg 2010). The second aspect is to treat improvement as a never-ending process (Hakes 1994; Khanna *et al.*, 2004; Lam *et al.*, 2008; Walsh *et al.*, 2002). As such, the management should not consider a certain level of improvement as the optimum (Mitchell *et al.*, 2013). This means that the full benefits of TQM can only be realised when there is a plan to improve every aspect of an organisation infinitely (Joubert *et al.*, 2005). To ensure that improvement is a never-ending process, managers should make it a routine to establish new goals after meeting the current ones (Dyck and Neubert 2008). The third aspect is the control of business processes (Davenport, 1993; Hakes 1994; Sila and Ebrahimpour, 2005). In this aspect, the management should recognise that the existing systems and processes produce products and services offered by an organisation. Therefore, ensuring that the systems are efficient and effective will ensure that the products and services are of high quality (Dreikorn 2004).

The commitment of every member of the organisation towards the achievement of the goals and objectives of the organisation is the fourth aspect of TQM (Gatchalian, 1997; Tang *et al.*, 2010). To ensure this commitment the leaders of the organisation must establish a communication system that facilitates interaction among all the members (Beer, 2003; Prajogo and Cooper, 2010). As such, strong teams will be established across all the departments to ensure that tasks are shared equally and appropriately (Daily and Bishop, 2003). The fifth aspect is upstream preventive management to ensure that all the resistance to the implementation of TQM is countered through appropriate change management (Jones, 2013; Recardo, 1995; Todnem By, 2005). The sixth aspect is on-going preventive action to ensure that the TQM approached is reviewed and appraised regularly to facilitate its effectiveness in enhancing quality improvement to improve customer satisfaction and meet the long-term goals of an organisation sustainably (Hung *et al.*, 2011; Prajogo and Sohal, 2001).

2.4 Implementing TQM

To implement TQM, the six aspects of total quality should be integrated to form a management framework (Hakes, 1994). This should be done by first defining the missions, goals and objectives of the organisation (both short term and long term) and identifying how they will be communicated to the customers, employees as well as the suppliers. Therefore, defining the mission, aims and objectives is not enough. The management of the organisation should figure out how such objectives will be communicated to the aforementioned individuals (Taloo, 2007). The second step in implementing TQM is determining how to collate the external customer and competitor intelligence. At this stage, several things are done. First, the needs and expectations of the market are defined, including how they will be met. Second, the attitudes of the customers are assessed to determine areas that require improvements. Third, activities of the competitors are identified and measures to counteract them established (i.e., performance measurement).

Since, TQM is a continuous improvement mechanism, establishing performance criteria to be measured is important in order to determine if any improvements exist in an organisation (Antony and Preece, 2002). The fourth step is to identify how to communicate improvement opportunities to the concerned parties. The fifth step is to identify the strategies to use in implementing the improvement opportunities. The sixth and final step is the coordination of the total quality program to ensure that it achieves the desired goals and objectives. However, the method suggested by Hakes (1994) as a model of implementing TQM is just one among many (e.g., see Ahire *et al.*, 1996; Bou-Llusar *et al.*, 2009; Gómez *et al.*, 2017; Kaynak, 2003; Mohammad *et al.*, 2011). Therefore, an organisation should identify the most appropriate way of implementing TQM based on its needs, aims and objectives. Importantly, in South Africa with its own construction excellence model (Dlungwana *et al.*, 2002) and important foundational studies on TQM implementation (Haupt and Whiteman, 2004; Joubert *et al.*, 2005).

2.5 Benefits and Importance of TQM Implementation by ISO 9001 certified construction companies in South Africa

2.5.1 Continuous Improvement

The fact that TQM fosters continuous improvement of an organisation (Charantimath 2011) makes it a major benefit to the ISO 9001 certified construction companies in South Africa. In this regard, these companies are required to improve their processes and systems on a regular basis because they operate in an industry experiencing dynamic transformations (Ball, 2014; Bolton, 2006; Hamann, 2004; Tangri and Southall, 2008). As such, a mechanism that guides in continuous improvement is very important for the ISO 9001 certified construction companies in South Africa. Examples of such a mechanism in South Africa include SACEM (Dlungwana *et al.*, 2002) and the framework for assessing client needs and satisfaction in the building development process (Mbachu and Nkado, 2006). These mechanisms can both contribute to TQM implementation (Haupt and Whiteman, 2004; Joubert *et al.*, 2005). The fact that TQM philosophy stresses on an integrated, systematic organisation wide perspective involving every individual and system in the organisation makes it effective for enhancing customer satisfaction for all customers, an element that every construction company in South Africa requires.

Charantimath (2011) also defined TQM as a necessity and a quality journey with no end. In this regard, every construction company requires TQM to excel (Harrington *et al.*, 2012; Hoonakker *et al.*, 2010; Low and Teo, 2004). Any construction company practicing TQM is guaranteed to improve all its aspects and processes continuously (Bon and Mustafa, 2013), which will provide competitive advantage in the vast growing competitive sector. Therefore, any construction company practicing TQM will benefit from the continuous improvement of all its sectors (Jiménez-Jiménez *et al.*, 2015; Panuwatwanich and Nguyen, 2017), which is the ultimate goal of the model (Honarpour *et al.*, 2012; Prajogo and Sohal, 2006). The model of an organization also responds to and is affected by TQM as supported by Spencer's (1994) study, corroborated by Hackman and Wageman's (1995) study, and, subsequently, validated over the years (e.g., Detert *et al.*, 2000; Rusjan, 2005; Talib and Rahman, 2010; Valmohammadi and Roshanzamir,

2015). This gives credence to TQM as an endless journey of continuous improvement (Fonseca, 2015) towards organizational excellence (Calvo-Mora *et al.*, 2015).

2.5.2 Customer Focus

Satisfying the needs of the customers beyond their expectations is the primary goal of any organisation (Richardson, 2010). This has also been realized in South Africa's construction industry, culminating in the SACEM (Dlungwana *et al.*, 2002) and framework for assessing client satisfaction (Mbachu and Nkado, 2006). However, this objective can only be met if the management maintains a customer focus. Consequently, the South African construction clients have expressed concerns with regard to the quality of construction services they receive, the cause of which was mostly attributed to poor site management (CIDB, 2011). While construction site would seem to be the prevalent cause as an earlier study by Haupt and Whiteman (2004) has considered TQM implementation on construction sites, the subsequent study by Joubert *et al.* (2005) seemed to change the focus into a more holistic view of TQM in a bid to creating customer satisfaction. A construction company implementing TQM will be able to maintain a customer focus because TQM philosophy defines customer satisfaction as the key goal of the entire system (Kärnä *et al.*, 2009; Leitner 2001; Sit *et al.*, 2009).

