Cape Peninsula University of Technology

FRAMEWORK FOR THE EFFECTIVE IMPLEMENTATION OF TOTAL QUALITY MANAGEMENT IN THE MAINTENANCE OF TERTIARY INSTITUITION BUILDINGS IN SOUTH AFRICA

By

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ABSTRACT

The standards of maintenance management of building facilities at many educational institutions, including tertiary institutions, need improvement. TQM has been proven to be effective in the improvement of quality in the maintenance of school building facilities, although many tertiary institutions are still grappling to implement TQM in the maintenance of their buildings. This particular research project investigates the extent of TQM practices; determines challenges experienced; determines success factors and establishes a framework that will ensure the effective implementation of Total Quality Management in the maintenance of tertiary institution buildings in South Africa.

A quantitative research design was adopted, where a questionnaire with closed-ended questions was distributed to purposively-sampled maintenance workers in a tertiary institution. A total of 54 respondents participated in the study. The study adopted a case study approach. Five CPUT campuses were selected as the cases for the research study. Descriptive and inferential statistics were used to analyse the data. Data analysis was carried out by means of ranking; ANOVA test and Kruskal-Wallis test of association. The findings obtained indicate that all the TQM practices were implemented. Respondents perceived non-involvement of maintenance workers in decision-making as the most frequently experienced challenge during their building maintenance activities. A statistically significant different existed in the perception of workers' affiliated campuses on TQM success factors. Findings revealed that TQM success factors were extensively practiced with respect to training and education of maintenance workers, use of statistical methods, and commitment to satisfaction to school stakeholders, as well as commitment from top management.

To improve the maintenance management standard of buildings in tertiary institutions and ensure effective TQM implementation during maintenance activities, the study suggests a framework that provides interventions in situations where significant differences were found. It also suggests nine factors to the CPUT Maintenance Department to ensure effective implementation or actualisation in the maintenance of its buildings. A further study to identify new trends in the application of TQM in the maintenance of school buildings by conducting continuous studies from time to time is highly recommended.

Keywords: maintenance, South Africa, tertiary institution buildings, Total Quality Management.

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DECLARATION

I, Mariam Temisola Akinlolu, declare that the content of this research work is my own, unaided work and that this work has not been previously submitted towards obtaining any qualification. Therefore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

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Signed **Date**

DEDICATION

For every woman with a redline under her name in Microsoft Word.

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LIST OF ABBREVIATIONS

- **ANOVA**: Analysis of Test of Variance
- **BSI**: British Standards Institution
- **CPUT**: Cape Peninsula University of Technology
- **CSF'S**: Critical Success Factors
- **MBNQA**: Malcolm Baldridge National Quality Award
- **PDCA**: Plan, Do, Check, Act
- **SPSS**: Statistical Package for Social Sciences
- **TQM**: Total Quality Management
- **WOMENG**: Women in Engineering

DEFINITION OF TERMS

Buildings: “Buildings are structures enclosing a space and that comprises of roofs, walls, floors, windows and doors and other components” (Obaid, 2005:18).

Facilities: “Property such as a building, plant, or structure, built, established, or installed for the performance of one or more specific activities or functions” (Virginia Polytechnic Institute and State University, 2010).

Maintenance: “Required processes and services carried out to preserve, repair, protect and care for a building’s fabric and engineering services after completion, repair, refurbishment or replacement to current standards to enable it to serve its intended functions throughout its entire life span without drastically upsetting its basic features and use” (Olanrewaju, 2010:55).

Quality: “Complete features and characteristics of a product or service that convey its ability to satisfy implied needs” (Zsuzsanna, 2014:5).

Tertiary Institution: An academic institution that provides education beyond high school which includes universities, colleges, graduate and professional schools (U S Department of Education, 2000:2).

Total Quality Management: Management technique used to amplify quality and productivity in business organisations (Asiabaka, 2008:11).

CHAPTER ONE

1 INTRODUCTION

1.1 INTRODUCTION TO TOTAL QUALITY MANAGEMENT

Total Quality Management is perceived as a step in realising the deliberate changes that will bring about necessary transformations in proper management and maintenance of building facilities (Ater, 2013:12). The idea of TQM is to make sure that attempts to gain the required level of quality are well planned and organised. The implementation of TQM is identified as one of the most effective ways to monitor and maintain facilities and enhance continuous improvement in the management of facilities, in order to meet customer needs (Ashford, 1994:23). The TQM principles and framework have achieved significant popularity, with most organisations using it as a tool to achieve competitive advantage (Venkateswarlu & Nikalant, 2005:807). The adoption of TQM principles has been beneficial to not only service and manufacturing organisations, but also healthcare, government agencies and educational institutions. However, in the application of TQM, some impediments arise. One must not only adopt its processes, but also ensure that they are properly implemented (Shin, Kalinowski, El-Enein, 1998:11).

Research shows that out of every three TQM implementations, two fail as a result of poor managerial structure, lack of TQM knowledge, low involvement of employees and ineffective leadership (Yen, Krumwiede & Sheu, 2005:172). Hence, for the successful implementation of TQM, there must be positive hands-on leadership, upfront preparation and continuous maintenance of a sensible plan (Oakland, 1989:56). Awareness should be generated and maintenance staff should be encouraged to change their attitudes and show their commitment to quality.

Tertiary institution building maintenance is an integral component of its educational programmes. Xaba (2012:215) indicates a strong link between the quality of school buildings and learner achievement. However, Facilities Management in the educational sector began to receive attention in South Africa, only through the publishing of Notice 1438 of 2008 of the National Education Policy (Nhlapo, 2009:1). This suggests that, while it is a critical aspect of teaching and learning, school facilities maintenance has not been given sufficient priority. School administrations have experienced a lot of setbacks in the maintenance of buildings, due to several bottlenecks. Several studies indicate that most schools' administrative

functions, including maintenance, are complex in nature and require special skills to execute (Chaka, 2008:14).

The Chartered Institute of Building (1990:5) defines maintenance as work undertaken in order to preserve, restore or improve every building or facility, as well as its services and surroundings, to presently-acceptable standards so as to sustain the utility and value of the facility. The British Standard (BSI, 1993:4) also refers to building maintenance as a combination of any actions required to retain an item, or restore it to an acceptable condition. The significance of facilities maintenance to the functionality of tertiary institutions' is universally recognised, to the extent that many educational departments have dedicated structures responsible for the maintenance and management of their buildings and facilities (Szuba & Young, 2003:20).

1.2 BACKGROUND OF THE PROBLEM STATEMENT

Education affects the life of everyone in a society, whether as a student, teacher, parent, employer or consumer of goods and services produced by school leavers. Sani (2007:10) views schools as a social system that has an input, a process and an output cycle. The inputs of schools are comprised of human, financial and material resources. Human inputs consist of students, teachers, school administration and academic staff, while the physical inputs are comprised of the buildings, school roads, grounds, furniture and general infrastructure that make up the school plant. All of these inputs are transformed to produce the desired results, and the maintenance of physical infrastructure in particular will create a conducive learning environment for effective teaching and learning.

While quality has become a universal concern, tertiary institutions are challenged with maintaining existing physical facilities within acceptable quality standards (Buys & Nkado, 2006:990). Arguably, maintaining buildings within acceptable quality standards is one of the most important aspects of administration.

Quality as a measure of excellence depends on the individual perspective (Amusan & Bamisile, 2006:3). The acceptability of a product or a service will depend on its conformance to specification and its ability to function satisfactorily over a period of time (Amusan & Bamisile, 2006:3). According to Olawunmi (1992:13), the consequences of neglecting this aspect of quality management in the maintenance of facilities and buildings results in high costs of maintenance and low building performance, wasted energy and effort, and

inadequate management of maintenance. However, the issues stated above could be rectified by applying the principles of TQM, which is the theoretical basis upon which this study is conceptualised.

Brigham (1993:7) states that TQM remains a minimum universal requirement for staying in business. It is also emphasised that the implementation of the TQM process has often been deficient and erroneous (Mishra & Pandey, 2013:7). According to Brigham (1993:7), the common mistakes made in the implementation of TQM are misunderstanding of participation, lack of leadership and lack of, or misappropriation of, funds. The implementation of TQM in these cases involves overshooting of funds, time and effort. With such high financial and resource considerations, TQM may not yield the expected benefits at the expected time (Haupt & Whiteman, 2004:166). Owolabi and Amusan (2014:14) have identified some challenges in the implementation of TQM during building maintenance, namely lack of proper planning and lack of an appropriate administrative culture supportive of TQM. Other barriers were further identified as: lack of customer focus, poor management commitment and involvement, lack of employee empowerment and training, drive for short-term financial outcomes, politics and turf issues, as well as availability of resources.

The achievement of acceptable levels of quality in maintenance has long been a problem. Although TQM has been a productive instrument for the improvement of quality in the maintenance of school building facilities, many tertiary institutions are still struggling to implement TQM in the maintenance of their buildings (Yang, 2003:93). Considerable investments in time, money and resources, both human and material, are wasted each year because of sloppy or inadequate quality management procedures during the maintenance process (Obaid, 2005:16). Documentation exists that shows that many organisations have attempted to implement TQM, but have failed in their implementation (Zabaida, 1998:58). Youssef and Zairii (1995:11) agree that several organisations that have tried to implement TQM were faced with a number of challenges, ranging from management to structural barriers.

1.3 PROBLEM STATEMENT

School maintenance departments have been experiencing difficulty in implementing TQM during the process of maintaining their buildings, due to non-compliance with the practices and principles of TQM; however, the use of the right TQM framework would assist in eliminating the challenges experienced during the implementation of TQM in the maintenance of tertiary buildings.

1.4 RESEARCH QUESTIONS

This study will be guided by the following research questions:

The main research question:

What framework can be adopted to ensure the effective implementation of TQM in the maintenance of tertiary institution building facilities?

Sub-questions:

i. To what extent is TQM implemented during the maintenance of tertiary institution buildings in South Africa?

ii. What are the challenges faced during the implementation of TQM in the maintenance of tertiary institution buildings?

iii. What are the factors that ensure the effective implementation of TQM in the maintenance of tertiary institution buildings?

iv. What framework will ensure an effective implementation of TQM during tertiary institution building maintenance in South Africa?

1.5 AIM

The study aims to develop a framework for the effective implementation of TQM in the maintenance of tertiary institution building facilities.

1.6 OBJECTIVES

i. To investigate the extent of TQM practices in the maintenance of tertiary institution building facilities.
ii. To determine the challenges faced during the implementation of TQM in the maintenance of tertiary institution buildings.
iii. To determine the factors that ensure the effective implementation of TQM in the maintenance of tertiary institution buildings.
iv. To establish which framework will ensure an effective implementation of TQM in the maintenance of tertiary institution buildings.

1.7 HYPOTHESES

The following are the hypotheses for the study:

H1. There is no statistical difference in workers' affiliated campuses, workers' positions and their perception of the extent of TQM practices in the maintenance of tertiary institution building facilities.

H2. There is no statistical difference in workers' affiliated campuses, workers' positions and their perception of the challenges faced during the implementation of TQM in the maintenance of tertiary institution buildings.

H3. There is no statistical difference in workers' affiliated campuses, workers' positions and their perception of the factors that ensure successful implementation of TQM in the maintenance of tertiary institution building facilities.

1.8 CONCEPTUAL FRAMEWORK

1.8.1 Definition of quality and maintenance

It is important to shed more light on quality issues in maintenance from the point of view of processes and procedures (Obaid, 2005:82). To begin with, the definition of quality must be provided before identifying quality in maintenance. Quality has been defined from many perspectives by several researchers. Garvin (1998:39) discusses quality by raising questions of whether quality can be subjective or objective and relative or absolute.

Juran (1992:11) defines quality as "conformance to specification" or "conformance to standard". Deming (1986:5) reveals that quality should be aimed at the consumer's present and future needs. Feigenbaum (1991:7) defines quality as the total composite product and service characteristics of marketing, engineering, manufacture and maintenance through which the product and service in use will meet the expectation by the customer.

From a general perspective, Narayan (1998:39) defines maintenance as the preservation or restoration of the desired function of a given process, at the lowest total cost. Furthermore, Geraerds (2000:1) describes maintenance as a set of activities intended to keep technical systems in check and restore them to the conditions required for them to achieve their intended purpose with respect to buildings. Niebel (1994:8) explains maintenance as work undertaken to restore every facility to an acceptable standard at an acceptable cost.

1.8.2 Quality in maintenance

According to the traditional definition of quality as the conformance to specifications, the maintenance team aims at making sure that the facilities are kept in good condition in order to ensure effective workmanship which, in turn, conforms to specification and improves the product's quality (Obaid, 2005:83). Therefore, by making reference to the definitions of quality and maintenance, quality in maintenance can be described as a group of activities satisfying internal stakeholder expectations to attain the organisation's aims based on customer requirements by preserving or restoring facilities to an effective condition (Nieble, 1994:10).

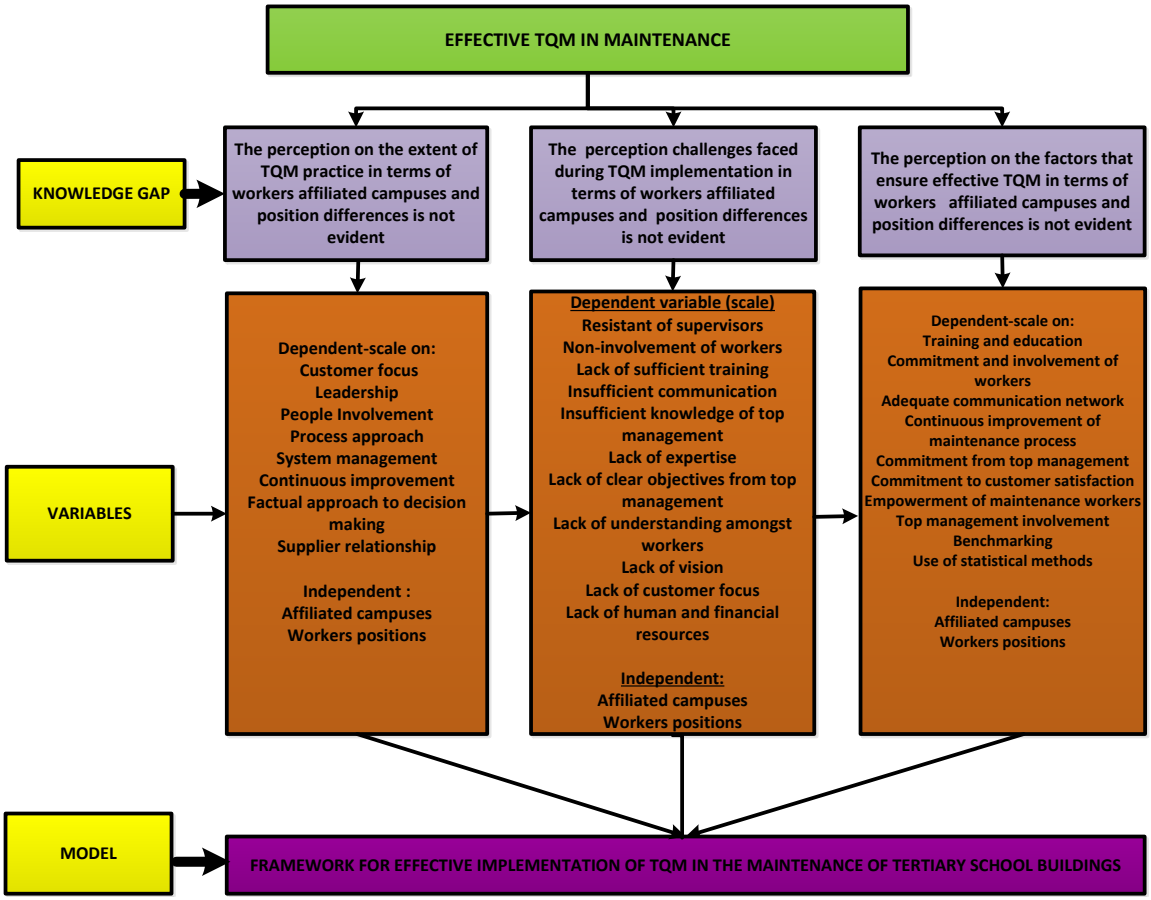

Figure 1.1: Conceptual Framework

This research project is concerned with understanding the TQM and its interaction with maintenance management activities of tertiary institution buildings, and its conceptual framework is shown in Figure 1.1. The knowledge gap indicates the lack of evidence in terms of significant statistical differences of affiliated campuses and positions on the extent of TQM practice, challenges in the implementation of TQM, and TQM success factors in achieving effective maintenance of tertiary institution buildings. Scale responses addressing the hypothesis related to the extent of TQM practice, challenges experienced during the

application of TQM and factors for effective implementation of TQM were used to derive the independent variables. Dependent variables were derived by considering the diverse needs of the different campuses and staff of maintenance departments in relation to the various positions they occupy in the department.

Therefore, this conceptual framework will contribute to achieving the aim of the research and an effective framework could be developed for maintenance of tertiary institution buildings using TQM principles.

1.9 SIGNIFICANCE OF THE STUDY

The research aims at developing a framework to guide the implementation of TQM during tertiary institution building activities. Practically, the findings and recommendations from this research could assist the maintenance teams of tertiary institutions to gain more insight into the challenges faced in the implementation of TQM in the maintenance of their building facilities, and thus assisting the planning process for proper maintenance management and policy-making. The research will provide more input into the existing body of knowledge, and other researchers will benefit from the data obtained and information gathered, which could then serve as a basis for further research.

1.10 DELIMITATION

The study is limited to a tertiary institution's building facilities in the Western Cape Province in South Africa.

1.11 ASSUMPTIONS

This study assumes the following

- The maintenance departments of tertiary institutions are confronted with challenges during the implementation of TQM in the maintenance of their building facilities.
- The target population will provide relevant information to justify the study objectives and research questions.

1.12 ETHICAL STATEMENT

This study is carried out in accordance with internationally accepted ethical standards and guidelines relative to research and other policies. Names of respondents are not connected and recorded in any particular completed research instrument. No compensations whatsoever are paid to any participant in the course of the study and quality as regards the following is assured by:

- Completeness of the research instrument;
- General conduct and competence of interviewers;
- Quality of data capturing carried out by encoders; and
- Being forced to participate in the study.

1.13 CHAPTER OUTLINE

Chapters in the study are outlined thus:

Chapter One: This introductory chapter consists of the introduction to the study, background of the research problem, the problem statement, the significance of the study, the research aim, research objectives and sub-objectives, research question and sub-questions, the scope and limitation of the study, definition of terms and, finally, the ethical considerations of the study.

Chapter Two: This chapter presents the review of relevant literature on quality, TQM philosophies and practices, challenges in the implementation of TQM, and success factors in the effective implementation of TQM. Maintenance management and the application of TQM in tertiary institutions are comprehensively reviewed in this chapter.

Chapter Three: The research methodology chapter consists of discussions on the research method adopted in the study. This chapter examines the research design, research population, sampling technique, instruments for data collection, administration of instruments, and techniques for data analysis and model formation.

Chapter Four: This is the data analysis and discussion of findings section. This chapter provides the report on the elicited data. It also analyses the results obtained in the study. It discusses the research findings, which are represented in graphical and tabular forms.

Chapter Five: This is the final chapter and contains the conclusions and recommendations for the study. It is based on the analysis made from the findings, on the basis of which overall conclusions are drawn and final recommendations are made as regards the aim of the research.

CHAPTER TWO

2 LITERATURE REVIEW

2.1 Introduction

Predominantly, this section concentrates on quality theories, TQM theories, TQM concepts, the dimensions of TQM practices, the extent to which TQM is practiced during maintenance activities, challenges in the implementation of TQM, and success factors for the effective implementation of TQM in the maintenance management of tertiary institution buildings. This literature review is conducted to enable the researcher to understand the concepts of TQM in building maintenance. The intention is to permit the researcher to recognise and cover the objectives and constitute a base for an overall understanding and identification of the barriers affecting the implementation of TQM in the maintenance of tertiary institution building facilities.

The TQM philosophy has been unsuccessfully adopted by numerous organisations, since they have been unfamiliar with proper TQM practices (Hafeez, Malak & Abdelmeguid, 2006:1215). Yen, Krumwiede and Sheu (2002:338) posit that the management bodies of organisations experience different challenges during the implementation of TQM. Lakhe and Mohanty (1994: 427) consider implementation of TQM to be a difficult task, because organisations view it as a tool for fixing problems rather than as a technique that promotes change towards continuous improvement. The knowledge and understanding of TQM principles and their implementation is very important in an organisation, if its needs are to be achieved. Verkateshwarlu and Nilakant (2005:809) argue that adequate knowledge and experience of TQM minimises the chances of making mistakes during the implementation of TQM.

2.2 Theories of Quality

Deming (1986:54), Crosby (1979:7), and Juran (1993:55) indicate that there are different notions of the definition of quality, with everyone having their own versions depending on their beliefs. Reeves and Bednar (1993:30) perceive quality as the characteristics of a product or service which bear on its ability to satisfy stated or implied needs. Crosby (1984:50) defines quality as conformance to requirements or specifications. This perspective gives a clear-cut reference to the importance of people and organisational change with special reference to cultural change and commitment of top management to quality. According to Lam (2000:28) and Ashworth (1994:76), quality is the totality of features of a product or service that bears on its stated ability or implied needs and its acceptability.