The responsibility of the construction company is to provide quality facilities that meet or exceed the expectations of the customer. However, the construction company must do that at the lowest possible cost in order to survive the stiff competition in the industry (Frein 2012). Implementing TQM in ISO 9001 certified construction companies is, therefore, important because the framework identifies the needs of the customer and the method and culture to use in meeting those needs at the lowest cost (Lee and Whang, 2005; Low and Ong, 2014). Enhancing quality at each stage of construction, TQM eliminates the costs that would be incurred in repeating works done poorly (Isaksson, 2005; Schiffauerova and Thomson, 2006), especially among ISO 9001 registered companies (Chiarini, 2015). In addition, ensuring quality at each stage of the production ensures that the customers are provided with facilities that satisfy their needs beyond expectations. A construction company implementing TQM will also

have a better understanding of the customer (Lagrosen, 2001; Käser, 2010). In this regard, the customers are both external and internal (Dahlgaard *et al.*, 2008).

2.5.3 People Involvement

While the external customers are the end users of the products, the internal customers are the second departments or processes in an organisation that depend on the products of the first. Under TQM, both customers are stakeholders and need to be managed in a construction project (Atkin and Skitmore, 2008) as upheld by people involvement in the entire supply chain (Kannan and Tan, 2005; Wong, 1999). For example, product specifications are prepared by the specialist designers who manufactured the products. On the other hand, ISO 9001 certified construction companies become the customers for those products. Therefore, a construction company implementing TQM will be able to involve everybody involved in the construction process because of better understanding of the different types of customers involved and understanding their needs (Joubert *et al.*, 2005). Meeting the needs of the internal customers is a prerequisite for meeting the needs of external customers; hence, the role of people involvement and an important aspect in ISO 9001 certified construction companies. TQM is contingent upon managing the parties in the supply chain (Flynn and Flynn, 2005).

People empowerment affects the mining industry in South Africa (Fauconnier and Mathur-Helm, 2008), which echoes the finding that people involvement is an inhibiting factor to TQM in South Africa's construction industry (Haupt and Whiteman, 2004). Moreover, to maintain customer focus in a construction company, the triple role concept is essential (Tang *et al.* 2005). Under this concept, every individual involved in a construction process assumes the role of a processor, supplier and customer (Oberlender, 2000). For example, the designer is a customer of the project owner, processor of the plans and specifications of the facilities to be constructed, and the supplier to the contractors. If every individual operates based on the triple role concept, there will be a better focus on understanding and meeting customers' needs. Therefore, every individual will have a customer focus, which will facilitate quality control at every stage of construction in accordance with the requirements of TQM (Daily and Bishop,

2003). A consistent customer focus facilitates meeting customers' needs beyond expectations, resulting in increasing competitive advantage (Ulrich and Smallwood, 2007).

2.5.4 Project Process Improvement

Most of the construction works are undertaken as a project (Cox and Thompson, 1997; Zhang and Fan, 2013). With the changing trends in the construction industry, projects are becoming complex and huge in terms of cost and size (Geraldi *et al.*, 2011; Olawale and Sun, 2010). On the other hand, the resources, machines, time, and work force to undertake the huge construction costs are scarce (Heck *et al.*, 2014; Whitty and Maylor, 2009). Therefore, the management of a construction project from inception to completion requires a well-defined process that takes into consideration the scarcity of resources and the need to meet quality demands by the customers (Dreikorn, 2004; Thomas and Mengel, 2008, 2014). The dynamic nature of the industry requires a continuous improvement of the processes involved in the management of construction projects, which is characterised by fragmentation (Fellows and Liu, 2012). TQM management philosophy explains how the processes can be improved (see Davenport, 1993; Näslund, 2008); therefore an organisation implementing TQM will benefit from an integrated project delivery (Kent and Becerik-gerber, 2010).

In TQM, a process is defined as the way in which a project is undertaken (González-Benito *et al.*, 1999; Heck *et al.*, 2014; Jaffar and Aspinwall, 1999). Therefore, a process contains the procedures, tasks and policies required to meet the internal and external needs of the customer (Schniederjans and Kim, 2003). Under TQM management, the product will be right if the process followed in building it will be right (Siha and Saad, 2008; Tang *et al.*, 2005). Therefore, ISO 9001 certified construction companies should focus on improving the processes to enhance quality of the products (Lee and Chang, 2005). TQM calls for incremental gains on a process to ensure that it continues to add value to the products it produces (Zellner, 2011). As such, periodical benchmarking and occasional reengineering become important aspects in ensuring that a process adds value to the production process (Low and Ong 2014). Benchmarking in TQM practices has been identified as required for continuous quality

improvement (Zairi and Hutton, 1995), improving operational performance (Samson and Terziovski, 1999), and, ultimately, operational management (McAdam *et al.*, 2008).

2.5.5 System Improvement

The fragmentation of the construction industry including its activities lends it to being managed as a system (Dubois and Gadde, 2002) and, increasingly, project-based organizations (Eriksson, 2013). Consequently, to ensure an efficient and effective project process improvement in the ISO 9001 certified construction companies, 5 Ms (Material, Machine, Method, Man, and Measurement) should be observed closely. A construction company that implements TQM has a framework to observe the 5 Ms, which will ensure a continuous project process and, ultimately, system improvement (Tang *et al.* 2005). To ensure a continuous quality system improvement, techniques such as the IMS or MMS (Heras-Saizarbitoria and Boiral, 2013; Ivanova *et al.*, 2014) can be applied. From the process level, a checklist can be used to list all the aspects that should be monitored regularly to determine if there is need for improvement (Low and Ong, 2014). In the case of a construction project, there are many aspects involved such as the designs, specifications, materials, regulations and costs among others, which Basu (2014) has surmised as being design, process, and organization quality.

Therefore, a checklist can be used to ensure that all that aspects to be checked regularly for quality control is checked. The cause and effect diagram (fishbone/Ishikawa diagram) by Karo Ishikawa can be used to list down the entire major causes of the problems (Bose, 2012; Hakes, 1994; Ilie and Ciocoiu, 2010). This is in recognition of the fact that addressing the problem at its root cause is the best way to solve it. In a continuous system improvement, prioritisation becomes an important aspect. Pareto analysis is a technique that can also be used by ISO 9001 certified construction companies to identify the problems that require the most urgent solutions (Al Haadir and Panuwatwanich, 2011; Rosenfeld, 2013; Ulrich and Smallwood, 2007). Other techniques include flowcharts, check-sheets and histograms among others (Fotopoulos and Psomas, 2009b; Hakes 1994; Laborde and Sanvido, 1994). Project managers in ISO 9001 certified construction companies should be knowledgeable in the use of the various techniques

to facilitate their efforts in making system improvement an on-going and endless endeavour in their organisations (Chase, 1993; Gervais, 2003; Gimenez-Espin *et al.*, 2013).