Crosby (1984:53) points out that quality, or lack of it, depend more on top management than employees. Juran (1993:57) advances a theory on how results can be achieved by investing a minimal quantity of the organisation's operational cost on the prevention of errors. This theory recommends that organisations should get things done right the first time. Deming (1988:80) is of the opinion that quality is a predictable degree of consistency and dependability, at low cost and suited to the market. Juran (1993:55) defines quality as fitness for use. Crosby (1984:53) focuses on the activity of quality improvement and indicates that understanding the core concepts of quality and implementation, rather than incorporating a complex system which can be difficult to execute, is the key to quality improvement. Mukherjee (2006:32) explains that quality results from an adequately planned combination of features of a process or service associated with its use and the conditions in which it is used.

However, Crosby (1984:60) proposes the following three total requirements which need to be fulfilled for quality to be attained:

- *Quality* is defined as conformance to specification: quality is aimed at getting everything done right the first time. Requirements have to be understood clearly by employees for this to be achieved. Management has to ensure that the requirements needed to be met by the employees are established, and the resources needed by the employees to meet these requirements are supplied.
- *Prevention* is the system of quality: appraisal is viewed as unreliable and a costly way of achieving quality. Appraisal deals with inspecting and checking a product after the job is over. The practice of prevention is based on having proper knowledge about the process that requires preventive action. Preventive action is carried out by taking a look at the processes and recognising opportunities for error. These errors can be avoided by getting rid of the problem causes.
- *The price of non-conformance* is the measurement for quality: two factors make up the cost of quality, and these are the price of conformance, which consists of cost of training and education on quality as well as prevention efforts, and the price of non-conformance, which is characterised by cost of delay, rejection and rework. It is also the price the organisation has to pay for not doing things right the first time.

Garvin (1988:40) helps us conceptualise quality, and offers a comprehensive definition, by raising questions of whether it is subjective or objective. This focuses more on a trilogy of quality planning, quality control, and quality improvement. Garvin (1988:390) also categorises the definitions of quality into five groups. Table 2.1 presents examples for each one of the identified categories.

Table 2.1: Categories of Quality

Group	Definition
Transcendent	• Quality is neither mind nor matter, but belongs to a third-party unit and is independent of the two… even though quality cannot be defined, you know what it is (Pirsig,1974:188) • Quality is a condition of perfection signifying that there is a distinction between fine quality and poor quality…Quality is attaining or reaching for the highest standard rather than being satisfied with a sloppy standard (Tuchman,1980:38)
Product Based	• Quality refers to the number of unpriced attributes a unit of priced attributes can accommodate (American Economic Review,1982:956) • Reduction of quality results in differences in quantity of some preferred ingredients or attributes (Abbott,1995:127)
User Based	• Quality is fitness for use (Juran,1974:22) • Quality deals with the capacity to satisfy wants (Edwards,1968:37)
Manufacturing Based	• Quality is conformance to specification (Crosby, 1979:15) • Quality is the level to which a particular product conforms to design or specification (Gilore,1974:16)
Value Based	• Quality is an approach to getting what is best for certain customer conditions (Feigenbaum,1961:1) • Quality is the level of distinction at an acceptable price and the control of variability at an acceptable cost (Broh,1982:3)

Source: Garvin (1988:40)

Townshend (1990:80) discusses the duality of quality and proposes that there are two sub-concepts to quality, quality in fact and quality in perception. Townshend (1990:80) further explains that quality, in fact, is perceived as the characteristic that provides goods and services through its hard work and performs up to expectation in accordance to specifications, while quality in perception is viewed as that type of quality which the customer views as subjective.

The above exposition clearly reveals the importance of quality. In fact, quality has been considered as the driving force for all human efforts and is regarded as playing an important role in our lives (Mishra & Pandley, 2013:3). Rao (1998:87) indicates that the planned systematic routine to be used in preventing problems sabotaging quality is achieved through the application of the TQM principles. It can be said that TQM is a critical determinant in the success of organisations. In several countries, the implementation of TQM has become a recurrent and preferred practice for improving quality (Krasachol, Willey & Tannock, 1998:42). The achievement of quality is made possible through the successful management of change; much of modern day thinking on this focuses on total quality management (Pineda, 2013:35). The next section discusses TQM.

2.3 TOTAL QUALITY MANAGEMENT (TQM)

2.3.1 An overview of TQM

According to Zairi (2002: 1164), there is very limited knowledge of TQM. It is obviously necessary to be aware of what TQM entails, since lack of the knowledge of TQM is considered as a major challenge during the implementation of TQM (Soltani, 2005:46). TQM came into existence in the 1970s, as at this time the progression of quality shifted from quality control to a better approach of quality in order to deal with the growing appetite for quality (Klenke, 2008:5). Quality management has evolved from quality inspection, to quality control, to quality assurance then to Total Quality Management (Kenya Institute of Management, 2009:50).

Juran (1993:64) and Steeples (1992:17) identify three periods in TQM evolution: quality control, quality assurance and TQM, while Garvin (1998:39) and Radford (2003: 102) argue that there are four stages of TQM evolution, which are: inspection, statistical quality control, quality assurance, and strategic quality management. It is evident that quality management has evolved into a system that aims to readjust the mission, culture and working practices of an organisation by means of pursuing continuous quality improvement (Ashworth, 1994:80).

Juran (1989:82) defines TQM as the totality of processes through which quality planning, quality control and quality improvement are achieved. Zairi and Simintiras (1991:430) view TQM as a total socio-technical system, with the aim of ensuring that things are done right the first time, all the time. In TQM, quality in all aspects of maintenance and operations is required, with activities and processes carried out effectively the first time and defects and waste eliminated as far as possible (Ramesh & Ravi, 2015:144). Furthermore, TQM describes the culture and attitude of an organisation that is aimed at providing customers with services that satisfy their needs (Chepkoech, 2015:8).

Pheng and Teo (2004:286) point out that much work has been carried out on the implementation of TQM and results show that better quality products, higher customer satisfaction and higher market share are often achieved following the adoption of TQM. It has been suggested in Japanese industry that TQM is less of a product-related concept and more of a customer-related one (Hackman, 1995:319).

Mukherjee (2006:40) argues that the wheel of any organisation is run by the customer. This suggests that an organisation can only survive when it renders services and products that satisfy the needs of the customer. Oakland and Marosszeky (2006:15) explain that TQM emphasises moving the focus of control from the individual, with the objective of making everyone accountable for their own performance and to get them committed to achieving

quality in a highly motivated fashion. Hence, it is perceived that TQM fortifies management's effort to adopt a strategic concept of quality, which focuses on prevention rather than problem detection.

TQM is an approach in which top, middle and lower management become involved in the continuous improvement of processes. It is a merger of quality and management techniques channelled towards the reduction of losses which result from wasteful practices (Chepkoech, 2015:8). According to Pheng and Teo (2004:287), TQM considers an organisation's goals, people and processes to ensure that things are done right the first time and aims at improving the competitiveness, effectiveness and flexibility of the whole organisation. In order to fulfil customer requirements and ensure the customer's satisfaction, products and services must be provided in the right quantity and quality, at the right place, and within the specified time. Furthermore, for all these requirements to be fulfilled, doing things right the first time is required. TQM is concerned with the creation of a quality culture, where the goal of the staff of the institution is to satisfy and conform to the specifications of its customers, where the structure of the institution gives them the opportunity to do so. Deming's experience during World War II played a vital role in developing TQM (Mishra & Pandey, 2013:3).

Total Quality Management means that the organisation's culture is defined by and sustains the constant realisation of customer satisfaction through a homogenous system of tools and techniques. This involves the continuous improvement of organisational processes, resulting in high quality products and services (Mishra & Pandley, 2013:3). TQM has a common objective, which is to make sure that continuous improvement in the organisation's people, processes, systems and environment is present, in order to achieve improved efficiency and effectiveness (Bahri *et al.* 2012:11).

Mukherjee (2006:48) explains that TQM is a people's process and top management involvement is crucial for its success. De Knop, Hoecke and Bosscher (2004:57) identify three fundamental components of TQM: focus on customer satisfaction, continuous improvement, and total involvement and commitment. Peters (1984:119) describes these components as compulsory in order to forge ahead to an effective, market-oriented (service) organisation. The implementation of TQM is a complex process that requires time and resources (Chepkoech, 2015:9). It involves a process that focuses on investigating and meeting customer needs and expectations through the involvement of everyone and through continuous improvement. Teamwork and leadership that emphasise continuous employee training and development are required (Oluwatoyin, 2008:44).

Oakland (1998:30) views TQM from the perspective of improving the effectiveness, flexibility and competitiveness of a whole organisation and also see it as an important method of planning, organising and understanding each process, depending on each individual at each level. TQM is mainly concerned with continuous performance improvement. To achieve this, people need to know what to do, how to do it, have the right tools to do it, and be able to measure performance and receive feedback on current levels of achievement (Arthur & Irving 1992:55). Langford (1990:125) affirms that TQM requires never being satisfied with the current level of quality and success in meeting customers identified needs, requirements, interests and expectations. Ammar (2003:3) emphasises that TQM is a required journey that will never end, because it plans to improve both process and product. It is about listening and entering into a dialogue about people's fears and aspirations (AbdulAzeez *et al*., 2015:560).

In the context of maintenance, Pheng and Teo (2004:8) define TQM as a top-down management philosophy focused on monitoring process variation, employee involvement, and continuous quality improvement in order to meet customer needs. Generally, these definitions emphasise that TQM involves people at all levels in all activities (Obaid, 2005:14). Wali and Boujelbene (2011:234), discuss six practices that can be used to measure TQM. These are leadership, strategy and planning, customer focus, information and analysis, people management, and process management. Prince and Gaskill (1990:80) identify three TQM dimensions;

- The dimension of product and services: this is the level of satisfaction a customer obtains from a product or service.
- The dimension of process: the level of supplier satisfaction with the process of internal work that was used in the development of the product and services supplied to the customer.
- The people dimension: this is the level of customer satisfaction with people's relationship with the organisation.

From the principle of TQM, it is imperative to know that the success of continuous improvement requires people to know what task to do at a given time and how to do it. Looking at some of these fundamental principles, it is most important for every stakeholder to have a purposeful understanding of TQM, its importance and the positive long-term effect it will have on organisational structure (Ater, 2013:23). TQM is based on three fundamental components: quality planning, quality control and quality improvement (De Knop *et al.*, 2004:60). These components are briefly explained below.

2.3.1.1 Quality Planning

Quality planning is carried out to create a route towards TQM (Al-Saket, 2003:24). Juran (1989:82) defines quality planning as an activity that comprises determining customer's needs and developing products that will satisfy those customer needs. Juran (1989:83) further explains that quality planning is a simultaneous exercise which involves all parties related to the product and services so as to provide input and give early warning signs during the planning process. Al-Saket (2003:25) explains that quality planning deals with the achievement of the goals of an organisation, its product features and processes. Mukherjee (2006:56) points out that quality planning is the origin of the journey an organisation must undertake to achieve quality.

According to Mukherjee (2006:142), during the quality planning process, a quality plan is drawn for all functions including materials, human resources, finance and operations. This quality plan defines specific objectives and the resources needed to achieve these objectives are identified and made available in advance. Furthermore, alternatives are analysed and the most appropriate alternative for the attainment of the objective is identified. The quality plan provides an actual direction for the organisation and consolidates its efforts to attain its overall objectives at the appropriate time. Juran's (1989:85) quality planning steps are as follows:

- Define the project;
- Identify the customers that would assist the organisation to accomplish its goals;
- Determine the needs of the customer;
- Translate the needs into your language;
- Develop a product that is able to respond to the customer needs;
- Establish quality objectives;
- Develop plans to meet these objectives;
- Develop a process that can produce the product;
- Optimise the process;
- Prove that the process can produce the product by showing that the process is capable i.e. a plan should be developed at the operation level; and
- Convert the process to operations.

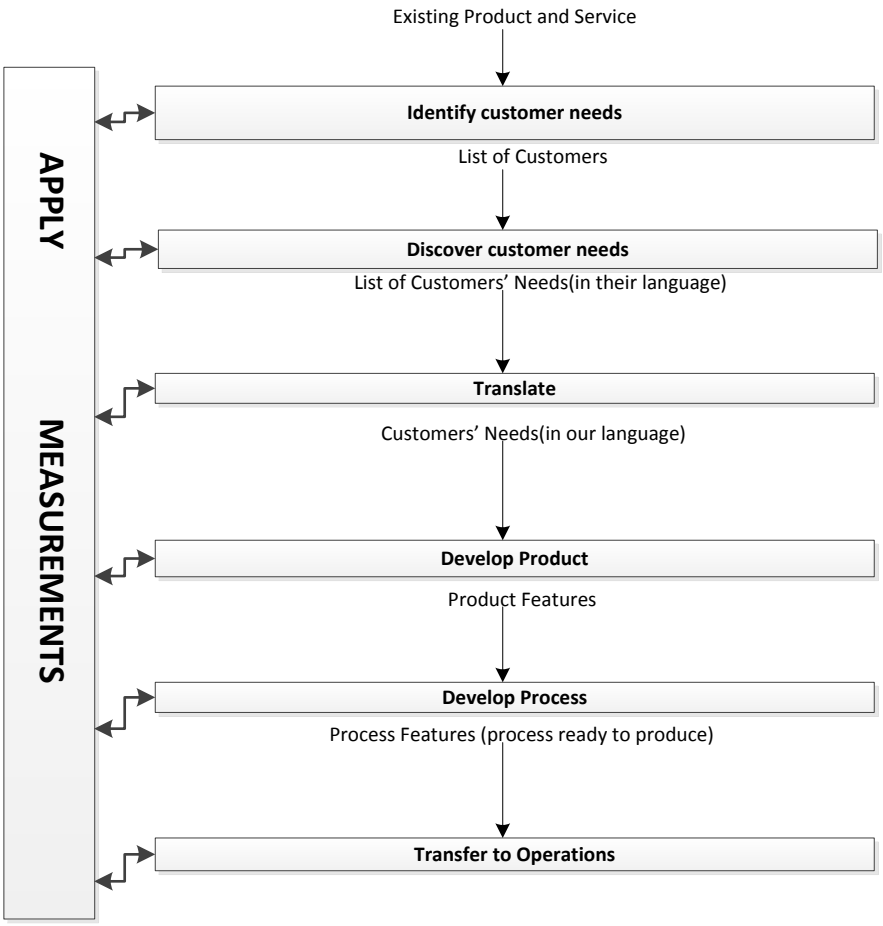

Figure 2.1: Generalised Quality Planning Process

Source: Juran (1989:88)

2.3.1.2 Quality Control

This is an integral aspect of the TQM process that is conducted throughout the organisation to achieve its objectives. According to Mukherjee (2006:142) despite all precautionary activities, deviations may still occur, which lead to disruption of achievement of objectives. Juran (1989:145) perceives quality control as a managerial process during which actual performance is evaluated, goals are compared and actions are taken on the variances. Quality control is concerned with the execution of plans rather than process improvement (Ater, 2011:24). Mukherjee (2006:57) further illustrates that quality control should be conceived from within, or the system of self-control has to be developed.

Quality control places more emphasis on the control of processes. Deviations in the processes are rectified in line with the quality plan during quality control. For self-control to be achieved, employees, as well as top management, should be equipped with a means for identifying quality goals, determining their performances on the quality goals, and a means

for regulating their performances. Ozeki and Asaka (1990:7) propose the PDCA control cycle as a methodology for performing quality control. The cycle is as follows:

- Plan: discover your goals and formulate a process that could be used in the achievement of these goals;
- Do: execute your plan;
- Check: assess the outcome of your plan and its execution; and
- Act: take all necessary action involving quality control.

Ater (2011:24) proposed that quality control consists of the following steps:

- A clear definition of quality.
- Adequate knowledge of the expected performance or targets.
- Evaluation of the actual operating performance.
- Comparison of the performance to goals.
- Taking action on the difference.

Juran (1989:93) clearly states that for quality to be successfully achieved, the participation of upper management is crucial. The quality control process requires taking preventive actions to avoid deviations and retain current performance and ensure regularity in the performance of the process and service.

2.3.1.3 Quality Improvement

Quality improvement serves as a drive for the whole organisation (Al-Saket, 2003:26). According to Juran (1989:28), quality improvement is a beneficial change in the structure and processes of an organisation to increase performance and also eliminate inadequacies. Quality improvement is essential for the management of an organisation in order to help them survive in a competitive environment, meet up with increasing customer satisfaction levels and overcome deficiencies of new technology. Mukherjee (2006:142) explains that quality improvement provides enhanced performance for an organisation. It brings about eradication of problems and fosters continuous improvement. Juran (1989:30) introduces ten steps to quality improvement, which are as follows:

- Awareness of the need and opportunities for improvement should be created by the organisation. The rate at which an organisation improves its quality determines its growth rate.

- Top management should identify specific goals and objectives for improvement, depending on the 'Pareto Analysis', by choosing crucial activities that boost the performance of the organisation.
- The department in charge of quality should choose a heterogonous cross-functional team to take charge of quality improvement in an organisation.
- Trainings regarding problem-solving tools and techniques should be provided for the team members and employees.
- Brainstorming sessions should be carried by the team members in order to discover the root cause of the problem.
- Remedies to solve the cause of a problem should be developed, as soon as the root cause of the problem and the actual problem itself is clearly identified.
- The organisation should test remedies for problems to prove their adequacy before applying them. Simulations could be carried out before deciding ultimately on the best remedy to implement.
- Changes should be communicated by team members to the relevant persons. The team members should convince and train the relevant persons to implement the solutions. Through this process, the project team must conquer resistance to change and regulate the solution for implementation.
- Top management should give rewards and recognition to the team members by communicating end results in open board meetings. Lessons learnt should also be discussed. Appropriate benefits can also be given to team members who deserve it.
- The project or management team, as well as those concerned with the operation of the organisation, should ensure that there is a suitable quality control system in place.

2.4 The Concept of TQM

TQM is perceived as more than a management philosophy, but is also considered as a suitable framework applied by organisations to guarantee the achievement of their aims (Altahayneh, 2014:110). As a result of this proactive approach, all primary, supporting and managerial processes should be delineated in a procedure that ensures quality for customers, employees and other stakeholders (De Knop *et al*., 2004:60). Many authors like Juran, Crosby, Deming, Feigenbaum, Oakland and Kanji have contributed to laying foundation stones that form the fundamental concepts and values of TQM. The number of concepts and their formulation also differs. Yung (1997:224) argues that Deming's 14 points

of quality management are perceived as the foremost framework or theoretical baseline of TQM.

Deming (1988:82) highlighted the following as fundamental values and concepts of TQM.

1. **Adopt the new philosophy**: Adoption of a new philosophy, which allows for quality in all aspects and places much emphasis on cooperation over competition. It also creates a mistake-free environment. Deming (1988:82) suggests that learning and adopting something new brings about growth, which comes from change. The frequency with which the organisation implements a new philosophy helps in the organisation's growth rate.

2. **Improve every process**: Every planning and service process should be constantly improved for the satisfaction of customers and the fulfilment of the management objectives, rather than depending on a system based on inspection. Supervision should be performed at all levels of every process to minimise errors. This enhances continuous improvement, productivity and quality of products and services.

3. **Cease dependence on Inspection**: The need for constant inspection should be eliminated as a means to achieving quality by focusing on the service process. Deming is of the opinion that more emphasis should be placed on statistical techniques for inspection rather than wasting time and resources on manpower for 100% inspection.

4. **Creation of constancy of purpose**: Constancy of purpose for continual improvement should be created by developing a mission statement on the objectives of the processes through innovation, research and maintenance. Deming (1988:82) suggests that top management should define the vision, mission and objectives of the organisation so that there will be a unified objective. Constancy of purpose between the employees and top management is very crucial for the employees to give of their best for the achievement of the organisational goal.

5. **End lower tender contracts and reduce the number of vendors**: The practice of awarding business solely on the basis of price should be discarded, since the lowest bid does not amount to the lowest life cycle cost. The number of vendors or suppliers should be reduced for better control and consistency. Frequent changing of suppliers in order to get cheaper prices will lead to instability in the quality of materials supplied. Management should solicit suppliers who provide products with the best quality

6. **Drive out Fear**: Effective communication and other means to drive out fear should be encouraged throughout the organisation. This point is stressed by Deming, who feels that the presence of fear hinders progress in the end result. An organisation driven by fear is headed for failure. Hence, extra effort should be put in to eliminate fear. It is further stressed that an organisation should be self-sustaining and fear should not be the motivation to attain results.

7. **Promote Leadership**: Leadership aimed at helping people and processes perform better should be encouraged, rather than leadership with emphasis. Promote leadership to encourage people to carry out their jobs properly, due to the accomplishment of desired vision, mission and goals.

8. **Institute Training and Education**: On-the-job training should be promoted in order to enable the employees to perform their duties and responsibilities better. The training needs and skills required by each employee should be identified.

9. **Encourage new skills**: Innovations, new skills and development enhances quality and productivity of an organisation as well as reduces the cost of production. An organisation should have quality improvement and suggestion programmes to promote the implementation of new skills.

10. **Teach and use statistical methods**: Deming emphasises that statistical knowledge and its implementation enhances accuracy in results, labour and material productivity. It also reduces the effort an organisation puts in to attain end results.