2.6 Restructuring a Construction Company for TQM

Evidence from literature indicates that TQM benefits ISO 9001 certified/registered construction companies greatly (Antony and Preece 2002; Dahlgaard *et al.*, 2008; Gharakhani *et al.*, 2013; Talib *et al.*, 2013). However, some ISO 9001 registered construction companies are yet to implement TQM (Dam, 2010; Ehigie *et al.*, 2005; Pool, 2000). The hesitation among these ISO 9001 registered construction companies can be attributed to the costs and benefits of ISO 9001 registration (Magd, 2008; Rusjan and Alič, 2010; Sampaio *et al.*, 2009; Zaramdini, 2007), including transitioning to the IMS or MMS (Heras-Saizarbitoria and Boiral, 2013; Tarí *et al.*, 2012). Therefore, such companies might need to restructure to facilitate the implementation process (Gimenez-Espin *et al.*, 2013; Zu *et al.*, 2010). One of the things that such companies should do is changing the communication system. Most of the ISO 9001 certified construction companies that have not yet implemented TQM use the traditional forms of communication that are mainly vertical (Gronstedt, 1996; Khanam *et al.*, 2013). Such a communication system restricts free flow of information in an organisation (Joubert *et al.*, 2005).

The prevailing unsupportive communication style means many quality issues are not addressed. Therefore, organisations with such communication systems should include horizontal and diagonal communications in their systems to ensure that information flows freely and faster across the different departments (Allen and Brady, 1997; Gronstedt, 1996). With free and faster flow of information, all flaws will be reported to the relevant authorities and action taken before it is too late (Khanam *et al.*, 2013; Patterson *et al.* 2011). It is also important for the ISO 9001 certified construction companies to make use of the electronic media, especially the email, websites and the social media to ensure that they receive feedback easily from the customers and the suppliers (Baym, 2010; Martínez-Lorente *et al.*, 2004; Ravichandran, 2000; Taylor and Wright, 2006). Apart from changing the communication cycle, the Plan-Do-Check-Act (PDCA) cycle, as also embedded in Six Sigma as another form of continuous improvement,

describes the activities that an organisation can undertake to restructure and be best placed to implement TQM (Cheng, 2008; Gilson, 2010; Lodgaard *et al.*, 2016).

2.7 TQM Culture in the Construction Industry

It should be acknowledged that TQM implementation, either as discrete or continuous improvement practices implementation, does fail when the right atmosphere has not been created (see Beer, 2003; Mosadeghrad, 2014; Rahman, 2004; Sanchez and Blanco, 2014; Wu *et al.*, 2015). This is further compounded by the construction industry's unique multi-party temporal and spatial involvement (Alashwal *et al.*, 2011; Segerstedt and Olofsson, 2010), which makes integration an arduous task (Kent and Becerik-Gerber, 2010). The construction industry has a poor emphasis on quality in comparison to other sectors like the manufacturing and the service industry (Cruz and Paulo, 2013). Defining and assessing construction quality is a challenge (Delgado-Hernandez and Aspinwall, 2008; 2008), compounded by the subjective view of quality (Wicks and Roethlein, 2009). This has led to categorizing into design quality, process quality, and organization quality (Basu, 2014) and designing frameworks for ensuring construction client satisfaction (Ahmed and Kangari, 1995; Hu *et al.*, 2009; Kärnä, 2004; Maloney, 2002; Mbachu and Nkado, 2006) as upheld by TQM (Koh and Low, 2009).

If the efforts shown in the TQM is not consistent with cultures that have been set by the organisation, all the efforts shown will be undermined (Beer, 2003; Mosadeghrad, 2014). Other reports have stressed the need for the construction industry to develop some substantial changes in terms of the structure and culture (Irani *et al.*, 2004; Tata and Prasad, 1998), which acts as the driver to ensuring that there is efficiency, high quality management and that safety is maintained (Dam, 2010). Nevertheless, in addressing the issue of cultural changes, there have been some hindrances because the people involved in the TQM do not have an understanding of what it means (Corrigan, 1995; Jurow and Barnard, 1993; Lakhe and Mohanty, 1994; Psychogios and Priporas, 2007; Vouzas and Psychogios, 2007) including the best approach to follow (Ahire *et al.*, 1996; Bou-Llusar *et al.*, 2009; Das *et al.*, 2008; Morrow, 1997). Regardless of the manner in which awareness on the cultural issues has grown and the fact that different

organisations have different cultures, some generally accepted characteristics define the culture of an organisation (Babatunde and Low 2015; Coffey, 2010; Pettigrew, 1979).

2.8 TQM Implementation Practices

The preceding section expounded on the unique challenges of defining and assessing construction quality in order to be able to design a framework for explicating TQM achieving client satisfaction. Following includes some TQM implementation practices spanning design quality, process quality, and organization quality, which are adapted from Ahire *et al.*, (1996) and Das *et al.* (2008) in support of continuous improvement practices:

2.8.1 TQM Program and Top Management Support

TQM thrives when the top management is committed to the initiative (Allen and Brady, 1997). This can be achieved when TQM program supports the top management performance target for the firm (Douglas and Judge, 2001; Kaynak, 2003). Top management supports influence employee involvement and empowerment (Ugboro and Obeng, 2000) to bring about innovation and continuous improvement (Wallace *et al.*, 2016; Yang and Conrad, 2011).

2.8.2 TQM and Compliance Checking

Unlike ISO 9001 registration that requires a third-party audit, TQM prides itself in non-reliance on a third-party check. However, this does not preclude the need for compliance checking for process and system improvement (Hawkes and Adams, 1995; van der Aalst *et al.*, 2012). Compliance checking under TQM takes on the role of value-adding auditing experiences (Poksinska *et al.*, 2006) as against vicious compliance checking (Karapetrovic, 1999).

2.8.3 TQM and Formal Training and Education

It is important that organisations establish educational programs for workers to improve quality management and boost TQM as a continuous improvement of work processes (Singh, 2001). TQM training creates awareness, builds employees' commitment to quality policy and strategy, facilitates teamwork, enhances performance standards, and bolsters the skills and abilities of employees (Kassicieh and Yourstone, 1998; Palo and Padhi, 2003; Quazi and Jacobs, 2004).

2.8.4 TQM and Quality Manuals/Documents

ISO 9000: 2000 is reputed for its close alignment with the TQM philosophy (Conti, 1999; Kartha, 2004; Zhu, 1999). This subjects TQM implementation to also keeping quality manuals and documents among ISO 9001 registered companies, leading to improved TQM performance among these registered companies (Martínez-Costa *et al.*, 2008; 2009). Quality manuals and documents also improve supply chain quality assurance (Sroufe and Curkovic, 2008).

2.8.5 TQM and Company Quality Values

TQM consists of values, techniques and tools (Hellsten and Klefsjö, 2000), making it susceptible to cultural and structural constraints (Tata and Prasad, 1998). While like with the other management systems, the company culture plays an important role in TQM implementation (Dahlgaard and Dahlgaard-Park, 2006), TQM implementation is differentiated by its organizational culture influenced company-wide approach (Gimenez-Espin *et al.*, 2013).

2.8.6 TQM and Tendering Procedures

Quality management of the suppliers is an important aspect of TQM because suppliers' products are usually the source of quality problems (Retik and Langford, 2012). Supplier relationship must be embraced in public administrations (Dewhurst *et al.*, 1999) and trickled down to the accounting and tendering systems (Ajam *et al.*, 2010; Hoque and Alam, 1999; Rwelamila and Smallwood, 1999) for sustainability and competitiveness (Ho, 2010).

2.8.7 Other Programs as a form of TQM

Most activities done in the organisations constitute processes (Borgbrant and Atkin 2009). TQM aims to achieve overall quality performance, in which the management of the processes becomes important (Cruz and Paulo, 2013). TQM influences innovation (Jung and Wang, 2006; Singh and Smith, 2004) so much so TQM encompasses all forms of continuous improvement practices (Ahire *et al.*, 1996; Das *et al.*, 2008; Khanam *et al.*, 2016; Yusr, 2016).

2.8.8 TQM as a future Target

Most ISO 9001 registered construction companies do not want to subject their employees to the cultural shock of TQM implementation immediately afterwards (Low and Teo, 2004). Their

strategy is an organizational-wide effort to imbibe the ISO 9001 quality management principles (Alič, 2014) and gradually reinforce continuous improvement (Kaye and Anderson, 1999; McNally, 1993) to keep enhancing customer satisfaction (Mehra and Ranganathan, 2008).

2.9 TQM Constructs for Continuous Improvement

From the preceding discussions, this study posits that the level of agreement, on TQM with respect to the practices/attributes presented in Table 2.1, among the different levels of construction professionals in ISO 9001 registered companies, can serve as a proxy to investigating how continuous improvement is being achieved. Systematic agreement is based on a theory of organizational alignment, which looks at the extent to which strategy, structure, and culture create an environment that facilitates the achievement of organizational goals (Sender, 1997) as also supported by de Vet *et al.*'s (2006) study on agreement.

Table 2.1: TQM Constructs

S/No.	Attribute
1	TQM program supports top management
2	TQM as a function of compliance checking
3	TQM through formal training and education
4	TQM through quality manuals/documents
5	TQM through company quality values
6	TQM achieved through tendering procedures
7	TQM achieved through other programs
8	TQM as a future plan/target

2.10 TQM and Quality Management Principles

ISO 9001 is also referred to as the quality management system (QMS) because it deals with QMS under the ISO 9000 series/family of standards. Since ISO 9001 registered companies require time to propagate and consolidate the ISO 9001 QM principles at the organization-wide level in preparation for the TQM journey (Farooqui and Ahmed, 2009; Gotzamani and Tsiotras, 2001 and 2002; Lakhal, 2014), it is worthwhile that their ISO 9001 QM principles are being

implemented effectively. It then follows that in as much as ISO 9001 registration is the beginning of the TQM journey, the important question of what is next for ISO 9000 companies (Coleman and Douglas, 2003) should take cues from implementation and performance of their quality management systems (i.e., ISO 9001) under ISO 9000 (Lee *et al.*, 2009; Sampaio *et al.*, 2009). While there are benefits of ISO 9001 implementation (Rusjan and Alič, 2010), it is affected by the motives among registered companies (Poksinska *et al.*, 2006b; Sampaio *et al.*, 2009), leading to major non-compliances and subsequent cancellation (Alič, 2014) and, ultimately TQM implementation failure (Beer, 2003; Bemowski, 2005; Feinbeg, 1996; Gyan, 2017; McNabb and Sepic, 1995; Mosadeghrad, 2014; Svensson and Wood, 2005).

Consequently, this study also posits that a binary agreement on the implementation of the ISO 9001 QM principles presented in Table 2.2, among the different levels of construction professionals in ISO 9001 registered companies, can serve as a proxy for identifying the main challenge for TQM implementation. A binary agreement suffices in this instance because, unlike TQM practices which are more difficult to grasp, the ISO 9001 QM principles are well defined (see ASQ, 2017c; ISO, 2015). The 9001: 2015 version is different from the earlier versions (2000 and 2008) in that it has removed system approach, which can be attributed to system approach being an integral part of all the QM principles.

Table 2.2: TQM and ISO 9000 QMS

S/No.	QM Principle
1	Customer focus
2	Leadership
3	Engagement of people
4	Process approach
5	Improvement
6	Evidence-based decision making
7	Relationship management

2.11 Chapter Summary

This chapter has reviewed the different aspects of TQM including its development, theorization, constructs, benefits and challenges to culminate in lists of its proxy measures by which construction companies in South can be investigated on how they are implementing TQM (see Table 2.1) and the challenges they are facing with regard to the quality management principles under the ISO 9001 (see Table 2.2). This is based on the realization that TQM is a set of systematic activities that companies engage in. It was also discovered that the construction industry fragmentation makes defining and assessing quality for the industry difficult. Tables 2.1 and 2.2 as well as defining and assessing quality form the basis for investigation in this study as discussed in the next Chapter.

CHAPTER 3 RESEARCH METHODOLOGY

3.1 Overview

This chapter discusses the research methodology (i.e., design and method), including the sampling techniques adopted to fulfil the three research objectives, which are linked to the three research questions. Based on Saunders *et al.*'s (2016) onion model, it discusses the methodological choices adopted in this study, culminating in discussions on the ethical considerations.

3.6.1 Research Philosophy

The first layer of the onion model focuses on the philosophies. The five philosophies identified include: Positivism, Critical realism, Interpretivism, Post-modernism, and Pragmatism. This study adopted pragmatism because the research questions “do not suggest unambiguously that either a positivist [i.e., observable social reality] or interpretivist [i.e., rich insights into the unobservable] philosophy is adopted” (Saunders *et al.*, 2007: 110). The data that were to be collected to answer the research questions suggested positivist and interpretivist stances; hence, the choice of pragmatism.

3.6.2 Research Approach

The second layer of the onion focuses on the approaches. The three approaches identified include: Deduction, Induction, and Abduction. This study adopted the inductive approach because the aim of this study was to investigate TQM implementation among ISO 9001 registered construction firms in South Africa. The research questions were exploratory and geared towards “building theory” as against “testing theory”, which is the premise of the deductive approach (Saunders *et al.*, 2016).

3.6.3 Research Choice

The third layer of the onion focuses on the choices. The six choices identified include: Mono method quantitative, Mono method qualitative, Multi method quantitative, Multi method qualitative, Mixed method simple, and Mixed method complex. This study adopted a mixed

method simple choice by combining the use of quantitative and qualitative data collection techniques and analytical procedures. The main method of data collection adopted in this study is the questionnaire used during the survey to collect quantitative and qualitative data.

3.6.4 Research Strategy Adopted

The fourth layer of the onion focuses on the strategies. The seven strategies identified include: Experiment, Survey, Archival research, Case study, Ethnography, Action research, Grounded theory. This study used the surveys because of the exploratory and descriptive nature of the research. The survey strategy is also comparatively easy both to explain and to understand and it allows collecting quantitative data that can be analysed quantitatively using descriptive and inferential statistics, as well as used to suggest possible reasons for particular relationships between variables.

3.6.5 Research Time Horizon

The fifth layer of the onion focuses on the time horizons. The two time horizons identified include: Cross-sectional and Longitudinal. Due to time constraints and, primarily, not needing to establish a trend over a period of time, this research was investigated at a particular time; that is, cross-sectional and which is associated with the survey strategy (Tan, 2011). This contrasts with the longitudinal time horizon that is used to study change and development, even with time constraints since the central question lies in answering the question of whether there has been any change over a period of time.