11. **Top management commitment**: Organisation-wide involvement, where every member of the organisation must be involved in all processes, should be encouraged. Top management should have a clearly defined permanent commitment to the improvement of quality and productivity.

12. **Improve Communication**: Lack of proper communication is one of the major problems between employees and management of an organisation. Communication needs to be impeccable in order for new philosophies and techniques to be learnt, for trainings to be facilitated and for constancy of purpose to be achieved.

13. **Eliminate targets**: Work standards that prescribe numerical goals for people in management should be eliminated. Deming advises that work standards should be critically examined from the point of view of whether the tolerance is tighter or is overdesigned. Rigid standards should also be avoided.

14. **Break down barriers**: Eliminate barriers that detract from the pride of workmanship of the employees, such as defective equipment, faulty machines and merit system.

However, Dale (1999:19) explains that TQM consists of eight key concepts and values ; role of divisional top management and quality policy, role of quality department, training, product / service design, supplier quality management, process management/operating, quality data and reporting, and employee relations. A survey of TQM carried out by the Malcolm Baldrige National Quality Award suggests the following eleven key concepts: committed leadership, adoption and communication of TQM, closer customer relationships, benchmarking, increased training, open organisation, employee empowerment, zero defects mentality, flexible manufacturing, process improvement, and measurement to determine critical factors of total quality management.

Apart from Deming's 14 points (1988:82), Dale (1999:19), Malcom Baldridge National Award, Oakland (2005:1056) develops a new TQM framework based on four P's (planning, performance, processes and people).

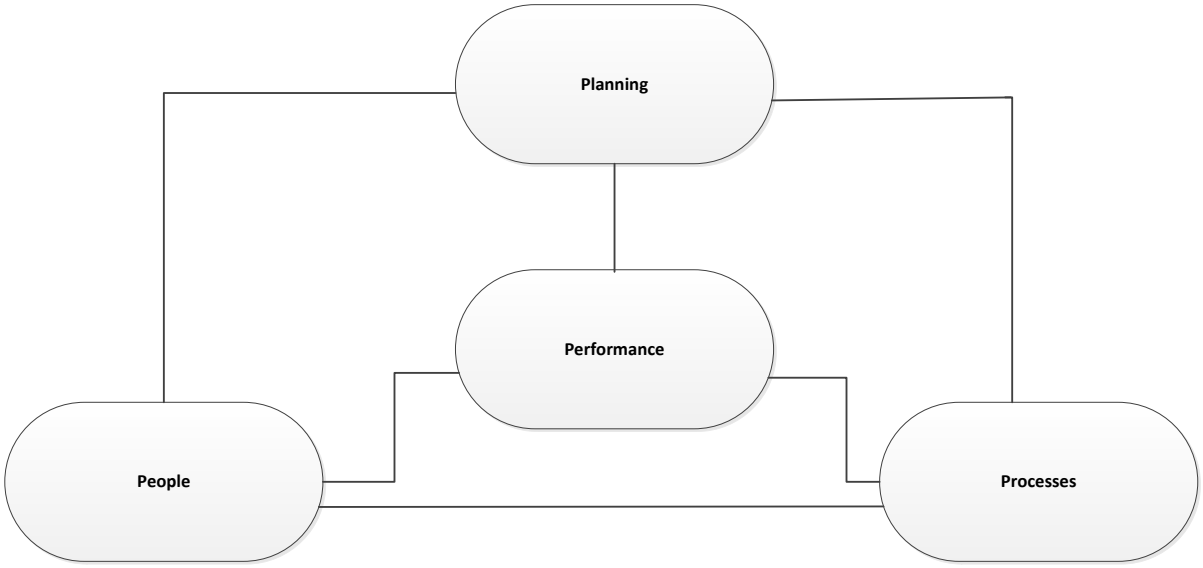

Figure 2.2: TQM Framework

Source: Rahaman (2014:20)

Oakland (2005:1957) links the four P's together, explaining that performance can be attained through planning and the involvement of all the people during the improvement of the processes. The four P's are discussed as follows:

- **Planning:** this involves developing policies, strategies and deployment of goals. Resources and quality designs are done at this stage.

- **Performance:** focuses on frameworks for the measurement of performance. Audits, self-assessment, benchmarking and reviews are done at this stage.
- **People:** concentrates on the management of workers through teamwork, communication, learning, training and innovation.
- **Processes:** It focuses on the management of processes, design and redesign of processes, with the goal of continuous improvement.

Bonstingl (2001:40) emphasises that whatever view one takes of TQM, it is best understood as a crucial set of fundamental principles, summarised as the Four Pillars of Total Quality Management. The first fundamental principle is that the organisation must first focus on the customers. Secondly, every member of the organisation must be dedicated to continuous improvement, collectively and personally. The third fundamental principle is that organisations must be perceived as systems and all the work carried out within them must be seen as an ongoing process.

Walton (1986:60) suggests that more than 85% of failures that occur in an organisation are directly related to how the organisation's processes and systems are set up. Fourthly, the success of TQM is dependent on the commitment of top management. Without collaboration and constant dedication from top management to ensuring TQM practices are part of the culture of an organisation, all efforts are bound to be unsuccessful. Senge (1994:20) suggests that organisations which have the capability of flourishing are learning organisations where people and processes are committed to continuous improvement collectively.

2.5 Dimensions of TQM Practice

Previous empirical studies on TQM confirm that TQM practices have been described by various researchers in different ways although they are interrelated (Terziovski & Samson, 1999:228). TQM practice is shaped towards one philosophy, which is waste reduction and continuous improvement, aimed at achieving the goal of customer satisfaction (Adair, 2004:60). TQM practices are a set of beliefs which are fundamental and comprehensive and are aimed at improving an organisations performance over a long period of time by placing focus on its customers in the process of addressing its stakeholder needs (Hoyle, 2001: 55). Various propositions have been developed in TQM by quality management gurus like Deming, Crosby, Juran, Feigenbaum and Ishikawa. Prajojo, Daniel and Amrik (2006:38) describe TQM as a philosophical practice of understanding and discovering better processes. It is a managerial methodology and approach. According to Al-Saket (2003:17),

TQM is a philosophy aimed at analysing the factors that influence quality, as well as tools and techniques with which quality can be adequately controlled and assured. TQM has become a crucial philosophy to ensure organisations become as efficient and competitive as they can be (Abu-Hassan *et al.* 2011:286).

Powell (1995:20) outlines the following TQM practices; executive commitment, adopting the philosophy, closer to customers, closer to suppliers, benchmarking, training, open organisation, employee empowerment, zero-defects mentality, flexible manufacturing, process improvement, and measurement. Martinez-Lorente, Dewhurst and Dale (1998:379) established seven common TQM dimensions, which include organisation, product design process, employee relations, supplier relationship, quality information, process instruments and design instruments.

Ho and Fung (1994:26) introduce ten TQM elements: commitment, leadership, total customer satisfaction, total involvement, ownership, continuous improvement, training and education, reward and recognition, error prevention, and cooperation and teamwork. Jusoh, Yousoff and Shamini (2008:45) identify seven dimensions, namely: customer focus, leadership, strategic planning, data information management, system management, people management, resources and partnership. According to Obaid (2005:16) eight TQM practices that have been perceived as fundamental to the management of quality are illustrated by the ISO 9000 (2000). They are as follows:

1. **Customer Focus**: Customers form the pillar of business of any organisation. Customer focus is concerned with the achievement of customer satisfaction through conformance to the customer's requirements (Obaid, 2005:16). Juran and Godfery (1998:41) emphasise that the main operational goal of any organisation is meeting customer demands. Fukui (2003:6 further explains that for an organisation to achieve success, it must meet the needs of customers and conform to their specifications. According to the ISO 9001 (2000) standard, customer focus is reflected through the requirements for addressing concerns with customer communication, management commitment, appointment of a management representative and the resolution of customer needs and expectations (Hoyle, 2001:35).
2. **Leadership**: For effective leadership, leaders must develop clear objectives, effective strategies and supporting plans. It is the responsibility of top management to lead employees to be more efficient at their jobs (Rahaman, 2014:28). The appropriate management structure should be established, and employee participation through empowerment should be encouraged (Oakland, 1997:67). Al-Khalifa (2000:196) states that leadership by top management that supports the

objectives and vision of the organisation is crucial in the TQM process. Management should consistently pay attention to their employees and monitor their progress (Obaid, 2005:16). Pheng and Teo (2004:12) explain that top management's commitment to quality is important for the success and progress of TQM implementation. Vladavic (2014:35) further emphasises that training of employees should be initiated by top management in order that the necessity of TQM be conveyed to them.

3. **People Involvement**: The participation of everyone in the organisation, from the top executives to the low-level management, assists in increasing productivity, which means obvious benefits (Obaid, 2005:16). According to Galgano (1994:68), the involvement of the workforce is important, as it is one of the conditions for an organisation's ultimate success. Sarajevo (2014:46) explains that the involvement of workers is one of the main drivers for the successful implementation of TQM.
4. **Process approach**: Process management is recognised as a requirement for a quality product. According to Hoyle (2001:40), desired results are more effectively generated when related activities and resources are managed as a process. Reid and Sanders (2005:158) argue that quality should be incorporated into every process. This entails the management of processes which have clearly defined objectives, and is based on the needs and interests of all parties involved. Therefore, for organisations to achieve success, an outstanding process management structure must be in place, one in which planning, evaluation and progress is managed.
5. **System Management**: Ludwig-Becker (1999:55) proposes that identifying, understanding and managing a system of interrelated activities, processes or a given objective, all contribute to the effectiveness and efficiency of the organisation.
6. **Continuous Improvement**: Continuous improvement is tailored towards achieving the best (Obaid, 2005:18). It is important for an organisation to practice continuous improvement. It is the driving tool of TQM, because it ensures consistent quality delivery to customers by involving everyone in the organisation. This propels an organisation to be both creative and logical in searching for ways to become productive and more effective at meeting stakeholder expectations (Westcott, 2013:291). Organisations are required to develop a programme for upgrading processes in order to achieve competitive advantage (Kinlow, 1992:14). Most researchers regard continuous improvement as the most important philosophy of TQM (Rahaman, 2014:32). Deming's quality improvement cycle is regarded as an effective framework for the achievement of continuous improvement.

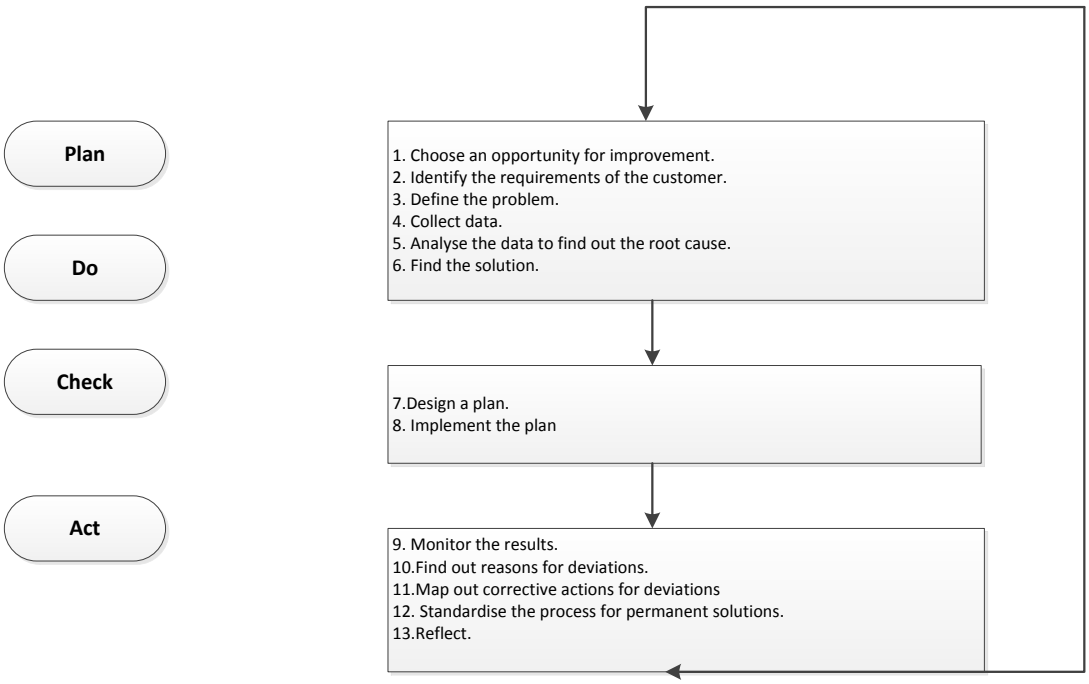

Figure 2.3: Quality Improvement Cycle

Source: Joyce (1995:126)

7. **Factual Approach to decision-making**: Management needs to continually take decisions. Hoyle (2001:45) suggests that, for an organisation to determine how well it is performing, data on performance measures are important. TQM requires that an organisation continually gather and analyse data in order to improve the accuracy of its decision-making, reach a consensus and allow prediction based on past occurrences (Westcott, 2013:292). Ishikawa (1985:109) proposes the following measures for ensuring a factual approach to decision-making in an organisation:

i. Recognising data clearly.
ii. Expression of facts with accurate data.
iii. Using statistical methods to analyse data.

8. **Supplier Relationship**: A mutually favourable relationship between the organisation and its suppliers amplifies the potential of the organisation to create value (Hoyle, 2001:45). The TQM philosophy promotes the involvement of everyone in the quality process, which also includes the suppliers. Reid and Sanders (2005:158) explain that, in recent times, organisations developed structures to manage supplier's locations and monitor the suppliers themselves. Juran and Godfery (1998:592)

further report that, in other to capitalise on supplier related issues, it is important to understand suppliers' quality.

2.6 Eight Building Blocks of TQM

Mukherjee (2006:42) summarises the internationally-recognised core concepts of Total Quality Management into eight building blocks. These building blocks are practiced together for the implementation of TQM. They are as follows:

- Customers' stated and implied needs should be understood and always acted upon. This will lead to the achievement of customer satisfaction.
- An internal customer-supplier relationship should be developed.
- Value added to the process or sub-process should be determined by measuring the cost of resources consumed.
- Processes should be done right the first time by ensuring zero defects in the products and services.
- All parties should be satisfied at the same time. Efforts should be made to satisfy employees, suppliers and customers.
- More focus should be placed on prevention to avoid repetition of mistakes. Mistakes should be analysed to determine the root cause, and appropriate preventive and corrective procedures should be carried out to avoid repetition.
- Everyone should be involved. TQM promotes involvement of all participants in the organisation i.e. employees, customers, suppliers and vendors.
- Work should be carried out under the seven zero emblem i.e. zero delay, zero paper, zero downtime, zero defect, zero accident, zero stock or inventory and zero disdain for others.

2.7 Implementation of TQM in maintenance

Recently, the facilities maintenance industry is operating in an era of change. With the rising expectations of the people, the living standard and tight budgets, there has been an urgent need to raise the standard of their practices (Pheng & Hong, 2005:25). In the mid 80's, there was growing interest in the study of maintenance models for systems experiencing failure. These studies pertained to the application of TQM techniques in the building maintenance process (Al-Zubaidi, 1993:90). Furthermore, Abu-Hassan, Khalid and Eziaku (2011:286) argue that TQM has demonstrated that it's a useful tool which ensures the attainment of set standards and successful productivity improvements in the maintenance process. For TQM

to be successful, it requires a focus on the customers, the total involvement of employees, effective leadership and continuous improvement (Oakland, 2005:1057).

Reid and Sanders (2005:140) state that organisations have realised the need to incorporate quality in their processes due to the high cost of poor quality. Guimaraes (1996:20) argues that, once TQM is implemented, employees achieve higher job satisfaction and involvement. Serafimovska and Ristova (2010:26) point out that, though TQM practices may differ between branches of organisations, there is a common agreement on the importance of leadership for successful implementation of TQM.

A review of previous literature reveals that many of Crosby's (1979:21) approaches to quality fit the needs of maintenance operations quite well (Obaid, 2005:39). TQM is not an accidental occurrence: it is often planned, executed and maintained. If quality is the goal in building maintenance, it has to be planned, and a basis for its future improvement must be established (Amusan & Bamisile, 2014:13). Furthermore, Abdul Azeez, Abass and Mansur (2014:243) explain that one of the most important problems affecting coordinated and acceptable application of the TQM concept in the maintenance of school buildings is the calibre of maintenance personnel involved. It is further stressed that the building maintenance team has a significant impact on the outcome of maintenance operations in any educational institution, because management is a living force and it is the force that gets things done to acceptable standards Abdul Azeez *et al.* (2014:13).

The relationship between quality and maintenance, while not totally absent, has not been addressed adequately in literature. It is crucial to note that most of the literature in existence seems to lack a focus on TQM practice in the maintenance of tertiary institution buildings. Not much attention is paid to the extent to which TQM is practiced in the maintenance of tertiary institution buildings. The issue of quality practice in maintenance practice has rarely been examined (Obaid, 2005:7). Ben-Daya and Duffuaa (1995) theorise a fracture in knowledge of understanding the issue of quality in the aspect of maintenance.

Yasin, Alavi, Kunt and Zimmerer (2004:377) clearly stipulate that the extent to which service organisations are reluctant to practice TQM is alarming, especially considering the importance of the service sector to global economies. Service organisations are stragglers with regard to the effective application of total quality management (TQM) practices towards the achievement of their strategic goals. Au and Choi (1999:292) further explain that service organisations are still behind their counterparts in other industries with regard to their commitment to TQM practices.

Powell (1995:20) stipulates that TQM practices have been established successfully in support of achieving strategic objectives. Several studies which have been carried out to compare TQM practices in manufacturing and service organisations have revealed that there is a need for manufacturing organisations to serve as a guideline or point of reference for the service organisations (Yasin & Wafa, 2002:35). TQM practices and initiatives have achieved global acceptance in the manufacturing sector. Hassan and Kerr (2003:288) report that service organisations in the healthcare, hospitality, insurance, construction and maintenance have begun to show interest in TQM. However, evidence from previous literature demonstrates that most successful instantiations of TQM practices exist in manufacturing, rather than service operational environments.

Data from a study carried out by Yasin *et al.* (2006:379) demonstrates that organisations in distinctive industries are heterogeneous in terms of their willingness to apply TQM practices and the extent to which they view the implementation of TQM as being effective. The study further demonstrates that the majority of organisations in the information technology, banking, pharmaceutical, accounting and hospitality industries have either applied TQM practices in their operations, or are planning to implement TQM. Yasin *et al.* (2006:379) posits that many service organisations have not recognised the need to implement TQM and that a huge percentage of organisations never considered implementing TQM.

Available literature shows that there is a growing interest in the application of TQM in education (Temponi, 2005:20). Ngware and Odebero (2006:339) explain the extent to which TQM is practiced in education by demonstrating Crawford and Shutler's (1999:69) support for the TQM practices in education through the adoption of Crosby's (1984:53) model. This model proposes an approach for applying TQM principles in education by focusing on the quality of the teaching structure being used, rather than the results of student's examinations. From this point of view, various causes of quality failure in the education system, which include poor input, lack of proper of attention to performance standards and unmotivated staff (Ali & Zairi, 2005:6) can be easily identified.

2.8 Application of TQM in tertiary institutions

Thiagarajan (2011:94) states that a country's higher education is its most powerful weapon, therefore there is a need for higher education institutions to speed up the implementation of TQM in campuses to be able to maintain a quality system and bolster the economy. According to Frazer (1999:39) universities are accountable to society, students and employers; therefore quality in tertiary education is important.

A considerable amount of literature has been published on the implementation of TQM in tertiary institutions. Several issues have been raised concerning whether TQM is right for

higher education (Dettman, 2004: 60). Chaffee and Sherr (1992: 362), Cornesky *et al.* (1992); Lewis and Smith (1994), as well as Wallin and Ryan (1994) give a number of reasons why TQM is a good fit for higher education;

1. The environments of higher education institutions are suitable for TQM implications.
2. The tradition of quality associated with higher education is what TQM is built on.
3. The development of students, staff, faculty members and school administrators is supported by TQM.
4. TQM applies principles like leadership, teamwork, customer improvement, decisions based on data and customer satisfaction.
5. TQM is a philosophy with tools and principles that can be customised by educational institutions to fit their intended needs and produce expected results.
6. TQM practices can be applied to both the administrative aspects and classroom activities of higher education institutions.

According to Finch and Crunkilton (1993:56), and Khawas (1993:17), the American Council on Education explored the extent to which TQM was applied to the operational practices of higher education. Findings from these studies showed that many campuses were considering the application of quality management tools and techniques to their programmes. Khawas' (1993:19) study reveals that TQM practices were implemented in seven universities and that two out of the seven reported their practices as being extensive. Powell (1995: 13) states that despite little academic study, TQM has received much attention compared to other management concepts or practices. Freed, Klugman and Fife (1994: 600) suggest that for TQM to be adequately implemented in education, the quality principles that support the values of higher education must be understood.

Dettman (2004:56) alleges dissimilarities in terms of the application of TQM in business and higher education. Lewis and Smith (1994), Sherr and Tector (1991), as well as Yudof and Busch-Vishniac (1996:23), support these findings by highlighting the following important considerations to be kept in mind when implementing TQM models;

1. There is less complexity in the investment of human resources compared to that of higher education. Human resources are important in business primarily for profitability.
2. The administrative and academic functions of higher education possess dual organisational structures. There is a division between the two functions which produces two separate outcomes, rather than one common goal.
3. There is an inherent reluctance to change in higher education. There is a disinclination to change a system or process that has previously worked well.