3.6.6 Data Collection and Data Analysis Adopted

The sixth and final layer of the onion focuses on the techniques and procedures of the research. The two areas covered include: Data collection and Data analysis. Depending on the research questions to be answered, it is possible to either generate new information from the existing ones by analysing existing data or collecting new data specifically for the research question(s). Existing data constitute secondary data while new data constitute primary data as now discussed in more detail in the subsequent sections.

3.6.7 Primary Data and Secondary Data

Primary data refers to the first-hand information gathered, assembled and issued for a particular purpose (Tan, 2011; Saunders *et al.*, 2016). Primary data are usually collected from the participants by the investigator through questionnaires. In view of the fact that it is collected from new sources for particular purposes it will entail collection of data by the investigator from individual observations as well as experiences (Rahman, 2017). This study sought primary data in order to be able to fulfil its three objectives discussed earlier under Chapter 1.

Secondary data are the pieces of information previously collected by another investigator for a particular purpose and, subsequently, readily accessible for new research study (Tan, 2011; Saunders *et al.*, 2016). This data are initially collected for diverse use and at diverse time. In essence, secondary data from books, newspaper, journals policy briefs and reports has been used in the development of literature review (Rahman, 2017). Secondary data collected through review of the literature served as the basis for the questionnaire design for collecting the primary data.

3.6.8 Reliability, Validity, and Generalizability

Reliability, validity, and generalisability are central to the decisions underpinning data collection and data analysis. Golafshani (2003: 598, 601, 602) surmised that “reliability and validity are tools of an essentially positivist epistemology” to buttress that, in qualitative research, reliability covers that which helps to “understand a situation that would otherwise be enigmatic or confusing” and validity as “rather a contingent construct, inescapably grounded in the processes and intentions of particular research methodologies and projects”. Reliability is the extent to which data collection techniques or analysis procedures will yield consistent findings while validity is about whether the findings are really about what they appear to be about (Saunders *et al.*, 2007: 149-150).

3.7 Population

The population for this study was employees of ISO 9001 construction companies in South Africa. The target population refers to a general set of the examination of all participants of real or supposed set of objects, people and events to which a researcher wishes to study (Berg and Lune 2014). The target population was employees of ISO 9001 construction companies based in two out of the nine provinces in South Africa. These two provinces were Mpumalanga and Gauteng provinces of South Africa. However, the actual population size could not be determined because there was no sampling frame for such a population, making it difficult to identify population members (Handcock *et al.*, 2014; Heckathorn, 1997; Salganik and Heckathorn, 2004). Generating a representative sampling frame for this population required a careful sampling technique as explained next.

3.8 Sampling Plan

The study targeted ISO 9001 certified construction companies in Mpumalanga and Gauteng Provinces, South Africa. Using purposive sampling of known ISO 9001 certified construction companies, this study targeted a sample size of 100 respondents who were workers of these ISO 9001 registered companies. Snowballing sampling technique was also used to increase the response rate through referrals from the known ISO 9001 certified construction companies. Different levels of employees of these companies were approached to encapsulate TQM. The sampled target respondents were considered the best fits to answer a question on quality.

3.9 Research Ethics and Procedure

The research topic and procedure were guided by ethical considerations. The general ethical issue was that the research should not subject the target participants to any embarrassment and/or harm. To ensure this was achieved, ethics application was submitted to the university and clearance was obtained as presented under Annex 1. The research entailed administering structured questionnaires presented under Annex 2 among the target participants. This is because questionnaires are not only expedient but also more effective in collecting and compiling data for this study.

The structured questionnaire used consisted of four main sections. Section A sought data for respondents profile, Section B sought data for Objective 1, Section C sought data for Objective 2, and Section D sought data for Objective 3. Before administering the questionnaire, pilot testing was undertaken to ascertain that it can collect data relevant to address the research objectives. It turned out that there was a preference to replace the professional background with the job role on the notion that it is a better predictor of a party's role on TQM. The questionnaires were administered face-to-face.

3.10 Data Analysis

Qualitative (i.e., text-based) data were collected with respect to Objective 1 (see Section B of the questionnaire) while quantitative (i.e., ranked or ordinal) data were collected with respect to Objectives 2 and 3 (see Sections C and D of the questionnaire). Ordinal data were collected for Objective 2 using a 5-point Likert scale item where 1 was "strongly disagree" and 5 was "strongly agree". Descriptive data were collected for Objective 3 using a binary or forced scale item of either "Yes" or "No". The text-based data collected for Objective 1 were analysed inductively. The ranked data collected for Objective 2 were analysed using the frequency distribution and measures of dispersion. The binary data collected for Objective 3 were analysed descriptively since it is impossible to define the numerically or by rank (Saunders *et al.*, 2016).

3.11 Chapter Summary

The research objectives and questions set out in this study necessitate a pragmatic philosophy and as such tended more towards the inductive approach. This study adopted a mixed method simple choice by combining the use of quantitative and qualitative data collection techniques and analytical procedures. It adopted cross-sectional survey using questionnaire to collect primary data on TQM implementation and challenges.

CHAPTER 4 DATA ANALYSIS AND FINDINGS

4.1 Overview

This chapter discusses the analyses of the data collected to achieve the three objectives of this study. It starts with discussions on the response rate and characteristics of the study participants (i.e., the respondents) before presenting a summary of the findings for each of the objectives following the sequence of the research process followed as discussed in the preceding chapter.

4.2 Response Rate

Out of the 100 structured questionnaires sent via email to the potential respondents (i.e., parties working in ISO 9001 registered construction companies), 70 questionnaires were returned. The resultant 70 percent response rate was higher than the 52.7 percent and 35.7 percent found to be common among studies collecting data from individuals and organizations respectively (Baruch and Holtom, 2008). It was also higher than those obtained in other construction industry research projects (e.g., Akintoye *et al.*, 2000; Kartam and Kartam, 2001; Lyons and Skitmore, 2004). The higher response rate achieved was due to the purposive and snowballing sampling techniques used to reach the employees of ISO 9001 registered construction companies in South Africa. The face-to-face paper surveys also contributed to the higher response rate (Duffy *et al.*, 2005; Heerwegh and Loosveldt, 2008; Nulty, 2008).

4.3 Respondents Profile

Section A of the questionnaire sought general information on the respondents' profile, including their gender, age range, highest educational qualification, and their job roles within their companies. This was to be able to obtain an overview of the respondents' characteristics for a judgment on validity and reliability; hence, credibility (see Creswell and Miller, 2000; Golafshani, 2003; Saunders *et al.*, 2016) for this study. A summary of the respondents' profile is presented in the following Table 4.1.

Table 4.1: Respondents' Profile

Characteristics	Description	Freq.
Gender	Female	20
	Male	50
	Total	70
Age	25 to 34	21
	35 to 44	29
	45 to 54	13
	55 to 64	7
	Total	70
Education level	Secondary School	4
	Technical College	16
	University	45
	Other (recognition of prior learning-experience)	5
	Total	70
Job role	Support staff (e.g., Accountants, HR Managers, Procurement/Supply Chain Managers)	19
	Team leader (e.g., Foremen, Supervisors, Clerks of Works)	8
	Middle manager (e.g., Construction/Project/Contract Managers)	19
	Senior manager (e.g., Program Managers, Portfolio Managers)	6
	Partner/Owner (e.g., Funders, Investors, Shareholders, etc.)	4
	Others (e.g., Bricklayers, Iron Benders, Painters, etc.)	14
	Total	70

The 70 respondents, with a mean age of about 40 years, were predominantly male (71.43%), which gave credence to the gender imbalance of the construction industry (Greed, 2000). They were predominantly university graduates (64.29%), which confirmed the widening enabling environment for innovation in the construction industry (Gambatese and Hallowell, 2011). In as much as their job roles varied, they were predominantly operations support staff members and middle managers, each constituting about 27.14% of the total respondents. Managers are able to synthesize insights from different mind-sets into a comprehensible whole (Gosling and Mintzberg, 2003) and they play an important role in TQM (Choi and Behling, 1997; Vouzas and Psychogios, 2007). The other skilled construction workers (e.g., Bricklayers, Iron Benders, and Painters) constituted about 20% of the total respondents.

4.4 Definition and Assessment of Construction Service Quality

Section B of the questionnaire was linked to the first objective of this study. It sought qualitative data from the respondents on how quality is defined and assessed within their respective ISO 9001 registered companies. Being text data, qualitative content analysis (Elo and Kyngäs, 2008; Vaismoradi *et al.*, 2013) was used. In particular, the summative content analysis that involves counting and comparisons, usually of keywords or content, followed by the interpretation of the underlying context (Hsieh and Shannon, 2005). Following from the text-based analysis of the qualitative data provided by the respondents', the findings on how quality is being defined are summarised in the following Figure 4.1.

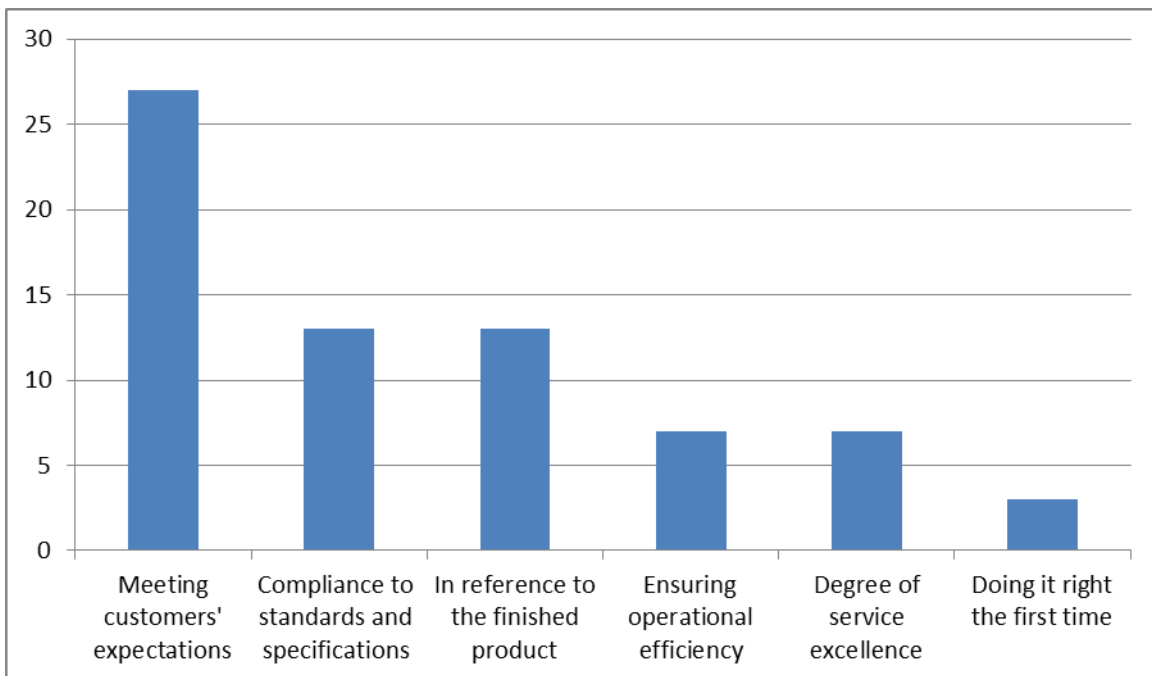


Figure 4.1: Defining Quality

Figure 4.1 revealed the majority of the respondents (27, about 38.57%) indicated that quality is being defined in their ISO 9001 registered construction companies as meeting customers' expectations, confirming that TQM will be relatively easier to implement. This is because existing studies (e.g., Kärnä *et al.*, 2009; Leitner 2001; Sit *et al.*, 2009) have underscored that a construction company implementing TQM will be able to maintain a customer focus because TQM philosophy defines customer satisfaction as the key goal of the entire system.

Following from the text-based analysis of the qualitative data provided by the respondents', the findings on how quality is being assessed are summarised in the following Figure 4.2.