4. Some important phrases in TQM do not always fit appropriately in the higher education setting. One of the difficulties involves referring to students as “customers”.
5. Staff members of higher education institutions display loyalty to their respective departments and fields of study, thus placing the immediate needs of their discipline before that of the institution.
6. Values, practices and policies that the affect the implementation of TQM exist in higher education institutions. Due to a strong display of individualism by faculty members, the teamwork required for the implementation of TQM is hindered.

Al-Muwasi (2003:96), Al-Qurati (2007), Badah (2003:66), Aghily (2004), Jersey (2004:134), Shyi (2004), Olsen (2009), Hirtz(2002), Detret and Jenni (2000),Munoz (1999), Lewis and Smith (1997:18), Thomson (1996) and Hazzard (1993:65) all reveal in their studies the importance of TQM in higher education that institutions of higher education were aware of TQM practices and learning it’s theories and principles.

Many universities and colleges have made efforts to overcome challenges associated with change in order to deliver quality higher education to their students. However, some higher learning institutions experience lacklustre performance outcomes, due to a lack of commitment to TQM practices (Dettman, 2004: 58). Moser (1991:125) proposes Deming’s Management Method as an effective tool in overcoming these challenges and believes that Deming’s Management Method could prove to be a useful tool in overcoming problems and coping with change in an effective way.

Dettman (2004: 61) reports that there has been relatively little literature concerning the challenges experienced during the implementation of TQM in institutions of higher education. Colleges and universities have encountered difficulty in applying TQM to their programmes, due to this shortage of relevant literature. Marchesa (1993:11) highlights some common declarations that hinder the application of TQM in tertiary education:

1. The assertion that faculty members already have good interaction with students.
2. There is no difference between TQM and good management.
3. The language of TQM does not fit into tertiary education.
4. The application of TQM techniques and tools are appropriate for business organisations, but are not appropriate in the educational setting.
5. The assumption that students are not regarded as customers.

Seymour (1992:530) also outlines some hindering factors regarding the implementation of TQM in higher learning institutions:

1. Short-cut approach to implementing TQM without practicing the underlying principles.
2. TQM involves a lot of planning, decision-making and training, thus making it a time-consuming process.
3. There is inconsistent support in terms of leadership from top management.
4. Resistance to change from managers and supervisors with regard to relinquishing their power to make decisions.

Ewell (1991:45) acknowledged that, while the principles of TQM captivate people, they could also be discouraged by its methods and semantic links to business, which is not generally regarded as being similar to teaching and learning. Although findings reveal that challenges and frustrations are experienced, none of the institutions suggested abandoning the practice of TQM (Dettman, 2004:60). Conclusions that TQM can be implemented in tertiary institutions are made, but there is a gap in the literature on how TQM can be successfully implemented in tertiary institutions (Munoz, 1999: 78). The knowledge of TQM's critical success factors will assist in eliminating the challenges experienced (Nadim & Al-Hinai, 2016: 146).

According to Zhang (2002) and Demirbag *et al.* (2006:35) the implementation of critical success factors in higher learning institutions is heavily dependent on the implementation of critical success factors in the manufacturing industry. Critical success factors are identified in higher education institutions in order to benchmark the application of TQM in tertiary institutions (Kanji & Malek, 1999:140). A considerable amount of literature has identified various critical factors for the implementation of TQM in higher education.

Bayraktar (2008:567) illustrates 11 critical success factors as follows: leadership, vision, measurement and evaluation, process control and improvement, programme design, quality system improvement, employee involvement, recognition and reward, education and training, student focus, and other stakeholders' focus. Owlia and Aspinwall (1997:530) conducted a study to test the validity and reliability of critical success factors in educational quality. Employee involvement, leadership, education and training, student focus, programme design and resources were found to be the most reliable critical success factors of TQM.

For the same purpose, Tang and Zairi (1998:670) explored the application of total quality management in higher education by conducting a benchmarking exercise with three case studies. Findings from the study reveal that respondents identify leadership, measurement and evaluation, employee involvement and, finally, process control as the

critical success factors of TQM. This view is supported by Kanji and Malek's (1999:153) study on the quality practices at tertiary institutions in the US and Malaysia. The study identifies leadership, measurement and evaluation, process control and improvement, quality system improvement, employee involvement, student focus, and other stakeholders focus as reliable critical success factors of TQM.

2.9 Challenges in the implementation of TQM

According to Skitti (2009:24) it is crucial to observe that in the TQM process, certain factors inhibit successful implementation. The task of implementing TQM is not an easy one, as it requires a shift of responsibilities to the management and continuous participation of all members of the organisation in the process of improving quality (Mohanty, 1994:19). Salagean *et al.* (2014:1235) explain that TQM implementation is a difficult and complex process that requires huge effort from organisations. Reports of the variances in the success and failures of such processes are well documented (Dahlgaard, 2006:66; Arshida & Agil, 2012:52; Huq and Marti, 2005:14).

According to Huq and Marti (2005:14), there are several reasons for TQM implementation failure, but the majority of the cited causes arise from management's inability to implement a total system. A larger share of the barriers and difficulties of implementing TQM have substantial connections to the people that affect quality directly or indirectly (Obaid, 2005:17). Matherly and Laster (1992:81) identify some roadblocks in the implementation of TQM as lack of adequate resources, fear of change, overlapping of leadership responsibilities and lack of management participation.

Walsh, Hughes and Maddox (2002:23) identify the dominant challenges in TQM implementation as being management behaviour, cultural change, time availability, enhancing service and obtaining tangible benefits. Obaid (2005:17) explains that lack of commitment on the part of the management and poor management behaviour appears to be the prevalent cause of failure of TQM initiatives in maintenance. Rohitratana and Boon-itt (2001:90) argue that two significant barriers in the TQM implementation process are lack of knowledgeable personnel, and lack of support and co-operation from the staff, both of which habitually result in impediments. Furthermore, Schein (1991:54) identifies one of the common causes of failure of TQM programmes as being a lack of top management commitment.

Tamimi and Sebastianell (1998:59) recognise several barriers in the implementation of TQM. The major challenges include lack of training in areas such as group discussions, communication techniques, quality improvement skills, problem identification and problem-solving techniques, and inadequate resources. In addition, Masters (1996:55) found the following elements resulting in ineffective TQM implementation; weak comprehension of TQM, lack of management commitment, inability to change organisational cultures, lack of accuracy in quality planning, absence of continuous training and lack of sufficient resources.

Amar and Zain (2002:13) list 11 elements discovered to be barriers against the successful implementation of TQM: human resource, management, attitude towards quality, organisational culture, interdepartmental relations, materials, machines, equipment, information, method, and training.

Table 2.2 illustrates common barriers in TQM implementation, according to several researchers and authors:

Table 2.2: Barriers and Challenges in the implementation of TQM

Barrier and Challenges	Authors' names and year
Middle management resistance	Oakland (1997), Al-Khalifa and Aspinwall(2000)
Lack of employee participation and involvement	Oakland (1997), MacDonald (1992), Sayle (1994)
Lack of customer requirements and feedback system	Adebanjo and Kehoe (1998), Nagi and Cheng (1997)
Lack of sufficient quality training and education	Sayle (1994), Whalen and Rahim (1994), Masters (1996)
Insufficient internal and external communication	Oakland (1997), Salegna and Fazel (2000), Nagi and Cheng (1997)
Lack of knowledge and skills of top management	Al-Khalifa and Aspinwall (2000), Adebanjo and Kehoe (1998)
Lack of employee empowerment	Salegna and Fazel (2002), Al-Khalifa and Aspinwall (2000)
Lack of expertise in quality management	Oakland (1997), Amar and Mohd Zain (2002)
Lack of top management commitment and support	Nagi and Cheng (1997), Oakland (1997), Dale (1994), MacDonald (1992)
Lack of Leadership	Nagi and Cheng (1997), Dale (1994), Amar and Mohd Zain (2002)

Source: Obaid (2005)

Nagi and Cheng (1997:88) classified the challenges of TQM implementation into four main categories: infrastructure challenges, which include insufficient quality of training, lack of recognition and rewards, underdeveloped quality measures and lack of TQM expertise. Cultural and employee challenges include change of culture, resistance to change, lack of employee commitment and involvement, and lack of confidence by employees. Managerial barriers include lack of top management commitment, lack of defined vision and mission, and lack of effective leadership. Organisational barriers are also listed as consisting of poor internal and external communication network, and organisational policy.

Soltani (2014:36) indicates that various researchers and academics have made attempts to give reasons concerning why the rate of TQM failure is high. Ater (2013:40) reports that for TQM to be successful, the commitment and support of top management is important. Pheng and Jasmine (2004:212) further explain that the level of support top management shows in the implementation of TQM is crucial for the implementation of TQM to be successful. Top management's commitment to TQM assists workers or employees to follow their lead and leadership. Young (1997:322) argues that the implementation of TQM in hospitals in India is influenced by quality improvement and top management disposition and involvement.

Viera (2009:56) further detects six challenging factors in the implementation of TQM in the healthcare industry: technical competence, quality structure, leadership, organisation design, organisation culture and top management involvement. Whalen (1994:362) illustrates the following challenges that are experienced in the implementation of TQM; lack of adequate training, complacent team attitude, insufficient resources, weak labour force, lack of top management commitment and poor planning.

According to a study conducted by Hamiidi and Zamanparrar (2008:45), the major barrier encountered during the implementation of TQM is lack of commitment on the part of top and middle management. Emphasis is placed on top management commitment and the creation of a befitting and supportive organisational culture. Without these, there will be little or no progress during TQM implementation. It was also discovered that in most organisations, lack of top management commitment was identified as a crucial element that led to unsuccessful TQM implementation.

Training and education of employees by increasing their technical abilities was also discovered as an important factor for successful TQM implementation. Johnson and Kleiner (2003:45) argue that the major challenges of TQM are non-existence of benchmarking and employee resistance to change. Mosadeghrad (2014:160) points out that studies carried out since the 1990's have displayed a very high level of failure in TQM implementation. Mosadeghrad (2014:162) categorises the challenges experienced during the implementation of TQM into five groups:

1. **Structural Challenges**: these deal with the physical resources and structures present during the implementation of TQM. They include: inappropriate organisational culture, lack of financial resources, non-existence of information systems and lack of physical resources.

2. **Contextual Challenges:** these obstacles arise as a result of the culture of the organisation itself militating against successful TQM implementation. They include

poor organisational culture, lack of teamwork, poor and ineffective communication networks, lack of innovation and lack of co-ordination amongst employees.

3. **Strategic Challenges:** these challenges are related to organisational leadership. They are significant barriers and are a strong impediment to the success of TQM programmes. They include lack of clear vision, poor leadership, lack of support from top management, poor planning, inconsistent objectives and lack of adequate TQM programmes.

4. **Procedural challenges:** these challenges arise from the difficulty and complications of the processes themselves. They include inadequate process management, lack of customer focus, lack of proper supplier relationship, lack of framework for review and self-evaluation, ineffective corrective procedure and bureaucracy.

5. **Human resources Challenges:** these barriers are caused by human related factors such as employee resistance to change and lack of employee involvement. They include lack of employee involvement and commitment, employee resistance to change, lack of education and training of employees, lack of employee recognition and rewards, lack of employee motivation and satisfaction and poor human resource management.

2.10 Success factors for the effective implementation of TQM

With regard to the critical success factors for the effective implementation of TQM, no universal factors are in existence. Critical success factors have a huge impact on customer satisfaction and they vary among organisations. The effectiveness of these factors has a long-term effect on the sustainability of TQM (Idris & Zairi, 2006:1247). Critical success factors should be linked with the goals of the organisation, since most organisations fail to practice them, despite being aware of the importance (Yusof & Aspinwall, 2000:283).

Fotopoulos and Psomas (2009:158) present seven critical success factors for the implementation of TQM: leadership, process management, service design, human resource management, customer focus, education and training, and supplier quality management. Black and Porter (1996:21) identify ten critical TQM success factors based on the Baldrige Award criteria, and these factors are: people and customer management, supplier partnership, customer satisfaction orientation, communication of improvement information, strategic quality management, external interface management, team structure of improvement, corporate quality culture, operational quality planning and quality improvement measurement systems. Blanchard and Thacker (1999:340) also propose that continuous training enhances employee knowledge about the mission, vision, direction and structure of

the organisation and enables them to acquire skills in an effort to improve the quality of their work, as well as make appropriate decisions.

Ahire, Golhar and Waller (1996:33) identify 12 factors that are important for the implementation of TQM, and these factors are: top management commitment, customer focus, supplier quality management, design quality management, benchmarking, use of statistical process control, internal quality information, employee empowerment, employee involvement, employee training, product quality, and supplier performance.

Antony, Leung, Knowles and Gosh (2002:552) suggest the following factors should be considered when implementing or developing an efficient TQM plan: (1) Training and education of employees, (2) Employee Involvement and commitment, (3) Communication, (4) Continuous Improvement, (5) Management Commitment and Leadership, (6) Commitment to Customer Satisfaction (7) Reduced cost of poor quality, (8) Improved competitive advantage (9) Service design.

2.10.1 Training and Education of Employees

Employee training and education is an important factor that assists in the achievement of quality and quality improvement during building maintenance. Knowledge of TQM and the importance of its principles are provided. Mete (2004:16) argues that training and education of team members is a crucial factor that helps in developing quality improvement. TQM is a concept which shifts an organisation's working approach.

In order to adapt to the new techniques involved, comprehensive and extensive training and education is required (Mukherjee, 2006:44). This includes the education of all employees of the organisation, aiming at increasing their knowledge and also providing information about the organisation's vision and mission, its objectives and the organisational structure (Lakhal, Pascil & Limam 2006:628). Mukherjee (2006:44) further explains that the TQM system requires continual improvement at all times, which necessitates constant advancement in the skill of all employees.

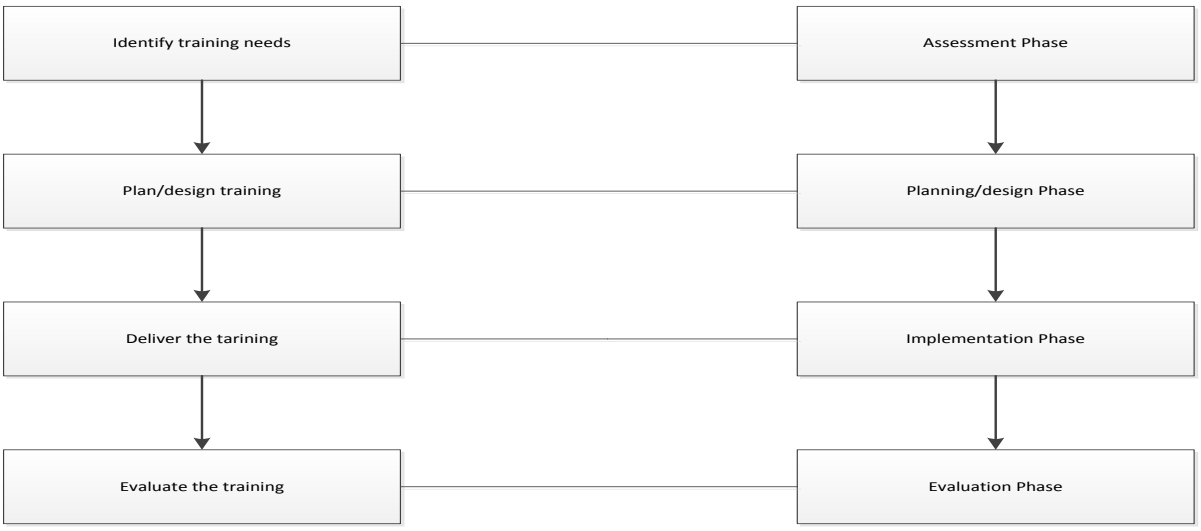

Figure 2.4: A systematic framework for training

Source: Oakland (2003:275)

2.10.2 Employee Involvement and Commitment

Zakuan, Muniandy and Saman (2012:28) view employee involvement as a process of empowering and encouraging employees to participate in the decision-making process and improvement activities suitable for their levels in the organisation. Chapman (2001) further emphasises that the involvement of employees can speed up understanding of organisational processes, enhance the level of decision-making and also promote knowledge and ideas among employees for the advancement of the organisation.

Leaders are responsible for ensuring all employees are involved and their ideas and experiences are exchanged amongst the team. Mukherjee (2006:44) explains that the involvement of an employee with a positive attitude is a positive contribution and promotes the attainment of an organisation's goal. Zakaun *et al.* (2012:29) explain that the involvement of all employees assists in the development of confidence amongst members of the organisation and encourages them to take adequate and proper decisions and solve problems together.

2.10.3 Communication

Kasongo and Moono (2010:16) indicate that the success of an organisation depends on its ability to put into place a proper communication network that facilitates proper exchange of information. There should be an effective and transparent communication network present between all levels of management. Schmint and Finnigan (1993:65) perceive communication during the TQM process as the factor that helps to instil confidence in others, as well as

encourage team members to share risks. According to Murphey (2009:50), top management must construe quality information in an understandable way so that all stakeholders can understand and also provide an adequate feedback channel to allow for proper communication.

2.10.4 Continuous Improvement

According to Adinolfi (2003:145), continuous improvement of all activities in an organisation is at the heart of TQM. Schminth and Finnegan (1993:67) view continuous improvement as being able to promote the performance of an employee who is capable of assisting in the implementation of TQM, provided that management reduces the command and control. Continuous improvement requires the full support of all parties, because it promotes progress in the relationship between the customer and employee, as well as fostering innovation and organisational development (Pineda, 2013:33).

The satisfaction of customers is ensured through the involvement of everyone in the organisation with a commitment towards improving quality in all aspects of the organisation (Rahaman, 2014:41). Crosby (1984:99) explains that, for continuous improvement to be effective, employees need to apply new skills, knowledge and values to improve performance.

2.10.5 Top Management Commitment and Leadership

According to Muraid and Rajesh (2010:55), management should be committed to being aware of the demand for change, should renew important elements, make structural changes in the organisation, resolve conflicts, promote the participation of members and design an effective plan to improve the management process. The involvement of employees alone is not sufficient for TQM to be successful.

The involvement of top management facilitates the TQM journey by ensuring that all decisions are made adequately and timeously. Direct support of top management is important for the ability to initiate proper actions. According to Rezeanu (2005:25) these actions can be taken to establish adequate policies on quality, establish an effective quality management structure, attract skilled personnel, propagate information on quality, effectively manage the change process and organise the TQM processes properly.

Mukherjee (2006:43) argues that top management should show commitment and implement TQM by demonstrating the organisation’s policy, vision and mission. Leadership plays a role in ensuring and enhancing long-term commitment to innovation and creativity (Ater, 2011:28). Thus, top management or team leaders should possess the ability to realise the

formulated vision by managing quality elements to transform the organisation with the use effective TQM practices (Idris & Ali: 2008:70). Savolainen (2000:215) explain that during the implementation of TQM leadership is driven by internal and external expertise. Kanji and Sa (2001:705) indicate that leadership excellence is linked to vision, mission, strategy and key issues in the organisation.

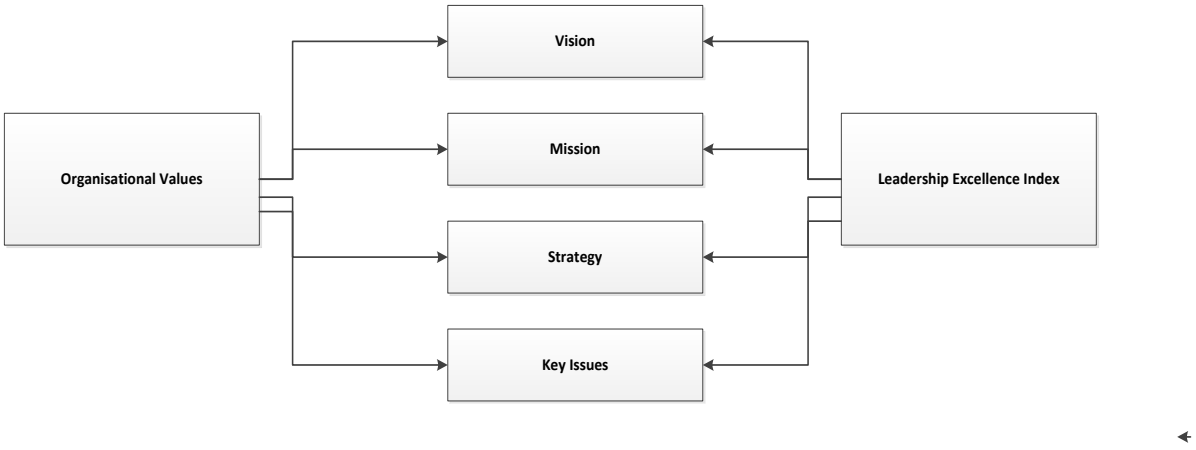

Figure 2.5: Leadership and structural equation model

Source: Kanji and Sa (2001:710)

2.10.6 Commitment to Customer Satisfaction

According to Rahaman (2014:41) customers should be continually satisfied by conforming to their requirements in terms of product design, quality, services and prices. Alavi and Yasin (2007:355) agree that customer focus is the core principle of TQM. Hasson and Klefsjo (2003:54) believe that customer satisfaction is the most important requirement for the sustainability of any organisation and that sustainable organisations understand and agree that customers will get the satisfaction they want if they receive whatever product and service they are to receive, at the appropriate time and manner that satisfies their needs. Thus, the key rationale behind TQM is valuing the customer by paying attention to the basic customer needs and maximising customer satisfaction.

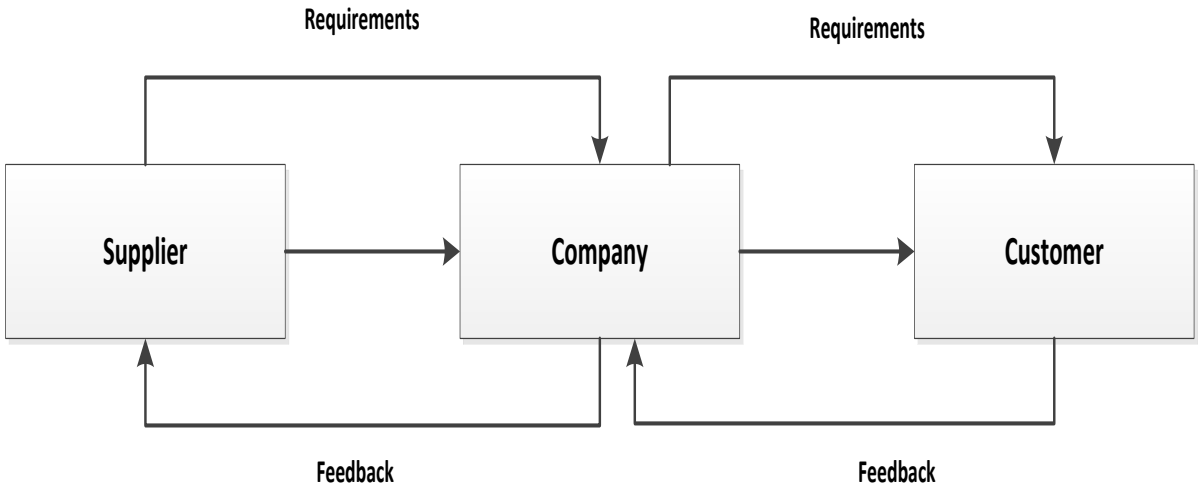

Figure 2.6: Customers' feedback system

Source: Hannan (1999:2)

2.10.7 Teamwork

According to Oakland (2005:1059) teamwork requires the exchanging of ideas and information, making decisions, solving problems and building trust amongst employees. This promotes an independent attitude towards achieving a common goal within the organisation. Rahaman (2014:30) explains that teamwork promotes efficiency in solving complex problems through sharing the knowledge and experiences of employees and accentuating recommendations over individual suggestions.

Rahaman (2014:31) points out that employees can only be encouraged by acknowledging their achievement or performances. This acknowledgement motivates them, promotes awareness of self-realisation and self-esteem, and encourages them to achieve desired organisational goals. Bank (1992:115) recommends the creation of a rewards and recognition system within an organisation, which influences employees to put in optimum effort to achieve desired performance and results.

2.11 Maintenance Management of tertiary school buildings

Maintenance of tertiary school buildings is important for creating a conducive environment that supports teaching, learning, research and innovation (Olanrewaju, Khamidi & Arazi (2010:76). Maintenance management is a systematic and properly arranged approach to planning, organising, monitoring and evaluating maintenance activities and their costs (Technical Information Document, 2000:76). According to Zulkarnain, Zawawi, Rahman and

Mustafa (2011:245), school buildings are structures with roofs, walls and other structural elements which provide space for learning, habitation and research.

The physical infrastructure or facilities of educational institutions plays a significant role in the creation and sustainability of a productive learning climate (Uline, Wosley, Tschannen & Lin, 2010:400). AbdulAzeez (2014:224) also indicates that the performance of educational buildings has a significant impact on the students' performance and learning process. Buildings are important resources of an educational institution, and they serve as a primary place of enclosure and ensure the protection and privacy of their users.

The qualities of the physical environment in which students learn affect the student's assimilation rate, staff satisfaction, and organisational productivity (Malkin & Wiley, 1992:58). Olanrewaju, Khamidi and Arazi (2010:77) report that, though the construction of new buildings provides enhanced educational quality due to an upgrade of facilities, the maintenance of existing buildings that have the capacity to facilitate knowledge transfer and promote other academic activities is crucial. Conversely, inadequacy of the institution's physical infrastructure makes it difficult for the university to achieve its primary business objectives.

Lowe (1990:57), in his study on the relationship between school facilities and learning climate in Texas schools, argues that adequate maintenance of school facilities positively affects teachers' performance by equipping them with a sense of personal safety and commitment as well as the belief that the management was invested in the learning process. The purpose of buildings in educational institutions is to provide a conducive and safe environment for various human activities. The issue of maintenance is the qualitative aspect of the building (Zulkarnain *et.al*, 2011:250). As educational technology changes, so do maintenance requirements (Adenuga, 2002:185).

Maintenance is required because buildings deteriorate with time, and this process is accelerated if proper maintenance does not occur. Since the buildings of an educational institution are national assets, proper maintenance is crucial (Hutton & Lloyd, 1993:15). Xaba (2012:217) argues that, for proper maintenance to be carried out effectively, some important aspects are required. This view is supported by Olanrewaju *et al.* (2010:78), who argue that the reliability, safety, availability and quality of a building are determined by proper maintenance management. It is further reported that university building maintenance would be effectively implemented if information on the criteria that influence university buildings is available.

Edwards (1992:266) research concerning school building conditions establishes that students in deteriorating school buildings achieve 6% below students in school buildings that are adequately maintained. McGuffey (1992:88) further argues that proper school building maintenance is integral for effective teaching and learning. Bastidas (1998:80) suggests that maintenance inspections should be performed to conceive a school maintenance plan and most importantly, gather information to form the basis for the maintenance programme, by means of, for example, checklists for building structures. Scottish Executive (2003:7) postulates that maintenance planning, which is associated with developing a maintenance strategy for achieving better use of school building facilities and diminishing the cost of resources, should be encouraged.

2.12 Chapter Summary

This chapter reviewed the theoretical and empirical literature in conformance with the research objectives with the aim of achieving the purpose of the study. It reviewed existing literature on the definition of quality and TQM, the TQM concepts, the dimensions of TQM practice, the application of TQM in tertiary institutions, and the challenges experienced during the implementation of TQM, as well as the success factors for the effective implementation of TQM. The maintenance management process of tertiary institution buildings and the implementation of TQM in the maintenance of tertiary institution buildings were also reviewed.

CHAPTER THREE

3 RESEARCH METHODOLOGY

3.1 INTRODUCTION

In this section, the various types of research methodology adopted for obtaining and analysing the data are identified and described. The research strategies are explained and the strategy adopted for this research is justified. This chapter covers the description of various research approaches; the research design, the sampling design and techniques, questionnaire design procedures for data collection, specific methods adopted for collecting and analysing the data, testing the hypotheses, establishing validity and ensuring the reliability of the research instrument. Specific treatment of each hypothesis is also discussed.

3.2 RESEARCH METHODOLOGY

Research is a systematic process of collecting, analysing, and interpreting information with the aim of broadening the understanding of a situation of interest or concern (Leedy & Ormrod, 2010:2). Research methodology offers strategies and opportunities for conducting a study. Collis and Hussey (2003:100) state that research methodology majorly focuses on why a certain data was collected, what data was collected, where the data was collected, when the data was collected, how the data was collected and how the data will be analysed. The research methodology selected for any research project is a very important aspect, as it provides an overall framework for assembling and formulating the data required for the study. Leedy and Ormrod (2010:4) explain that in choosing a research method for a study, consideration should be given to the nature of the data that will be gathered in solving the problem.

3.3 RESEARCH DESIGN

The research design provides a framework for the collection and analysis of data (Bryman, 2004:24). It explains the plan for how information to respond to the research problem will be gathered and analysed. Leedy and Ormrod (2010:5) suggest that a practical presentation with regards to the data may be efficiently organised if the following four cardinal questions regarding research data are answered:

“What data is needed?”

“Where is the data located?”

“How will the data be obtained?”

“How will the data be interpreted?”

3.3.1 Quantitative Research Method

The quantitative research approach, also described as the positivist approach, adopts the use of numerical data systematically and objectively from a selected subgroup of a population to generalise the findings (Maree & Peterson, 2007:144). According to Bryman (2012:35), quantitative research can be interpreted as a research method that accentuates quantification in the gathering, interpretation and analysis of data. Furthermore, it:

- Involves a theory-testing process to the relationship between theory and research, in which emphasis is placed on theory testing,
- Has integrated the actions and standards of the natural scientific model and, in particular, that of positivism,
- Incorporates social reality from an external, objective view.

The quantitative research method gives room for researchers to diversify from the researcher's object of study as well as promote scientific objectivity (O'Leary, 2010:15). The quantitative approach investigates social problems by testing hypotheses. Its data usually contains variables measured in numbers and analysed with statistical formulas (Naoum, 2007:38). In other words, quantitative studies mostly begin with a statement of the hypothesis which is to be tested and ends with a confirmation or disconfirmation of the hypothesis after it is tested (Leedy & Ormrod, 2010:5). The development process of the quantitative research method is required to provide respondents with clear questions that can provide answers to the research questions (Dahlberg & McCaig, 2010:159). Quantitative research designs include research surveys, developmental design studies, correlation research studies, observation methods, experimental methods and ex post facto designs (Thomas, 2003:41).

3.3.2 Qualitative Research Method

Qualitative studies are based on qualitative information in the form of words, sentences and narratives (Blumberg *et al*. 2005:124). Hennink, Hutter and Bailey (2011:10) explain that the qualitative research method covers a wide range of philosophies and techniques. Qualitative research provides a more in-depth understanding of a situation than the quantitative research method (Silverman, 2006:56). However, Bryam (2012:36) interprets qualitative research method as a contrast to, rather than an opposite of, the quantitative research method. It can be described as a method that accentuates words rather than estimation in the process of gathering and analysing data.

According to Leedy and Ormrod (2010:5), qualitative research involves viewing the characteristics that cannot be easily diminished to numerical values. Leedy and Ormrod (2010:134) further explain that this kind of research method is mostly used when there is very little information about a particular area of study and the variables are unknown, or in an instance when the foundation of an important theory is not sufficient. Qualitative research approaches used include case study, ethnography, phenomenology, grounded theory, content analysis and historical research study (Leedy & Ormrod, 2010:134). O'Leary (2010:114) explains that the purpose of carrying out qualitative research is to gain in-depth understandings of people, environment and their culture through rigorous involvement in the reality of the study. Leedy and Ormrod (2010:110) argue that qualitative research method is often times exploratory in nature and observations are usually made in order to build theories.

3.3.3 Mixed Method Research

The mixed research method is the combination of alternative approaches (i.e. using both qualitative and quantitative methods in one research study for better understanding of the research problems) (Creswell &Clark, 2007:5). Hennik *et al.* (2011), explain that the mixed method approach is very broad and combines several research methods across or within paradigms with the aim of reducing the impact of personal bias and maximising validity in research. Mixed method research promotes the gathering of different types of data and subsequent analysis with different techniques, which gives room for various interpretations of the data.

According to Leedy and Ormrod (2010:135), the decision to use the mixed method strategy should be based on the research problem, research questions, and objectives of the study, as well as the skills of the researcher. The combination of both quantitative and qualitative methods is referred to as mixed method (triangulation). The use of both quantitative and qualitative methods in this study will allow for a better opportunity to explore the research questions from different perspectives which would lead to broader understanding of the issues related to challenges experienced in the implementation of TQM in the maintenance of school facilities.

The mixed research method consists of the following:

- The use and combination of qualitative and quantitative research methods within a single study;
- The direct focus on the link between approaches; viewing things from more than one perspective, and,

- An emphasis on the practical approaches to the research problems (Denscombe, 2007:16).

O'Leary (2013:128) also outlines the strategies of mixed method research which are designed in the following ways;

- The use of a quantitative perspective with acceptance of qualitative data: researchers that accept more of the underlying assumptions of the quantitative method, but also accept that some qualitative data might be helpful in validating the study, use this method.
- The use of a qualitative perspective with acceptance of quantitative data: this approach is adopted by researchers who are more concerned with quality over quantity, and accept more of the underlying assumptions of the qualitative approach.
- The question-driven perspective: the criteria for selecting this approach have nothing to do with a neither qualitative nor quantitative perspective, but rather a scrutiny of the research questions and a selection of the most appropriate method that can provide answers to the research question, irrespective of the paradigm.

3.3 RESEARCH STRATEGY

There are several research strategies for qualitative, quantitative and mixed research methods. They include case study, grounded theory study, content analysis, ethnography, phenomenological study, conceptual study, historical research, action research, exploratory studies, experimental studies, quasi-experimental studies and descriptive studies (Leedy & Ormrod, 2010; Nieuwenhuis, 2007). Taking into consideration the nature of the data needed, a comprehensive and detailed analysis of a single case was carried out. A case study approach was adopted for this study.

3.3.1 Case Study

A case study approach is used to support arguments within a detailed study of a situation over a specific period of time (Naoum, 2003:46). Flick (2011:70) explains that case study research can involve the study of a single case or a multiplicity of studies. A case study focuses on a particular event in order to facilitate better understanding of unique or exceptional qualities to inform practice for similar events (Leedy & Ormrod, 2010:135). The case study strategy can employ the qualitative and quantitative techniques for gathering data (Nieuwenhuis, 2007:75). One of the limitations of the case study approach is that there is difficulty in generalising from a particular case that has been studied, especially in a situation

when just a single case is analysed (Leedy & Ormrod, 2010:136). The case study approach is chosen as a suitable research strategy for this study because only a single case is going to be examined. A detailed and intensive analysis of this single case was carried out. The Western Cape Province, South Africa has four tertiary institutions; however, one institution was selected as the case study for the research.

3.4 AREA OF THE STUDY

The study investigates the effective implementation of Total Quality Management during the maintenance of tertiary institution buildings. The data for this research was collected from the staff of the maintenance department at a university in the Western Cape province of South Africa.

3.5 POPULATION OF THE STUDY

A population is a collection of people or items under consideration in a study (Collis & Hussey, 2003). Bryman (2004:87) describes a population as a universe of units from which a sample is selected. For the purpose of this research, the population for the study were the maintenance team members at a university in the Western Cape province of South Africa. The maintenance team consisted of top management, supervisors, foremen, clerks of works, technicians, labourers and administrators.

3.6 SAMPLING TECHNIQUE AND SAMPLE SIZE

According to Flick (2011:71), the sample of a study should be a minimised representation of the population in terms of representativeness of the variable. O'Leary (2010:164) further explains that the larger the sample in a research, the more represented and generalizable it is. A sample should be representative and be a sub-part of the entire population which has been selected to reveal the characteristics of the entire population (Jackson, 2008:18).

O'Leary (2010:164) explains that the research sample must possess characteristics that allow findings to be generalised based on the entire population. The purposive sampling method was adopted in this study. Struwig and Stead (2007:11) describe purposive sampling as a sampling technique adopted by handpicking typical and interesting cases. Those that were involved in the institution's building maintenance activities were invited to participate in the study. This sample is selected on the basis of the researcher's judgement (Struwig & Stead, 2001:111).

3.7 DATA COLLECTION METHOD

According to Naoum (2007:44), the method used to collect data depends on the nature of the investigation and the type of information that is required and available. Data collection

involves the exploration of different sources of data for the study. The data collected for a study consists mainly of the fieldwork, also called primary data, and desk study, also known as secondary data (Naoum, 2007:44; Struwig & Stead, 2001:40). Both primary and secondary data were be used in this study.

3.7.1 Secondary data collection method

Secondary data are available information explored from external sources other than those gathered from the current study (Struwig & Stead, 2007:80). Secondary data are obtained from several textbooks, journals and previous researchers on the subject of study (Struwig & Stead, 2001:51). Both qualitative and quantitative research makes use of secondary sources of data collection. Secondary data for this study was obtained from books, journals and conference papers. In this study, a literature review was conducted to develop a systematic and comprehensive view of the relevant literature topics.

Dahlberg and McCaig (2010:77) posit that the review of relevant literature enables a researcher to explore evidence that has been gathered in a research area and reveals an area that hasn't been researched properly. The data obtained from existing literature reveals the challenges in the implementation of TQM experienced by maintenance personnel during the maintenance of school buildings. It also shows the factors that could aid in the effective implementation of TQM in the maintenance of school buildings.

3.7.2 Primary data collection method

Struwig and Stead (2007:80) describe primary data as new data generated for the research study. Wegber (2009:26) defines primary data as information which is captured at the point where it is produced. This method of data collection requires the researcher to ensure respondents understand the purpose and relevance of the study (Kumar, 2011:140). Data is collected verbally by personal interviews, observation methods, email and documents (Struwig & Stead, 2001:40). Non-verbal data is collected with the use of questionnaires. A questionnaire survey is used to collect primary data for this study.

3.7.2.1 Questionnaire

Questionnaires are typically adopted in descriptive and analytical surveys in order to make investigations and opinions about a particular situation (Naoum, 2007:53). Kumar (2011:200) describes questionnaire design as the most essential part of survey research. Kumar (2011:200) further stresses that the key principle is to ensure validity of the research question by ensuring that there is correlation between the research objectives and research questions. This study will adopt the use of closed-ended questions. Closed-ended questions, which are also called structured or multiple-choice questions, consist of mutually exclusive

response categories which are specific and from which respondents select from a category that best suits their response (Fox & Bayat, 2007:91).

Closed-ended questions (five-point Likert scale) were used to allow respondents to select answers that have been gathered in advance by the researcher (Denscombe, 2007:169). According to Bryman (2012:709) a closed-ended questionnaire is a self-completion questionnaire that provides respondents with likely answers to choose from. The questions asked are phrased in such a way that respondents are directed to choose an answer from the specifically stated answers (Fox & Bayat, 2007:91). Open-ended questions allow respondents to be flexible when answering questions (Fellows & Liu, 2008:153). The questions for the survey were formulated based on the research aims and objectives and information gathered from existing literature.

3.7.2.2 Questionnaire structure

The questionnaire for the study was arranged in sections. Each section is aimed at achieving a particular research objective. Table 3.1 shows the questionnaire arrangement for this study. Section A of the questionnaire consists of information about the participant's profile; Section B is on the extent of TQM practice during the maintenance of tertiary institution buildings to achieve Objective 1; Section C is on the challenges faced during the implementation of TQM in the maintenance of tertiary institution buildings to achieve Objective 2; Section D collects information on the factors that ensure the effective implementation of TQM in the maintenance of tertiary institution buildings to achieve Objective 3.

Table 3.1: Questionnaire design

Section	Section Title	Objective to be achieved
A	Profile of respondents	To determine the role and position of respondents
B	Extent of TQM practice during the maintenance of school buildings	Objective 1
C	Challenges faced during the implementation TQM in the maintenance of school buildings	Objective 2
D	Factors that ensure the effective implementation of TQM in the maintenance of school buildings	Objective 3

3.7.2.3 Scale of Measurement

Scales of measurement are viewed as the method by means of which variables are interpreted and categorised. Each measurement scale has an impact on the type of statistical process to be adopted for the statistical analysis of a study (Adegelu, 2011:35). There are four measurement scales;

- **Nominal Scale:** This is a measurement scale that is comprised of data and numbers and measures with regards to appointment of individual units or categories. During statistical analysis, it allows one to ascertain the mode and percentage values.

- **Ordinal Scale:** An ordinal measurement scale measures in terms of rank orders, i.e. lesser or greater, smaller or larger. Measurable quantities are not represented by ordinal scales. This measurement scale allows the determination of the median, percentile and rank correlation.

- **Interval Scale:** This measurement scale represents quantities that have equal intervals but whose zero point depicts an additional measurement point. The interval measurement scale allows the establishment of the mean, standard deviation and enables one to perform most statistical inferential analysis.

- **Ratio Scale:** This measurement scale is similar to the interval scale. This scale has an origin point of zero absolute. It allows one to ascertain the geometric mean and percentile variation and enables one to perform all types of inferential statistical analysis.

The nominal and ordinal scale measurements were adopted for this research study.

3.8 DATA ANALYSIS

Data analysis deals with the examination, testing, tabulation, and categorisation of evidence to address the foremost proposition of a study (Yin, 2003:19). During the data analysis process, data gathered are examined to address the research questions or hypotheses (Creswell & Clark, 2007:131). Data analysis is usually carried out in order to determine the direction of the research (Naoum, 2007:100). Typically, the data gathered are usually large, making the results a little difficult to process (Naoum, 2007:100). In the case of quantitative data, data is analysed based on the type of research questions and a relevant statistical test is used to address the questions or hypotheses (Creswell & Clark, 2007:131). The data gathered for this study was analysed based on their nature. Since the research method adopted for this study is the quantitative research method, quantitative data analysis was carried out.

Walliman (2009:302) explains that for the properties of data in quantitative analysis to be properly investigated, the syntax of mathematical operations is most suitable. Leedy (2010:173) further explains that stated words cannot be expressed as numbers and an average conclusion cannot be derived from words. Kumar (1999:224) also points out that statistics make data readable and enhances exploration of the relationships between

variables. Kumar (1999:224) further explains that statistics are most suitable to find the interdependence that exists, as well as a place-confidence assessment on the findings. Two types of statistics exist, descriptive and inferential.