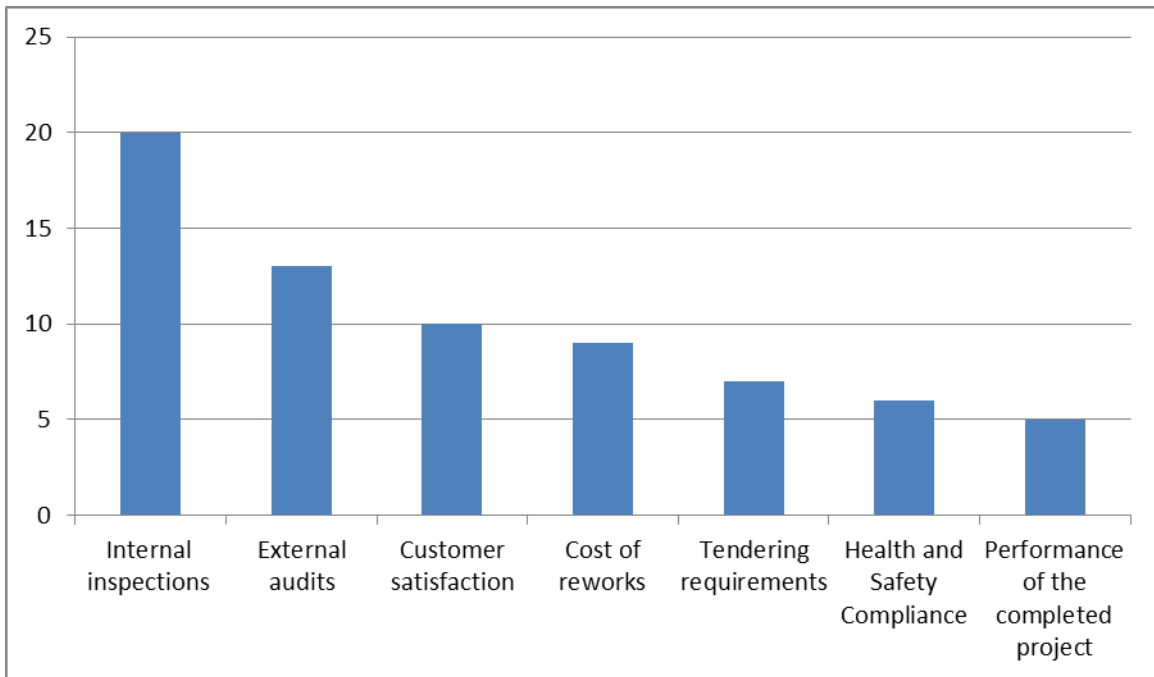


Figure 4.2: Assessing Quality

Figure 4.2 revealed that while there are diverse approaches to assessing quality among the ISO 9001 registered construction companies, the predominant approaches are through internal audits (28.57%) and external audits (18.57%). This is unsurprising since the main perception of the need for ISO 9001 is audits (Andersson *et al.*, 1999; Biazzo, 2005; Zeng *et al.*, 2007) in order not to have the registration withdrawn/cancelled (Alič, 2014). While TQM does not prioritise audits as an end, it does uphold value-adding auditing experiences (Poksinska *et al.*, 2006) as against the more commonly adopted vicious compliance checking (Karapetrovic, 1999) under ISO 9001. As such, audits can help to stabilize the QMS (Beckmerhagen *et al.*, 2004).

4.5 Total Quality Management Implementation

Section C of the questionnaire was linked to the second objective of this study. It sought quantitative data from the respondents on their level of agreement on how TQM/continuous improvement is being implemented or achieved in their companies. The mean ratings of the

levels of agreement on the eight TQM constructs presented to the respondents are shown in descending order in the following Table 4.2

Table 4.2: TQM Implementation within ISO 9001 Registered Companies

Attribute	Mean (M)	Standard Deviation (SD)	Coefficient of Variation (CV) = SD/M
The company often checks design conformance to standards.	3.98	0.70	0.18
Quality values are clearly captured in the company's mission and vision.	3.92	0.91	0.23
The company maintains quality manuals/documents	3.78	0.90	0.24
The TQM program implemented supports top management.	3.67	0.78	0.21
The company's tender system contributes to quality improvement.	3.54	1.01	0.29
The company uses a quality improvement plan other than TQM.	3.42	0.77	0.23
The company plans to implement TQM in future.	3.42	0.77	0.23
A formal training on TQM and quality improvement is often given to employees.	3.21	1.03	0.32

As presented in Table 4.2, the mean ratings have been used to rank the different TQM constructs as a proxy for continuous improvement practices among the ISO 9001 registered

construction companies. The standard deviation (SD) indicates by how much the sampled population differs from the mean (Leys *et al.*, 2013) while the coefficient of variation (CV) is a measure of spread that describes the amount of variability relative to the mean (Bedeian and Mossholder, 2000). The higher the SD, the greater the variation while the higher the CV, the greater the dispersion in the variable. Consequently, descriptive data analysis (Neyeloff *et al.*, 2012; Thompson, 2009) was performed on the quantitative data obtained with respect to the second objective of this study.

The descriptive data analysis is a concept between a confirmatory data analysis and exploratory data analysis (Abt, 1987). Descriptive statistics are numbers that summarise the data with the purpose of describing what occurred in the sample (Thompson, 2009). The respondents showed the highest level of agreement on “checking of design conformance to standards” and lowest level of agreement on “formal training on TQM and quality improvement” as ways of continuous improvement. These findings confirmed those of the existing studies on compliance checking (e.g., Hawkes and Adams, 1995; van der Aalst *et al.*, 2012) and training (e.g., Kassicieh and Yourstone, 1998; Palo and Padhi, 2003; Quazi and Jacobs, 2004).

4.6 Challenges facing TQM Implementation

Section D of the questionnaire was linked to the third objective of this study. It sought agreement in the form of binary or nominal data (i.e., Yes/No) from the respondents on challenges with regard to the implementation of the ISO 9001 QM principles within their companies. Binary data provides a quick, simple, and reliable way of collecting data from respondents because of its ability to reduce respondent fatigue by replacing traditionally used ordinal multi-category answer formats with forced binary scales (Dolnicar *et al.*, 2011). Binary data have also been found to represent interesting alternatives to the predominantly used ordinal format, especially when speed of completion for analysis is important (Dolnicar and Grün, 2007). This third objective of the study also lends itself to a descriptive data analysis as presented in the following Table 4.3.

Table 4.3: QMS Implementation within ISO 9001 Registered Companies

Question	Yes	No
Would you agree that your company conducts feedback exercises to obtain information about client satisfaction?	20	50
Would you agree that your management has an approach to quality improvement within the organization?	42	28
Would you agree that all employees are engaged in assessing and managing quality within your organization?	51	19
Would you agree that your company has an established quality system for its operations and processes?	46	24
Would you agree that your company has an established continuous improvement strategy for its quality system?	43	27
Would you agree that your company measures/assesses the quality of its completed projects for decision making?	42	28
Would you agree that your company face challenges meeting customer requirements because of its suppliers?	33	37

This study acknowledges that there are other forms of binary data analysis (e.g., Malhotra, 1983; Neuhaus *et al.*, 1991); however, the modal distribution of data indicated in the shaded cells in Table 4.3 serves as a form of data analysis because it suffices for the exploratory nature of this study. Table 4.3 revealed majorities of the companies were lagging in conducting feedback exercises to obtain information about client satisfaction since most respondents

answered “No” to the question posed. This negated the response on defining quality based on meeting customer expectations (see Figure 2.1). Respondents were almost equally divided (33 against 37) on the question pertaining to supplier relationship. Notably, majority of the respondents answered “Yes” to the question on employees being engaged in assessing and managing quality within their respective organizations, validating Alonso-Almeida and Fuentes-Frías (2012) study in favour of a global standard within and beyond an organization. Overall,

Table 4.3 suggests that the ISO 9001 registered construction companies could be prioritising company-wide internal efforts as compared to external efforts. In this case, customer feedback exercises to better prioritise resources towards meeting their requirements, leading to satisfaction (Agus *et al.*, 2000; Ooi *et al.*, 2011; Sit *et al.*, 2009) and supplier relationship/management. This calls for and reinforces supply chain management in the construction process (Vrijhoef and Koskela, 2000) for improved competitive advantage and organizational performance (Li *et al.*, 2006) on which effective TQM is also premised (Gunasekaran and McGaughey, 2003; Talib *et al.*, 2011; Vanichchinchai and Igel, 2009).

4.7 Chapter Summary

This chapter presented the results of the cross-sectional questionnaire survey. The results seemed to suggest that quality is being defined through meeting customers’ expectations and assessed through internal inspections. Checking of design conformance to specifications and standards seemed to be the most common form of ensuring continuous improvement while formal training for employees on quality initiatives was not as common. Feedback exercises and supplier relationship were not being fully/frequently implemented among the ISO 9001 registered construction companies.