3.8.1 Descriptive Statistics

According to Struwig and Stead (2001:7) descriptive statistics provide statistical summaries of data. Quartaroli (2009:75) also describes descriptive statistics as the act of summarising quantitative data collected in a study in an arranged sequence. Descriptive statistics is the simplest method of analysing information gathered and giving a broad overview of results (Welman *et al.* 2005:231). The method analyses the responses gathered from the study, either as percentages or as actual numbers (Naoum, 2007:105).

The purpose of this statistical tool is to provide an overview of a large amount of data (Henn *et al.,* 2006:206). Henn *et al.* (2006:206) explain that descriptive statistics describe the variables in the study with the use of mean value and respective percentage of respondents. Leedy and Ormrod (2010:257) further explain that there are three formal approaches that are used to describe the characteristics of data; frequency distribution, measure of central tendency and measure of dispersion. In this study, quantitative data was examined by the researcher and inferences were made through series editing, elimination of inconsistencies, and classification of the data on a similarity basis and, finally, tabulation of the data to relate variables.

For the purpose of this study, the descriptive statistics used are frequency distribution and measurement of central tendency (mean and standard deviation). This process consists of using methods for calculating numerical descriptions of the data (Dominowski, 1980:141). The distribution of scores and the location of the distribution on a scale of measurement are what constitute a frequency distribution. Dominowski (1980:141) explains that a measure of central tendency is a sole value on a scale of measurement that somehow represents the location of a set of scores. Descriptive statistics will describe the data sample outstandingly by describing the typical respondent and revealing the prevailing pattern of responses.

3.8.2 Inferential Statistics

Inferential statistics use examples of observations to ascertain observations found in a study (Simpeh, 2013:49) This method of data analysis provides room for researchers to generalise the results obtained from a population within a given error margin (Fox & Bayat, 2007:125). This means that the application of inferential statistics gives room for the data obtained from descriptive statistics to be used to draw conclusions as regards the entire population (Fox &

Bayat, 2007:125). Inferential statistics consists of statistics such as parametric and non-parametric (Struwig & Stead, 2001).

The technique adopted for inferential statistics in this study was the Analysis of Variance test (ANOVA). The ANOVA test is a parametric test adapted with the aim of testing the variances between and across three or more means of groups (Leedy, 2010:274). The ANOVA test is frequently used to evaluate the dissimilarities in mean scores between multiple groups (Elliot and Woodward, 2007:152) In a case where the value of the significance level is less than 0.05, a significant difference exists in the continuous variable across the groups (Pallant, 2006:294). Raw data generated from the closed-ended questions was captured with the aid of Statistical Package for Social Sciences (SPSS) and subsequent calculations were developed and interpreted.

3.8.2.1 Testing for normality

Kolmogorov-Smirnov and Shapiro-Wilk tests were adopted to test for a normal distribution or a non-normal one (Pallant, 2006:66). The Shapiro-Wilk test and Kolmogorov-Smirnov test makes comparisons between the scores obtained from a sample to normally distributed score sets with the same mean and standard deviation. In a situation where the test is non-significant i.e. the test significance is greater than .05, it means that the difference is not significantly different from a normal distribution and it is normal. However, if the test significance is less than .05, it means the test is significantly different from a normal distribution and it is not normal (Field, 2013:185). The Kolmogorov-Smirnov and Shapiro-Wilk tests are commonly affected by large samples in which small variations produce notable outcomes (Pallant, 2006:66). For this study, the Shapiro-Wilk test was used because of the study's small sample size.

3.8.2.2 Testing of the hypotheses

According to Kumar (2005) a hypothesis is an assumption or a proposed idea or a phenomenon. Leedy and Omrod (2010) point out that a research hypothesis is developed from the exploration of a problem, or sub-problems. A hypothesis is tested to investigate whether there is substantial evidence in a data sample to deduce that a particular condition is true for an entire population. A hypothesis can be either accepted or rejected. The Kruskal-Wallis test and the one-way Analysis of Variance (ANOVA) were adopted to test the validity of the hypotheses for this study.

3.8.2.2.1 Kruskal-Wallis test and One-way Analysis of Variance (ANOVA)

The ANOVA and Kruskal-Wallis test were applied to Hypothesis 1 and 2 while only the Kruskal-Wallis test was applied to Hypothesis 3. The Kruskal-Wallis test is a non-parametric test that is used to test the variance between more than two independent groups (Elliot, 2007). It is used to search for variances between multiple groups of scores when the scores come from different entities (Field, 2013:236). It is the non-parametric version of the one-way analysis of variance (ANOVA).

The ANOVA test is a statistical technique that tests the overall fit of a group of mean scores. It is a parametric test used to find the variance between several groups of mean scores (Field 2013:432). The ANOVA test only tests whether groups differ, but doesn't reveal where the significant difference lies amongst the groups. A post-hoc test is conducted to find out the groups that are significantly different from one another (Pallant, 2013:109). The level of significance for the Kruskal-Wallis test and ANOVA test was 0.05.

3.9 VALIDITY AND RELIABILITY OF DATA

Validity and reliability are represented in different forms based on the nature of the research problem (Leedy & Ormrod, 2010). Research instruments are tested for validity and reliability so as to show evidence that the instruments fulfil their purpose of design and consistency in findings when used (Struwig & Stead, 2007:158). Silverman (1993:192) explains that validity and reliability are important because they determine the credibility and objectivity of any study.

3.9.1 Validity

Struwig and Stead (2007:159) describe validity as the trustworthiness of findings from a study. According to Bryman (2012:47) validity is focused on the integrity of the conclusions that are derived from a study. Leedy and Ormrod (2010) further explain that research validity is related to the extent to which the instrument is able to measure what it is designed to measure. Denscombe (2007:316) argues that validity could be labelled with the use of triangulation, grounded data and respondent's validation. According to Struwig and Stead (2001:145), triangulation is used when a researcher wishes to analyse the data, to determine if there are contradictions in the data. Bryman (2004:1142) explains that triangulation uses multiple approaches to the investigation of a research question, to ensure confidence in the findings. For the purpose of this study, validity of the result was determined with the use of documented literature and quantitative measures.

3.9.2 Reliability

Struwig and Stead (2001:130) define reliability as the point to which test scores prove to be accurate, stable and consistent. Kumar (2011:181) explains that the degree of reliability becomes high if instruments used for measuring are accurate and consistent. Moser and Kalton (1989:353) further report that a score derived from a test is reliable to the degree that repeated measurements carried out by it under stable and consistent conditions provides similar results. Reliability is aimed at minimising errors in a study (Yin, 2003:200). According to Bryman (2012:46) reliability deals with the question of how repeatable the results of a study are. The following are three prominent factors, according to Bryman (2012:169), to be considered when measuring the reliability of research carried out:

- **Stability:** This deals with confirming the stability of a measure over a period of time, so there will be confidence in the results obtained, and ensuring there is no fluctuation in the measure for a sample of respondents.

  Internal reliability*:* This deals with the consistency of the indicators that formulate the scale or index. It entails affirming that the scores of respondents on any of the indicators are related to their scores on alternative indicators.
- **Inter-observer consistency**: There is a possibility that consistency in decisions does not exist when subjective judgment exists in the recording of observations, or the conversion of data into various sections where multiple observers are involved.

Reliability is typically used as an indication of whether the measures that are formulated for concepts in the study are consistent. Girden and Kabacoff (2008:119) explain that inner consistency can be tested with Kuder-Richardson formula 20 (KR-20), Cronbach's co-efficient alpha, split half techniques or factor analysis. To ensure reliability of this study, the Cronbach's co-efficient alpha was used in testing the consistency of the data gathered. According to Bryman (2012:170) the average of all viable split-half coefficients are importantly calculated with Cronbach's co-efficient alpha. Variation of the alpha co-efficient will be between 1 (indicating perfect internal reliability) and 0 (representing no internal reliability). In the case of Westergaard *et al.* (1989:93), the satisfactory level was determined with an alpha of 0.70. In Kelley and De Graaf's (1997) evaluation of religious orthodoxy, alpha was indicated as 0.93. However, in Berthoud (2000:169), the low level of 0.60 is perceived as good and makes reference to the case of BHPS ill-health index, which attained a level of 0.77. The figure 0.80 is used as a rule of thumb to represent a sustainable level of internal reliability (Maree & Pietersen, 2007:216).

3.10 CHAPTER SUMMARY

This chapter proffered an overview of the research methodology of this study. A mixed research method was adopted to achieve the aims and objectives and test the hypotheses of the study. A case study approach and questionnaire surveys were adopted for this study. Closed-ended questionnaires were administered and used to gather the primary data for the study. The reliability of scaled questions was tested with Cronbach's alpha. The data gathered was analysed using descriptive and inferential statistics.

Findings from the questionnaire survey are analysed and discussed in the next chapter.

CHAPTER FOUR

4 ANALYSIS AND DISCUSSION

4.1 INTRODUCTION

This chapter focuses on the in-depth analysis of data obtained from the questionnaires administered. Discussion covers the questionnaire response rate, profile of respondents and reliability testing. Discussions are subject to the objectives specified in Chapter One. Furthermore, this section presents the analysis and discussion of results concerning the extent of TQM practice, challenges experienced during the implementation of TQM and factors that ensure the effective implementation of TQM.

4.2 ANALYSIS OF THE STUDY

4.2.1 Questionnaire response rate

A total of 71 questionnaires were administered to employees of the maintenance department across five campuses at CPUT. 54 questionnaires, representing a response rate of 76% were duly completed and returned. All questionnaires were collected in person. The questionnaires were distributed across the campuses as follows: 20 questionnaires were distributed at Bellville campus; 17 questionnaires, representing a response rate of 85% were duly completed and returned.

22 questionnaires were administered at Cape Town campus; 17 questionnaires, representing a response rate of 77. 2%, were duly completed and returned.10 questionnaires were administered at Mowbray campus; 7 questionnaires, representing a response rate of 70%, were duly completed and returned. 10 questionnaires were distributed at Wellington campus; 5 questionnaires, representing a response rate of 50%, were duly completed and returned. 9 questionnaires were distributed at Granger Bay campus; 8 questionnaires, representing a response rate of 90%, were duly completed and returned (see Table 4.1).

Table 4.1: Response rate of questionnaire survey

Questionnaires	Bellville	Cape Town	Mowbray	Wellington	Granger Bay	Total	
	N	N	N	N	N	N	%
Administered	20	22	10	10	9	**71**	**100**
Total received	17	17	7	5	8	**54**	**76**

4.2.2 Analysis of profile of respondents

4.2.2.1 Position of respondents

Table 4.2 represents the distribution of the current positions of questionnaire respondents respectively. It shows that in Bellville campus, 2 respondents (3.7%) hold the position of top management, 3 respondents (5.6%) are in the position of supervisor, 1 respondent (1.9%) is in the position of foreman, 1 respondent (1.9%) is in the position of clerk of works, 5 respondents (9.3%) occupy the position of technician, 3 respondents (5.6%) are in the position of labourer and 2 respondents (3.7%) occupy the position of administrator.

In Cape Town campus, no respondents occupy the position of top management and labourer. 3 respondents (5.6%) hold the position of supervisor, 5 respondents (9.3%) occupy the position of foreman, 3 respondents (5.6%) hold the position of clerk of works, 5 respondents (9.3%) work in the technician position and 1 respondent (1.9%) occupies the position of administrator.

In Mowbray Campus, no respondent occupies the position of top management, foreman or clerk of works. 1 respondent (1.9%) occupies the position of supervisor, 1 respondent (1.9%) works in the position of technician, 4 respondents (7.4%) hold the position of labourer and 1 respondent (1.9%) occupies the position of administrator.

In Wellington campus, 1 respondent (1.9%) occupies the position of top management, 1 respondent (1.9%) occupies the position of supervisor, 1 respondent (1.9%) occupies the position of foreman, 1 respondent (1.9%) occupies the position of technician and 1 respondent (1.9%) works in the position of labourer. No respondent occupies the position of clerk of works or administrator.

In Granger Bay campus, 3 respondents (5.6%) occupy the position of top management, 1 respondent (1.9%) works in the position of supervisor, 2 respondents (3.7%) occupy the foreman position, 1 respondent (1.9%) occupies the position of clerk of works, and 1 respondent (1.9%) occupies the position of technician. No respondent occupies the position of labourer and administrator. Looking at the total aggregate of the position of the respondents across all campuses, Table 4.2 shows that 6 respondents (11.2%) occupy the top management position, 9 respondents (16.9%) occupy the position of supervisor, 9 respondents (16.9%) occupy the position of foreman, 5 respondents (9.4%) work in the position of clerk of works, 13 respondents (24.3%) occupy the position of technician, 8 respondents (14.9%) occupy the position of labourer and 4 respondents (7.5%) occupy the position of administrator.

Table 4.2: Distribution of position of respondents

Position	Bellville		Cape Town		Mowbray		Wellington		Granger Bay		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Top Management	2	3.7	0	0	0	0	1	1.9	3	5.6	6	11.2
Supervisor	3	5.6	3	5.6	1	1.9	1	1.9	1	1.9	9	16.9
Foreman	1	1.9	5	9.3	0	0	1	1.9	2	3.7	9	16.8
Clerk of Works	1	1.9	3	5.6	0	0	0	0	1	1.9	5	9.4
Technician	5	9.3	5	9.3	1	1.9	1	1.9	1	1.9	13	24.3
Labourer	3	5.6	0	0	4	7.4	1	1.9	0	0	8	14.9
Administrator	2	3.7	1	1.9	1	1.9	0	0	0	0	4	7.5
TOTAL	17	31.5	17	31.5	7	13.0	5	9.3	8	14.7	54	100

4.2.2 Duration in present position

Table 4.3: Duration of respondents in present position

No of years	Bellville		Cape Town		Mowbray		Wellington		Granger Bay		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
2	3	5.6	0	0	0	0	1	1.9	3	5.6	7	13.1
3	3	5.6	1	1.9	0	0	1	1.9	1	1.9	6	11.3
4	3	5.6	5	9.3	3	5.6	2	3.7	1	1.9	14	26.1
5	2	3.7	3	5.6	1	1.9	0	0	0	0	6	11.2
6	3	5.6	2	3.7	0	0	1	1.9	1	1.9	7	13.1
7	1	1.9	2	3.7	1	1.9	0	0	2	3.7	6	11.2
8	0	0	2	3.7	2	3.7	0	0	0	0	4	7.4
9	2	3.7	0	0	0	0	0	0	0	0	2	3.7
10	0	0	2	3.7	0	0	0	0	0	0	2	3.7
TOTAL	17	31.5	17	31.5	7	13.0	5	9.3	8	14.8	54	100

Table 4.3 shows how long the respondents have been in their present position. In Bellville campus, respondents have spent the following duration in their present positions; 3 (5.6%) respondents have worked in their present positions for 2 years, 3 respondents (5.6%) have worked in their present positions for 3years, 3 respondents (5.6%) have worked in the positions for 4 years, 2 respondents (3.7%) have been in their present positions for 5 years, 3 respondents (5.6%) have worked in their present positions for 6 years, 1 respondent (1.9%) has worked in their present position for 7 years, and 2 respondents (3.7%) have worked in their present positions for 9 years. No respondent has worked for 8 and 10 years in their present position.

In the Cape Town Campus 1 respondent (1.9%) has been in their present position for 3 years, 5 respondents (9.3%) have worked in their present positions for 4 years, 3 respondents (5.6%) have worked in their present positions for 5 years, 2 respondents (3.7%) have worked for 6 years, 2 respondents (3.7%) have worked for 7 years, 2 respondents (3.7%) have worked for 8 years, and 2 respondents (3.7%) have worked for 10 years.

In the Mowbray Campus, respondents have been in their present positions as follows: 3 respondents (5.6%) for 4 years, 1 respondent (1.9%) for 5 years, 1 respondent (1.9%) for 7 years and 2 respondents (3.7%) for 8 years.

In the Wellington campus, respondents have been in their present positions for the following durations: 1 respondent (1.9%) for 2 years, 1 respondent (1.9%) for 3 years, 2 respondents (3.7%) for 4 years, and 1 respondent (1.9%) for 6 years.

In the Granger Bay campus, respondents have been in their present positions as follows: 3 respondents (5.6%) for 2years, 1 respondent (1.9%) for 3 years, 1 respondent (1.9%) for 4 years, 1 respondent (1.9%) for 6 years, and 2 respondents (3.7%) for 7 years.

An aggregate of all campuses shows that, 7 respondents (13.1%) have been working in the present position for 2 years, 6 respondents (11.3%) for 3 years, 14 respondents (26.1%) for 4 years, 6 respondents (11.2%) for 5 years, 7 respondents (13.1%) for 6 years, 6 respondents (11.2%) for 7 years, 4 respondents (7.4%) for 8 years, 2 respondents (3.7%) for 9 years and 2 respondents (3.7%) for 10 years.

4.2.3 Experience

In Table 4.4, the years of experience of the respondents are represented. The experience levels of respondents are as follows: in Bellville campus, 4 respondents (7.5%) have less than 10 years of experience, 9 respondents (16.8%) have between 11 to 20 years of experience, 3 respondents (5.7%) have between 21 and 30 years of experience, 1 respondent (1.9%) has between 31 and 40 years of experience.

In the Cape Town campus, 2 respondents (3.8%) have less than 10 years of experience, 12 (22.0%) have between 11 and 20 years of experience, 3 respondents (5.7%) have between 21 and 30 years of experience. In Mowbray campus, 6 respondents (11.2%) have between 11 and 20 years of experience, 1 respondent (1.9%) has between 21 and 30 years of experience.

On Wellington campus, 2 respondents (3.8%) have less than 10 years of experience, 3 respondents (5.7%) have 11 to 20 years of experience. Granger Bay campus shows that 1 respondent (1.9%) has less than 10 years of working experience, 5 (9.4%) have between 11 and 20 years working experience, and 2 (3.7%) have between 21 and 30 years of experience.

An aggregate of the campuses shows that 9 respondents (16.2%) have less than 10 years of experience, 35 (65.1%) have between 11 and 20 years of experience, 9 (17.0%) have

between 21 and 30 years of experience, and 1 (1.9%) has between 31 and 40 years of experience.

Table 4.4: Number of years of experience of respondents

No of years	Bellville		Cape Town		Mowbray		Wellington		Granger Bay		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
0-10	4	7.5	2	3.8	0	0	2	3.8	1	1.9	9	16.2
11-20	9	16.8	12	22.0	6	11.2	3	5.7	5	9.4	35	65.1
21-30	3	5.7	3	5.7	1	1.9	0	0	2	3.7	9	17.0
31-40	1	1.9	0	0	0	0	0	0	0	0	1	1.9
TOTAL	17	31.5	17	31.5	7	13.1	5	9.3	8	15	54	100

4.2.4 Gender

Table 4.5, depicts the gender of the questionnaire respondents. On Bellville campus, 2 (3.7%) of the respondents are female and 15 (27.8%) are male. On Cape Town campus, 1 (1.9%) is female and 16 (29.6%) are male. On Mowbray campus, 1 (1.9%) is female and 6 (11.1%) are male. On Wellington campus, 1 (1.9%) is female and 4 (7.4%) are male. Granger Bay campus shows there are no female respondents and 8 (14.8%) are male. An aggregate of the campuses shows that 5 (9.3%) are female and 49 (90.7%) are male.

Table 4.5: Gender of respondents

Gender	Bellville		Cape Town		Mowbray		Wellington		Granger Bay		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Female	2	3.7	1	1.9	1	1.9	1	1.9	0	0	5	9.3
Male	15	27.8	16	29.6	6	11.1	4	7.4	8	14.8	49	90.7
TOTAL	17	31.5	17	31.5	7	13.0	5	9.3	8	14.8	54	100

4.2.5 Highest formal qualification

The highest formal qualifications of respondents are represented in Table 4.6. On Bellville campus 3 (5.6%) respondents possess matric certificates, 7 (13.0%) have diplomas, 3 (5.6%) have postgraduate diplomas, 2 (3.7%) possess a bachelor's degree, 1 (1.9%) has an honours degree, and 1 (1.9%) has a master's degree. Cape Town campus has 3 respondents (5.6%) with matric certificates, 11 (20.4%) with diploma certificates, 1 (1.9%) with a bachelor's degree, and 2 (3.7%) with honours degrees.

On Mowbray campus, 4 (7.4%) possess a diploma certificate, 1 (1.9%) has a postgraduate diploma, 1 (1.9%) has a bachelor's degree, 1 (1.9%) has an honours degree. Wellington campus shows that 2 (3.7%) have a postgraduate diploma, 1 (1.9%) has a bachelor's degree, 2 (3.7%) have an honours degree. On Granger Bay campus, 1 (1.9%) has a matric

certificate, 2 (3.7%) have a postgraduate diploma, 2 (3.7%) have a bachelor's degree, 2 (3.7%) have an honours degree, and 1 (1.9%) has a master's degree.

An aggregate of the campuses shows that 4 (7.5%) has a matric certificate, 14 (26%) have a diploma, 19 (34.3%) have a postgraduate diploma, 7 (14.1%) have a bachelor's degree, 8 (13.1%) are in possession of an honours certificate, and 2 (5.7%) have a master's degree.

Table 4.6: Highest formal qualification of respondents

Highest formal qualification	Bellville		Cape Town		Mowbray		Wellington		Granger Bay		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Matric Certificate	3	5.6	0	0	0	0	0	0	1	1.9	4	7.5
Diploma	7	13.0	3	5.6	4	7.4	0	0	0	0	14	26.0
Postgraduate diploma	3	5.6	11	20.4	1	1.9	2	3.7	2	3.7	19	34.3
Bachelor's degree	2	3.7	1	1.9	1	1.9	1	1.9	2	3.7	7	14.1
Honours	1	1.9	2	3.7	1	1.9	2	3.7	2	3.7	8	13.1
Master's degree	1	1.9	0	0	0	0	0	0	1	1.9	2	5.7
Doctorate degree	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	17	31.5	17	31.5	7	13.0	5	9.3	8	14.8	54	100

4.3 RELIABILITY TESTING

The reliability of scaled questions was tested with the use of Cronbach's alpha coefficient. Table 4.7 presents a summary of the reliability test for questions 5, 6, 8, 9, 10 and 11. The Cronbach's co-efficient for the scale questions was 0.84, which satisfies the reliability test requirements.

Table 4.7: Summary of reliability test

Question No	Statement	Number of items	Cronbach's alpha coefficient
5	Importance of TQM practices	31	0.73
6	Extent of TQM practice	31	0.78
8	Experience of challenges during the implementation of TQM	13	0.84
9	Impact of challenges experienced	13	0.85
10	Practice of TQM success factors	10	0.94
11	Level of agreement on the practice of TQM success-factors	10	0.88
	Total questions	**122**	**0.84**

4.5 ANALYSIS OF EXTENT OF TQM PRACTICE

4.5.1 Implementation of TQM

The study sought to investigate whether the maintenance department implemented TQM in the maintenance of its school buildings. Data gathered is represented in Table 4.9; Bellville campus (31.5%), Cape Town campus (31.5%), Mowbray (13.0%), Wellington (9.3%), and

Granger Bay (14.8%). This shows that all respondents indicated that TQM is implemented in the maintenance of the school buildings.

Table 4.8: Implementation of TQM

Response	Bellville		Cape Town		Mowbray		Wellington		Granger Bay		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Yes	17	31.5	17	31.5	7	13.0	5	9.3	8	14.8	54	100
No	0	0	0	0	0	0	0	0	0	0	0	0
Unsure	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	17	31.5	17	31.5	7	13.0	5	9.3	8	14.8	54	100

4.5.2 Importance of TQM practice

From Table 4.9, it is apparent that an aggregate of 53 respondents (98.1%) indicated that the practice of TQM was very important and 1 respondent (1.9%) from Mowbray campus indicated that TQM practice was merely important. Since all the responses fell in the range of very important and important, it can be deduced that all respondents tended to agree that the practice of TQM is crucial in the execution of maintenance activities.

Table 4.9: Perception of respondents on the importance of TQM

Response	Bellville		Cape Town		Mowbray		Wellington		Granger Bay		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Unimportant at all	0	0	0	0	0	0	0	0	0	0	0	0
Unimportant	0	0	0	0	0	0	0	0	0	0	0	0
Important	0	0	0	0	0	0	0	0	0	0	0	0
Moderately important	0	0	0	0	0	0	0	0	0	0	0	0
Important	0	0	0	0	1	1.9	0	0	0	0	1	1.9
Very important	17	31.5	17	31.5	6	11.1	5	9.3	8	14.8	53	98.1
TOTAL	17	31.5	17	31.5	7	13.0	5	9.3	8	14.8	54	100

4.5.3 Practice of TQM

This section sought to explore the knowledge of the respondents about the practice of TQM. Respondents were required to describe their level of agreement with 14 statements on the practice of TQM using a five-point Likert scale where; 1 = strongly disagree, 2 = disagree, 3 = somewhat agree, 4 = agree and 5 = strongly agree. Responses from each campus are presented separately.

4.5.3.1 Perception of the practice of TQM at Bellville Campus

It is important to note that all the mean scores were above the midpoint average, indicating that respondents tended to agree with all the statements. Furthermore, it is evident from Appendix C1 that the maintenance department's focusing on the achievement of stakeholder satisfaction when carrying out its activities and carrying out appropriate corrective measures

to avoid repetition are the highest ranked variables, with mean scores of 4.82.Development of a relationship with internal stakeholders and the measurement of the cost of resources consumed were jointly ranked third, with mean scores of 4.65. The overall mean score obtained was 4.50. These findings imply that respondents strongly agree that the first four variables or statements of Total Quality Management are practiced in the maintenance of school buildings.

4.5.3.2 Perception of the practice of TQM at Cape Town Campus

It is evident that the mean scores of all the statements were above average, indicating that respondents were generally in agreement with all the statements. The ranking by the mean of the responses with respect to the level of agreement on the statements concerning the practice of TQM is shown in Appendix C2; “appropriate preventive procedures should be carried out” was ranked first, with a mean score of 4.94, followed by the departments understanding of stakeholder needs, with a mean score of 4.80. Analysis of mistakes and the involvement of everyone in the execution of activities were both ranked third, with mean scores of 4.76. The overall mean score obtained was 4.60. These findings indicate that respondents agreed strongly with carrying out preventive measures to avoid repetition during the execution of maintenance activities and understanding and acting upon the needs of stakeholders. It was agreed that mistakes should be analysed to determine the root cause of any failures and everyone should be involved in the execution of maintenance activities.

4.5.3.3 Perception of the practice of TQM at Mowbray Campus

In the case of Mowbray campus, more than 80% of the respondents responded in the range of “agree” and “strongly agree” for all the statements on the practice of TQM. Appendix C3 suggests that “appropriate corrective procedures should be carried out to avoid repetition of mistakes” and “everyone should be involved in the execution of activities” were ranked first, with mean scores of 5.00.

“The department focuses on achievement of stakeholder satisfaction when carrying out activities” and “mistakes should be analysed” were both ranked third, with mean scores of 4.85 each. A mean score of 4.64 was obtained overall. This implies that respondents tended to agree more on the four statements concerning the practice of TQM, since their mean scores are between 4 and 5 and have lower standard deviations.

4.5.3.4 Perception of the practice of TQM at Wellington Campus

From the mean scores obtained, it is evident that respondents from Wellington campus agreed with all the statements regarding the practice of TQM. The mean scores obtained from all the statements were above 4.0. Appendix C4 shows that respondents ranked "appropriate corrective procedures should be carried out" and "appropriate preventive procedures should be carried out" first, with mean scores of 5.00 each. More than 80% of the respondents gave responses in the range of "agree" and "strongly agree" for all the statements. The overall mean score obtained was 4.67.

4.5.3.5 Perception of the practice of TQM at Granger Bay Campus

The results from Appendix C5 indicate that the statement "the department understands and acts upon stakeholder needs" was ranked first, with a mean score of 5.00, followed by "the department focuses on achievement of stakeholder satisfaction", "all parties should be satisfied in the maintenance process" and "efforts should be made to satisfy all stakeholders" with mean scores of 4.87 each. The mean scores obtained for all the statements were above 4.0 and more than 85% of the respondents responded in the range of "agree" and "strongly agree". An overall mean score of 4.64 was obtained. From the findings, it is safe to say that all the respondents tended to agree with all the statements on the practice of TQM.

4.5.3.6 Perception of the practice of TQM at all Campuses

Table 4.10: Perception of TQM practice (Total)

Statement	1	2	3	4	5	Total	Mean	SD	Rank
	%	%	%	%	%				
Appropriate corrective procedures should be done	0	0	3.7	9.3	87.0	54	4.83	0.46	1
Department focuses on achievement of stakeholder satisfaction	0	0	0	20.4	79.6	54	4.79	0.40	2
Appropriate prevention procedures should be done	0	0	1.9	16.7	72.2	54	4.79	0.45	3
Everyone should be involved in the execution of activities	0	0	1.9	20.4	77.8	54	4.75	0.47	4
Department understands stakeholder needs	0	0	0	25.9	74.1	54	4.74	0.44	5
More focus should be placed on prevention	0	0	5.6	22.2	72.2	54	4.66	0.58	6
Development of a relationship with internal stakeholders is a vital	0	0	0	35.2	64.8	54	4.64	0.48	7
Mistakes should be analysed	0	0	7.4	20.4	72.2	54	4.64	0.61	8
Efforts should be made to satisfy all stakeholders	0	0	9.3	22.2	68.5	54	4.59	0.65	9
All parties should be satisfied	0	0	13.0	27.8	59.3	54	4.46	0.71	10
Cost of resources consumed is measured	0	0	5.6	46.3	48.1	54	4.42	0.60	11
Value is added to maintenance processes	0	0	5.6	50.0	44.4	54	4.38	0.59	12
Mistakes are eliminated to save time and cost	0	1.9	18.5	24.1	55.6	54	4.33	0.84	13
Activities are done right the first time	0	1.9	13.0	35.2	46.3	54	4.18	0.99	14
OVERALL						54	4.58	0.59	

Table 4.10 shows the aggregate response obtained from all the campuses. The mean scores obtained were in the range between 4.83, which was the highest and 4.18, which was

the lowest. An overall mean score of 4.58 was obtained. It is evident that all the statements on the practice of TQM obtained a mean score of over 4.0, with 75% of the respondents giving responses of either “agree” or “strongly agree”.

The statement “appropriate corrective measures should be carried out” was ranked first, with a mean score of 4.83, followed by “department focuses on stakeholder satisfaction” and “appropriate preventive procedures should be carried out”, with mean scores of 4.79 each. Activities are done right the first time was ranked the lowest, with a mean score of 4.18. An overall mean score of 4.58 was obtained. Respondents from all campuses tended to agree to all the statements made concerning the practice of TQM. This is consistent with the findings of Mukherjee (2006:42), who recommends that eight internationally recognised building blocks should be practiced together for the effective implementation of TQM.

4.5.4 Importance of TQM practices

This section assists in ranking the TQM practices based on their level of importance from the perspective of the maintenance staff during their building maintenance activities. Literature reveals that there are a set of TQM practices that have been perceived as fundamental to the management of quality.

Powell (1995:20); Martinez-Lorente, Dewhurst and Dale (1998:379); Ho and Fung (1994:26); Jusoh, Yousoff and Shamini (2008:45) all highlight a number of TQM practices, including: executive commitment, adopting the philosophy, being closer to customers, being closer to suppliers, benchmarking, training, maintaining an open organisation, employee empowerment, having a zero-defects mentality, employing flexible manufacturing, process improvement, measurement, engaging with the product design process, maintaining good employee relations, understanding the importance of the supplier relationship, possessing quality information, understanding the role of process instruments and design instruments, commitment, leadership, total customer satisfaction, displaying total involvement, taking ownership, dedication to continuous improvement, training and education, employing mechanisms of reward and recognition, error prevention, and, lastly, cooperation and teamwork.

4.5.4.1 Perception of the importance of TQM at Bellville Campus

Customer focus, leadership, people involvement, process approach, system management, continuous improvement, factual approach to decision-making and supplier relationship are the TQM practices selected for this survey. Respondents were required to rate how important these TQM practices were to their building maintenance activities using a five-

point Likert scale where 1 = not important at all; 2 = unimportant; 3 = moderately important; 4 = important; 1 = very important. Responses from each campus are presented separately.

Findings from Bellville campus are presented in Appendix D1. From the sub-practices, respondents ranked the statement “data on performance measures is gathered” first, with a mean score of 4.82. “Related activities should be managed as a process” was ranked second, with a mean score of 4.80, followed by the statement “stakeholder needs should be effectively disseminated”, with a mean score of 4.76. Furthermore, looking at the overall practices, it is evident that respondents perceived people involvement as the most important TQM practice, with a mean score of 4.62 and S.D(0.48), followed by the necessity of a factual approach to decision-making, which was given a mean score of 4.62 and S.D (0.53). Customer focus was ranked third, with a mean score of 4.59.

4.5.4.2 Perception of the importance of TQM at Cape Town Campus

In Cape Town, respondents ranked the statement “maintenance department should establish an appropriate structure” as the most important sub-practice, with a mean score of 4.94. Stakeholder needs should be effectively disseminated and top management must develop clear objectives were ranked second with mean scores of 4.76. The mean scores for the remaining sub-practices ranged from 4.76 to 3.70. Appendix D2 shows that respondents perceived all the sub-practices as very important. Respondents clearly found leadership to be the most important TQM practice, giving it an overall mean score of 4.75, followed by customer focus, with an overall mean score of 4.61. The adoption of a process approach was ranked third, with an overall mean score of 4.54.

4.5.4.3 Perception of the importance of TQM at Mowbray Campus

Respondents in Mowbray indicated that objectives should be clearly defined and that the maintenance department should establish an appropriate management structure were the most important sub-practices, with mean scores of 5.00. Appendix D3 shows that respondents perceived leadership as the most important TQM practice, with an overall mean score of 4.75, followed by the process approach, with an overall mean score of 4.71 and a S.D of 0.42. Customer focus was ranked third, with an overall mean score of 4.71 and a S.D of 0.46. The overall mean scores obtained for the remaining TQM practices were in the range between 4.71 and 4.35.

4.5.4.4 Perception of the importance of TQM at Wellington Campus

Responses from Wellington campus are presented in Appendix D4. The responses obtained indicate that respondents perceive the practice of TQM as very important. The mean scores

obtained for all the sub-practices ranged between 5.00 and 2.80. Customer focus and people involvement were perceived as the most important TQM practices, with an overall mean score of 4.80, followed by the process approach, with an overall mean score of 4.65. The supplier relationship was ranked as least important, with an overall mean score of 3.33.

4.5.4.5 Perception of the importance of TQM at Granger Bay Campus

Appendix D5 presents the responses obtained from Granger Bay. As regards the sub-practices, the mean scores obtained ranged from 5.00 to 3.37. It is evident from the mean scores obtained that respondents perceived all the sub-practices as very important. More than 90% of the respondents gave responses of “very important”. In terms of the overall TQM practices, customer focus was ranked as the most important, with a mean score of 4.97, followed by people involvement, with a mean score of 4.89. Leadership was ranked third, with a mean score of 4.83.

4.5.4.6 Perception of the importance of TQM at all Campuses

Table 4.11 shows the aggregate response obtained from all the campuses. The mean scores obtained for all the sub-practices ranged from 4.79 to 3.47. Respondents perceived “stakeholder needs should be effectively disseminated” as the most important, with a mean score of 4.79. “Related activities should be managed as a process” was ranked second, with a mean score of 4.79 and S.D (0.52), followed by “maintenance department should establish an appropriate management structure”, with a mean score of 4.77. Customer focus was perceived as the most important TQM practice, with an overall mean score 0f 4.69, followed by leadership, with an overall mean score of 4.65. Supplier relationship was perceived as the least important TQM practice, with an overall mean score of 4.04. The mean scores obtained for the TQM practices indicate that respondents agreed that all the TQM practices were important. The findings are very much supported by literature.

In a study carried out by Sadikoglu and Olcay (2013:9), it was revealed that all TQM practices in general are important. The study discovered that all TQM practices had different outcomes and improved different aspects of an organisations processes. Findings show that expectations and input of customers is crucial for production of high and reliable quality services. It was revealed that collaboration with suppliers was very important for the effective implementation of TQM by evaluating the suppliers with respect to quality and providing training on quality standards. Zehir, Ertosun and Muceldili (2012:279) highlights leadership, process management and customer focus as the most commonly accepted and practiced dimensions of TQM.

Table 4.11: Importance of TQM practices (Total)

TQM practices	1	2	3	4	5	Total	Mean	SD	Sub-rank	Rank
	%	%	%	%	%					
Customer focus										
Stakeholders should be the focus	0	0	0	37.0	63.0	54	4.62	0.48	15	
Stakeholder satisfaction should be achieved	0	0	0	33.3	66.7	54	4.66	0.47	10	
Stakeholder needs should be regularly sought	0	0	0	25.9	74.1	54	4.74	0.44	4	
Stakeholder needs should be effectively disseminated	0	0	1.9	16.7	81.5	54	4.79	0.45	1	
Stakeholder expectations should be considered	0	0	3.7	27.8	68.5	54	4.64	0.55	14	
OVERALL							4.69	0.46		1
Leadership										
Top management must develop clear objectives	0	0	1.9	29.6	68.5	54	4.66	0.51	11	
Effective strategies should be developed	0	0	5.6	20.4	74.1	54	4.68	0.57	9	
Maintenance department should establish an appropriate management structure	0	0	3.7	14.8	81.5	54	4.77	0.50	3	
Contingency plans should be developed	0	0	9.3	24.1	66.7	54	4.57	0.66	17	
Top management should encourage members	0	0	9.3	27.8	63.0	54	4.53	0.66	19	
Top management should pay attention	0	0	3.7	20.4	75.9	54	4.72	0.52	7	
OVERALL							4.65	0.53		2
People Involvement										
Participation of everyone assists productivity	0	0	14.8	31.5	53.7	54	4.38	0.73	25	
Involvement of workers is important	0	0	5.6	22.2	72.2	54	4.66	0.58	12	
Satisfaction of workers should be measured	0	0	1.9	24.1	74.1	54	4.72	0.49	6	
Work environment that contributes to employee safety should be maintained	1.9	0	1.9	20.4	75.9	54	4.70	0.60	8	
OVERALL							4.61	2.61		3
Process Approach										
Related activities should be managed	0	0	5.6	9.3	85.2	54	4.79	0.52	2	
Resources should be managed as a process	0	0	1.9	33.3	64.8	54	4.62	0.52	16	
Objectives should be clearly defined	0	0	1.9	22.2	75.9	54	4.74	0.48	5	
Processes based on interest should be managed	0	0	22.2	27.8	50.0	54	4.27	0.81	28	
OVERALL							4.60	0.58		4
Continuous Improvement										
Processes should be continually improved	0	0	5.6	37.0	57.4	54	4.51	0.60	20	
Improvement teams should be available	0	0	20.4	18.5	61.1	54	4.40	0.81	24	
Programmes for improving continuous imp. should be implemented	0	0	5.6	22.2	72.2	54	4.66	0.58	12	
OVERALL							4.52	0.66		5
Factual approach to decision-making										
Ensure data on performance is gathered	0	0	9.3	25.9	64.8	54	4.55	0.66	18	
Data to improve decision-making is analysed	0	0	3.7	55.6	40.7	54	4.37	0.55	26	
Statistical methods should be used analysis	0	0	7.4	51.9	40.7	54	4.33	0.61	27	
OVERALL							4.41	0.61		6
System Management										
Sys and processes should be well identified	0	0	14.8	46.3	38.9	54	4.24	0.69	29	
Activities should be managed for effectiveness	0	0	14.8	25.9	59.3	54	4.44	0.74	23	
Clear instructions should be available	0	0	14.8	20.4	64.8	54	4.50	0.74	21	
OVERALL							4.39	0.72		7
Supplier Relationship										
Mutually fav. Relationship with suppliers	16.7	9.3	1.9	27.8	44.4	54	3.74	1.51	31	
Regular supplier audits should be conducted	1.9	0	3.7	38.9	55.6	54	4.46	0.74	22	
Ensure suppliers can maintain qty. standards.	9.3	13.0	1.9	27.8	48.1	54	3.92	1.37	30	
OVERALL							4.04	1.20		**8**

In an analysis conducted by Cho and Pucik (2005:559), leadership was perceived as the most important practice in the implementation of TQM. Prajogo and Sahol (2005:905), as well as Sadikoglu and Zahir (2010:280) also highlighted supplier management, process management and system management as the dimensions of TQM practice that are significantly important for the effective implementation of TQM. The mean scores obtained for this study and the comparison with literature reveals that these TQM practices are significant and important in the implementation of TQM during the maintenance of university buildings.

4.5.5 Extent of TQM practice

This section explores the extent to which the maintenance department observed TQM practices in the maintenance of its buildings. Respondents were required to rate their level of observance using a five-point Likert scale, where 1 = never, 2 = rarely, 3 = sometimes, 4 = often, and 5 = always.

4.5.5.1 Perception of the extent of TQM practice at Bellville Campus

Responses from Bellville campus are presented in Appendix E1. The sub-practice ranked first was the “related maintenance activities are managed effectively”, with a mean score of 4.70, followed by “resources are managed as a process”, with a mean score of 4.58. “Objectives are clearly defined” was ranked third, with a mean score of 4.52. Respondents ranked process approach as the TQM practice that was most frequently practiced, with an overall mean score of 4.41, followed by customer focus, with an overall mean score of 4.02. Leadership was ranked third, with an overall mean score of 3.95. The overall mean scores for the remaining TQM practices ranged between 3.90 and 3.16.

4.5.5.2 Perception of the extent of TQM practice at Cape Town Campus

As presented in Appendix E2, respondents from Cape Town campus perceived people involvement as the most implemented TQM practice, with an overall mean score of 4.29, followed by process involvement, with an overall mean score of 4.20. Customer focus, with an overall mean score of 4.00, was ranked third. The mean scores obtained for the remaining TQM practices ranged from 3.81 to 3.31. It is evident from the mean scores obtained that the TQM practices in question were being implemented. From the sub-practices, respondents ranked “stakeholder inputs are encouraged” first, with a mean score of 4.52. “Satisfaction of workers is measured regularly” was ranked second, with a mean score of 4.58, followed by “related maintenance activities are managed effectively”, with a mean score of 4.47.