CHAPTER 5 DISCUSSIONS AND CONCLUSION

5.1 Overview

This chapter discusses the findings in relation to the three objectives of this study, their practical and theoretical implications, limitations of the study, recommendations for future similar studies, and conclusion.

5.2 Findings

By triangulating findings with respect to the three objectives and questions established in this study, it will be possible to achieve the aim of this study. From the analyses in the preceding chapter, the subsequent sections discuss the findings for each objective.

5.2.1 Definition and Assessment of Construction Service Quality

For the first objective, while construction service excellence was a common theme in the definitions of quality among the participants, the assessment of quality emphasised audits. This could be attributable to the reliance on ISO 9001 audit system and suggests the level of TQM maturity among these companies might still be low.

5.2.2 Evaluation of TQM Implementation

For the second objective, the respondents' level of agreement was highest on TQM implementation through their company often checking design conformance to standards. It also had the lowest standard deviation and coefficient of variation, which indicated low variability in the level of agreement. Formal training on TQM and quality improvement is often given to employees ranked lowest based on the respondents' level of agreement.

5.2.3 Evaluation of the Rate of progress of TQM as Continuous Improvement

For the third objective, while majority (51 of the respondents) agreed that all employees are engaged in assessing and managing quality within your organization, only a few (20 of the respondents) were conducting feedback exercises to obtain information about client satisfaction.

5.3 Implications

It would be easier for ISO 9001 registered construction companies to implement TQM because of the complementarities that exist between ISO 9001 and TQM, however, these companies need to be well established in their ISO 9000 QMS system before embarking on the TQM journey.

5.3.1 Practical Implications

The journey towards TQM implementation in many of the African countries is fraught with peculiar challenges. This is because TQM is also distinguished by its organizational-wide and cultural-shift approaches. This needs to be looked into among the ISO 9001 registered construction companies.

5.3.2 Theoretical Implications

While there are different views on TQM concepts due to the different nomenclature adopted among authors, the key TQM concepts have remained unchanged. South Africa already has the South African Construction Excellence Model (SACEM) that can be used to nurture companies towards TQM.

5.4 Limitations

This study has been based on the overarching assumption that ISO 9001 registered construction companies practice TQM since the ISO 9000 series is a subset of TQM. This assumption is premised on TQM's focus on continuous improvement. It is, nonetheless, possible that some of the ISO 9001 registered construction companies were still focussed on the immediate benefits of ISO 9001 registration; thus, TQM failing to take off in the first instance.

5.5 Recommendations

Firstly, there is the need to align the excellence embedded in the definition of construction quality with how construction quality is being assessed. Unlike ISO 9001 that prioritises audits, TQM is a proactive organization-wide approach to quality management. Secondly, checking design conformance to standards should be complemented formal training on TQM and quality improvement. Lastly, the move towards a universal or standardized model for assessing and

managing quality in all organizations operating in the South African construction industry should begin with increase ISO 9001 registration followed by SACEM's award.

5.6 Conclusion

The aim of this study was to investigate TQM implementation among ISO 9001 registered consulting construction firms in South Africa, giving the complementarity between TQM and ISO 9000 series. Truly, ISO 9000 is a subset of TQM; it has some common points with TQM, which may help companies already certified to ISO 9001 to be more similar in character to a TQM company. Construction companies in South Africa should think beyond ISO 9001 if they are to maximize this capability which appeared to be dormant at the moment.

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APPENDIX 1

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SCHOOL OF CONSTRUCTION ECONOMICS AND MANAGEMENT RESEARCH ETHICS COMMITTEE

CLEARANCE CERTIFICATE

PROTOCOL NUMBER CEM/16/07/MPM/MSC

PROJECT TITLE

Benefits of TQM implementation among ISO 9001 certified construction companies in South Africa

INVESTIGATOR

Mokopi Petrus Morumudi

SCHOOL/DEPARTMENT

SCHOOL OF CONSTRUCTION ECONOMICS AND MANAGEMENT

DATE CONSIDERED

11/7/2016

DECISION OF THE COMMITTEE

Approved conditionally with respect to the declaration

EXPIRY DATE

10th July 2017

DATE

11 July 2016

CHAIRPERSON


Dr. Kola Ijasan

cc: Supervisor : Dr. O. Babatunde

DECLARATION OF INVESTIGATOR (S)

To be completed in duplicate and **ONE COPY** returned to the Secretary Mrs. M. Sithole at the CEM reception desk.

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to completion of a yearly progress report.**



Signature

18 / 07 / 2016

Date

APPENDIX 2

**TQM IMPLEMENTATION AMONG ISO 9001 REGISTERED CONSTRUCTION
COMPANIES IN SOUTH AFRICA.**

SECTION A: General Information

1. Gender

- (a) Male []
(b) Female []

2. Age in years

- 18-29 []
30- 49 []
50 and above []

3. What is your highest Level of education?

- (a) Secondary []
(b) Technical College []
(c) University []
(d) Others []

4. What is your job role in the company?

- (a) Owner []
(b) Manager []
(c) Supervisor []
(d) Others (please specify) []

SECTION B: Definition of construction quality and its assessment

Construction industry calls for the highest level of quality in the services provided. This is the best way that a contractor will be able to source more contracts in the future either by referral or by the track record of past projects.

How does your company define quality and assess the quality of its constructions services?

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SECTION C: Total quality management implementation

Total Quality Management (TQM) may be generally defined as a holistic approach to long-term success that conceptualizes continuous improvement as a process applicable to all areas of an organization. TQM encompasses product quality, as well as all organizational functions: distribution, marketing, planning, distribution, and so on.

Please indicate your level of agreement with the TQM implementation attributes listed in the following table by rating on a scale of 1 (extremely disagree) to 5 (extremely agree).

Attribute	Extremely Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Extremely Agree (5)
The TQM program implemented supports top management.					
The company often checks design conformance to standards.					
A formal training on TQM and quality improvement is often given to employees.					
The company maintains quality manuals/documents					
Quality values are clearly captured in the company's mission and vision.					
The company's tender system contributes to total quality management.					
The company uses a quality improvement plan other than TQM.					
The company plans to implement TQM in future.					

SECTION D: Quality management system (QMS) implementation

One of the most important aspects in service sector such as construction industry is to ensure that the client is satisfied. Quality management system (QMS) aims to achieve this through its seven principles. Please answer the questions following questions on the QMS principles in the table below by indicating YES or NO.

Question	Yes	No
Would you agree that your company conducts feedback exercises to obtain information about client satisfaction?		
Would you agree that your management has an approach to quality improvement within the organization?		
Would you agree that all employees are engaged in assessing and managing quality within your organization?		
Would you agree that your company has an established quality system for its operations and processes?		
Would you agree that your company has an established continuous improvement strategy for its quality system?		
Would you agree that your company measures/assesses the quality of its completed projects for decision making?		
Would you agree that your company face challenges meeting customer requirements because of its suppliers?		

THANK YOU