4.5.5.3 Perception of the extent of TQM practice at Mowbray Campus

As presented in Appendix E3, respondents perceived “stakeholder inputs are encouraged” as the most frequently implemented TQM sub-practice, with a mean score of 4.85. “Objectives are clearly defined” was ranked second, with a mean score of 4.71, followed by “resources are managed as a process”, with a mean score of 4.75. The mean scores of the remaining sub-practices ranged from 4.42 to 2.57. Respondents at Mowbray ranked people involvement as the most frequently implemented TQM practice, with an overall mean score of 4.46, followed by customer focus, with an overall mean score of 4.39. Supplier relationship was ranked third, with an overall mean score of 4.18.

4.5.5.4 Perception of the extent of TQM practice at Wellington Campus

Appendix E4 shows the responses from respondents on Wellington campus. As regards the sub-practices, the mean scores obtained ranged from 4.80 to 3.00. Respondents ranked “related maintenance activities are managed effectively”, “stakeholder inputs are encouraged” and “top management consistently pays attention to its employees” as the most implemented TQM sub-practices, with mean scores of 4.80. The mean scores of the remaining sub-practices ranged from 4.60 to 3.00.

Process approach was ranked as the most implemented TQM practice, with an overall mean score of 4.25 followed by people involvement, with an overall mean score of 4.20. System management was ranked third, with an overall mean score of 4.00. The overall mean scores for the remaining TQM practices ranged from 4.00 to 3.40.

4.5.5.5 Perception of the extent of TQM practice at Granger Bay Campus

Responses from Granger Bay are presented in Appendix E5. Respondents ranked the statements “satisfaction of workers is measured regularly”, “maintenance department contributes to the safety of workers”, “related maintenance activities are managed effectively” and “resources are managed as a process” as the most important TQM practices, with scores of 5.00. The mean scores of the remaining sub-practices ranged from 4.87 to 1.12. People involvement was ranked as the most implemented TQM practice, with an overall mean score of 4.87, followed by process approach, with an overall mean score of 4.53. System management was ranked third, with a mean score of 4.29. Supplier relationship was ranked as the least implemented TQM practice, with an overall mean score of 2.83.

4.5.5.6 Perception of the extent of TQM practice at all Campuses

Table 4.12 shows the total responses from all the respondents across all the campuses. The mean scores obtained for all the sub-practices ranged from 4.61 to 2.49. Related maintenance activities are managed effectively, with a mean score of 4.61 was ranked first followed by resources are managed as a process, with a mean score of 4.59. Stakeholder inputs are encouraged was ranked third, with a mean score of 4.53. Respondents ranked people involvement as the most implemented TQM practice, with an overall mean score of 4.97 followed by process approach, with a mean score of 4.25. Factual approach to decision-making was ranked the least implemented TQM practice, with an overall mean score of 3.37. This indicates that all workers are involved in the maintenance process and the maintenance department contributes to the safety of workers. It is also demonstrated that satisfaction of workers is measured regularly. In addition, everyone participates in the execution of activities.

Results shows that people involvement, process approach, customer focus and system management are the most implemented TQM practices. These findings are supported by literature. The Department of Trade and industry (2011) reveals that the involvement of people, core management of systems and processes and satisfaction of customers form the basis of TQM. Vladavic (2014:74) states that people involvement is at the core of TQM and it plays a key role in the achievement of ultimate success within an organisation.

Ceronio (1996:21) explains that for TQM standards to be achieved, workers should be involved and allowed to participate in all processes. Cartwright (1996:61) suggests that the involvement of people in the implementation of activities is a quality strategy for organisations. Galgano (1994) further emphasises that the involvement of the workforce is important, as it is one of the conditions for an organisation's ultimate success. Sarajevo (2014) states that people involvement is at the core of TQM and it plays a key role in the achievement of ultimate success within an organisation. Tang, Chen and Wu (2010:1232) reveal that the practice of people involvement is one of the keys to increasing the positive outcomes of TQM.

Table 4.12: Extent of TQM practice (Total)

TQM practices	1	2	3	4	5	Total	Mean	SD	Sub-rank	Rank
	%	%	%	%	%					
People Involvement										
Everyone participates in the execution of activities	3.7	3.7	16.7	42.6	33.3	54	3.98	0.99	14	
All workers are involved in the maintenance process	0	3.7	11.1	44.4	40.7	54	4.22	0.79	11	
Satisfaction of workers is measured regularly	1.9	1.9	18.5	24.1	53.7	54	4.25	0.95	9	
Maintenance department contributes to the safety of workers	1.9	5.6	9.3	33.3	50.0	54	4.24	0.97	10	
OVERALL							4.97	0.92		1
Process approach										
Related maintenance activities are managed effectively	0	1.9	11.1	11.1	75.9	54	4.61	0.76	1	
Resources are managed as a process	0	0	14.8	11.1	74.1	54	4.59	0.74	2	
Objectives are clearly defined	0	0	14.8	20.4	64.8	54	4.50	0.74	4	
Processes based on interest of all parties are effectively managed	0	13.0	22.2	44.4	20.4	54	3.72	0.94	20	
OVERALL							4.25	0.79		2
Customer focus										
Regard stakeholders as the focus	5.6	0	44.4	24.1	25.9	54	3.64	1.04	22	
Satisfy stakeholders by conforming to specification	20.4	11.1	9.3	22.2	37.0	54	3.44	1.57	27	
Stakeholder inputs are encouraged	0	0	11.4	24.1	64.8	54	4.53	0.69	3	
Stakeholder expectations are considered	0	1.9	33.3	29.6	35.2	54	3.98	0.87	13	
Stakeholder needs are effectively disseminated and understood	1.9	1.9	7.4	44.4	44.4	54	4.27	0.83	7	
OVERALL							3.97	1.00		3
System Management										
Systems and maintenance processes are well identified and understood	1.9	0	18.5	70.4	9.3	54	3.85	0.65	16	
Activities are managed in order to contribute to effectiveness	1.9	5.6	20.4	53.7	18.5	54	3.81	0.87	18	
Clear instructions are available	1.9	1.9	29.6	18.5	48.1	54	4.09	1.01	12	
OVERALL							3.91	0.84		4
Continuous improvement										
Continuous improvement of all services and processes is practiced	3.7	3.7	27.8	27.8	37.0	54	3.90	1.06	15	
Improvement teams are available in all departments	3.7	5.6	29.6	46.3	14.8	54	3.62	0.93	23	
Programmes for upgrading the continuous improvement process is implemented	1.9	14.8	13.0	48.1	22.2	54	3.74	1.03	19	
OVERALL							3.75	1.00		5
Supplier relationship										
A mutually favourable relationship exists between the department and suppliers	0	3.7	25.9	51.9	18.5	54	3.85	0.76	17	
Regular supplier audits are conducted	3.7	22.2	24.1	33.3	16.7	54	3.37	1.12	28	
Maintenance department ensures all suppliers can maintain quality standards and meet specifications	3.7	14.8	24.1	38.9	18.5	54	3.53	1.07	25	
OVERALL							3.58	0.98		6
Leadership										
Top management develops clear objectives	31.5	16.7	5.6	27.8	18.5	54	2.85	1.57	30	
Effective strategies are developed to control maintenance	27.8	20.4	14.8	18.5	18.5	54	2.79	1.49	31	
Contingency plans are developed to control maintenance	3.7	14.8	22.2	27.8	31.5	54	3.68	1.17	21	

TQM practices	1	2	3	4	5	Total	Mean	SD	Sub-rank	Rank
	%	%	%	%	%					
Maintenance department puts in place appropriate management structures	0	3.7	16.7	27.8	51.9	54	4.27	0.87	8	
Top management encourages members through empowerment	1.9	3.7	9.3	27.8	57.4	54	4.35	0.93	6	
Top management consistently pays attention to members	3.7	0	7.4	29.6	59.3	54	4.40	0.92	5	
OVERALL							3.58	1.20		7
Factual approach to decision-making										
Ensure data on performance measures is gathered	3.7	31.5	33.3	18.5	13.0	54	3.05	1.08	29	
Data to improve decision-making is continually analysed	1.9	11.1	44.4	22.2	20.4	54	3.48	1.00	26	
Statistical methods are used to analyse data	1.9	7.4	40.7	29.6	20.4	54	3.59	0.96	24	
OVERALL							3.37	1.01		8

In a study conducted by Joiner (2005:617) it is revealed that there was an increase in the implementation of the basic TQM practices such as customer focus, process approach, continuous improvement and leadership (Chen, 1997:30; Guimaraes, 1994:34) Powell (1995:20) states that organisations which focus on people involvement, customer focus and continuous improvement tend to outperform organisations that did not focus on these TQM practices. Joiner (2005:618) points out that the extent to which TQM practices are implemented in an organisation determines ultimate success. However, Douglas and Judge (2011: 159) assert that mere concern for quality will not guarantee ultimate success, but rather the extent to which TQM practices are implemented.

4.6 Analysis of challenges experienced during TQM implementation

4.6.1 Experience of challenges during TQM implementation

The study seeks to investigate whether the maintenance departments experienced challenges during the implementation of TQM in the maintenance of their school buildings. Table 4.13 shows that Bellville campus (31.5%), Cape Town campus (31.5%), Mowbray (13.0%), Wellington (9.2%), and Granger Bay (14.8%) responded 'Yes'. Respondents responded affirmatively when asked if they experienced challenges during their implementation of TQM.

Table 4.13: Experience of challenges during TQM implementation

Response	Bellville		Cape Town		Mowbray		Wellington		Granger Bay		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Yes	17	31.5	17	31.5	7	13.0	5	9.2	8	14.8	54	100
No	0	0	0	0	0	0	0	0	0	0	0	0
Unsure	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	17	31.5	17	31.5	7	13.0	5	9.2	8	14.8	54	100

4.6.2 Frequency of challenges experienced

This section seeks to investigate how often respondents experienced challenges in the implementation of TQM during their maintenance activities. A five-point Likert scale was used for this purpose where 1 = never, 2 = rarely, 3 = sometimes, 4 = often and 5 = always. Responses from each campus are presented separately.

4.6.2.1 Frequency of challenges experienced at Bellville Campus

As shown in Appendix F1, the mean scores for the variables range from 4.52 for lack of support from top management and 3.58 for lack of vision within the maintenance department. After ranking the mean scores of the responses, lack of support from top management was ranked as the most frequent challenge experienced, with a mean score of 4.52, followed by non-involvement of maintenance workers in the decision-making process, with a mean score of 4.47. Lack of sufficient training and education on quality was ranked third, with a mean score of 4.23. Given that mean scores for all the variables ranged from 4.52 to 3.58, it can be deduced that maintenance staff generally experienced challenges during the implementation of TQM.

4.6.2.2 Frequency of challenges experienced at Cape Town Campus

The response obtained from the Cape Town campus indicates that non-involvement of maintenance workers in the decision-making process, lack of sufficient training and education on quality, and lack of human and financial resources were ranked highest, with mean scores of 4.64. Appendix F2 indicates that the mean scores range from 4.64 to 3.70. This demonstrates that respondents always experience challenges in the implementation of TQM.

4.6.2.3 Frequency of challenges experienced at Mowbray Campus

From Appendix F3, it is evident from the ranking of the mean scores of responses that lack of human and financial resources dominates, with a mean score of 4.71, followed by non-involvement of workers in the decision-making process, with a mean score of 4.28, and lack of focus on school stakeholders, with a mean score 4.14. The mean scores obtained from the remaining variables range from 4.00 to 2.57. It can be deduced that in Mowbray campus, challenges are often or sometimes experienced in the implementation of TQM.

4.6.2.4 Frequency of challenges experienced at Wellington Campus

Appendix F4 indicates that, on the Wellington campus, non-involvement of maintenance workers was ranked first, with a mean score of 4.80, and standard deviation of 0.44, followed by lack of sufficient training and education, with a mean score of 4.80 and standard deviation of 1.78. Lack of human and financial resources was ranked third, with a mean score of 4.40. The mean scores obtained for the remaining challenges ranged from 4.20 to 3.40, indicating that the respondents often experienced challenges during TQM implementation. More than 80% of the respondents felt that maintenance workers were not involved in the decision-making process and that there was lack of sufficient training on quality in the maintenance department.

4.6.2.5 Frequency of challenges experienced at Granger Bay Campus

In Granger Bay, non-involvement of maintenance workers in decision-making and lack of focus on school stakeholders were ranked first, with mean scores of 5.00, followed by lack of sufficient training and education, with a mean score of 4.87. Appendix F5 shows that the mean scores obtained for the remaining variables range from 4.62 to 3.37, demonstrating that respondents experienced these challenges regularly.

4.6.2.6 Frequency of challenges experienced at all campuses

Table 4.14: Frequency of challenges experienced (Total)

Challenges	1	2	3	4	5	Total	Mean	SD	Rank
	%	%	%	%	%				
Non-involvement of maintenance workers in decision-making	0	0	3.7	31.5	64.8	54	4.61	0.56	1
Lack of human and financial resources	1.9	0	7.4	33.3	57.4	54	4.44	0.79	2
Lack of sufficient training and education on quality	5.6	1.9	1.9	29.6	61.1	54	4.38	1.03	3
Lack of support from top management	0	0	25.9	20.4	53.7	54	4.27	0.85	4
Lack of focus on school stakeholders	1.9	3.7	11.1	31.5	51.9	54	4.27	0.94	5
Workers lack expertise in management of quality	3.7	3.7	18.5	25.9	48.1	54	4.11	1.07	6
Insufficient communication network	3.7	3.7	13.0	40.7	38.9	54	4.07	1.00	7
Resistance from supervisors to implement approved ideas	9.3	1.9	11.1	40.7	37.0	54	3.94	1.18	8
Lack of clear objectives from top management	5.6	1.9	25.9	27.8	38.9	54	3.92	1.11	9
Maintenance workers are not involved the formulation of policies	5.6	3.7	22.2	33.3	35.2	54	3.88	1.11	10
Top management in the maintenance department does not have sufficient knowledge of maintenance activities.	5.6	5.6	22.2	31.5	35.2	54	3.85	1.13	11
Lack of understanding amongst workers	1.9	1.9	42.6	31.5	22.2	54	3.70	0.90	12
Lack of vision within the maintenance department.	1.9	9.3	29.6	42.6	16.7	54	3.62	0.93	13
OVERALL						54	4.08	0.96	

With regard to the aggregate responses from all the campuses, the mean scores obtained, as presented in Table 4.14, were in the range of 4.61 to 3.62. Respondents ranked non-involvement of maintenance workers in decision-making as the most frequently experienced challenge, with a mean score of 4.61, followed by lack of human and financial resources, with a mean score of 4.44. Lack of sufficient training and education on quality was ranked third, with a mean score of 4.38. It is evident from Table 4.35 that all the challenges were often or always experienced by the respondents in their implementation of TQM. Lack of understanding amongst workers, with a mean score of 3.70, and lack of vision within the maintenance department, with a mean score of 3.62, were ranked as the least frequent challenges that were experienced.

A study conducted by Suleman and Gul (2015:123) which set out to investigate the challenges to successful implementation of TQM in public schools, discovered that the main challenges experienced during implementation of TQM are lack of clear instructions from top management, lack of funding and resources, resistance from supervisors and lack of understanding amongst workers. Munro (2008:55) and Sergiovani (2001:62) suggest that lack of expertise in the management of quality and lack of sufficient training on quality were the most frequently experienced TQM barriers. A study carried out by Brown (1994:32) reveals a lack of top management support and commitment as the main reason for failures in the implementation of TQM.

Kosgei (2014:15) and Mobegi (2010:83) conclude that lack of top management support, inadequate training on quality and insufficient communication networks were the most commonly experienced challenges. Findings from Hamidi and Zamanparrar (2005:23) suggest that a lack of top management support was the most experienced challenge when implementing TQM. These findings suggest that without the commitment and support of top management, progress in the implementation of TQM is impossible. According to Suleiman and Gul (2015:131) top management commitment influences the effective implementation of TQM, but findings in the present study demonstrate that a lack of support from top management hinders the successful implementation of TQM in the maintenance of university buildings. Ater (2013) highlights the importance of resources in the implementation of TQM practices in public schools and explains that lack of financial and human resources brings about barriers in the area of management, planning and administration of infrastructural facilities.

Atieno and Simatwa (2012:93) indicate non-involvement of workers in the decision-making process and formulation of policies as major challenges faced in educational institutions. The current study ranked non-involvement of maintenance personnel in the decision-making

process as the most frequently experienced challenge to the implementation of TQM in the maintenance of university buildings. Findings in the present study are consistent with the findings of Sallis (2002:18); McCulloch (1993:24); Atieno, Patrick and Ogweno (2014:11).

4.6.3 Level of impact of challenges experienced

This section presents the impact of the challenges experienced by maintenance workers on the implementation of TQM during the maintenance of school buildings. Respondents were required to rate the challenges that have the greatest impact on the implementation of TQM during their maintenance activities on a five-point Likert scale where 1 = very low, 2 = low, 3 = moderate, 4 = high, and 5 = very high. Responses from each campus are presented separately.

4.6.3.1 Level of impact of challenges experienced at Bellville Campus

From Appendix G1, it is evident from the responses that non-involvement of maintenance workers in decision-making, and lack of sufficient training and education, are the challenges experienced that have the greatest impact on the implementation of TQM. Non-involvement of maintenance workers was ranked first, with a mean score of 4.05, followed by lack of sufficient training and education on quality, with a mean score of 3.82. Lack of vision within the maintenance department was ranked third, with a mean score of 3.64. The mean scores obtained for the remaining challenges ranged from 3.64 to 3.11, demonstrating a moderate level of impact.

4.6.3.2 Level of impact of challenges experienced at Cape Town Campus

The mean scores obtained, as indicated in Appendix G2, range from 4.35 to 3.11. Non-involvement of maintenance workers in decision-making was ranked as the challenge with the highest impact, with a mean score of 4.35, followed by lack of focus on stakeholders, with a mean score of 4.00. Lack of understanding between workers was ranked third, with a mean score of 3.94. The mean scores obtained for the remaining challenges range from 3.94 to 3.11. This indicates that the challenges have moderate to high impacts on the respondent's implementation of TQM.

4.6.3.3 Level of impact of challenges experienced at Mowbray Campus

From Appendix G3, it is evident that respondents perceived the lack of human and financial resources, with a mean score of 4.14, as the challenge that had the greatest impact on the implementation of TQM. This is followed by a lack of focus on school stakeholders, with a mean score of 4.00. Lack of vision within the maintenance department and the statement "maintenance workers are not involved in the formulation of policies that directly affect their

work" were ranked third, with a mean score of 3.85. The mean scores obtained for the remaining challenges range from 3.71 to 2.28, demonstrating that the rest of the challenges had moderate impacts on the implementation of TQM in their maintenance activities.

4.6.3.4 Level of impact of challenges experienced at Wellington Campus

For Wellington campus, Appendix G4 shows that lack of vision within the maintenance department was the challenge that respondents perceived to have the greatest impact on TQM implementation, with a mean score of 4.20. Respondents ranked lack of focus on stakeholders second, with a mean score of 3.80. This was followed by lack of human and financial resources and non-involvement of maintenance workers in the decision-making process, with mean scores of 3.80. The remaining challenges fell between 3.60 and 2.40. From Appendix G4, it is evident that respondents experience moderate to high impact from the challenges during the implementation of TQM.

4.6.3.5 Level of impact of challenges experienced at Granger Bay Campus

The responses obtained from Granger Bay indicate that lack of human and financial resources, with a mean score of 4.39, is the challenge that has the greatest impact on TQM implementation within the maintenance department. Appendix G5 shows that respondents ranked lack of focus on school stakeholders, with a mean score of 4.00, second, followed by non-involvement of maintenance workers in decision-making, with a mean score of 3.75. The mean scores for the remaining challenges range from 3.75 to 1.37. Respondents expressed that all the challenges had some impact on their implementation of TQM, except for resistance from supervisors to implement approved ideas, with a mean score of 1.37, which was perceived to have low impact on their implementation of TQM.

4.6.3.6 Level of impact of challenges experienced at all campuses

Regarding the challenges that have the greatest impact on the implementation of TQM of the aggregate of all campuses, the mean scores obtained, as presented in Table 4.15, were between 3.94 and 2.75. Lack of human and financial resources was ranked highest, with a mean score of 3.94, followed by non-involvement of maintenance workers in the decision-making process, with a mean score of 3.90. Lack of focus on stakeholder needs was ranked next, with a mean score of 3.81. The mean scores for the remaining challenges ranged from 3.70 to 2.75, demonstrating moderate to low impact. The two lowest ranked challenges were represented by the statements "workers lack expertise in the management of quality", with a mean score of 3.31, and "resistance from top management to implement approved ideas", with a mean score of 2.75.

Respondents reported that lack of human and financial resources to support their maintenance activities had the greatest impact on their being able to implement TQM within the maintenance department, while resistance from top management and supervisors to implement approved ideas during the execution of maintenance activities had the least impact.

Table 4.15: Level of impact of challenges experienced (Total)

Challenges	1	2	3	4	5	Total	Mean	SD	Rank
	%	%	%	%	%				
Lack of human and financial resources	0	5.6	33.3	22.2	38.9	54	3.94	0.97	1
Non-involvement of maintenance workers in the decision-making	9.3	1.9	9.3	48.1	31.5	54	3.90	1.15	2
Lack of focus on school stakeholders	1.9	3.7	37.0	25.9	31.5	54	3.81	0.99	3
Lack of vision within the maintenance department.	1.9	9.3	35.2	24.1	29.6	54	3.70	1.05	4
Maintenance workers are not involved the formulation of policies	0	5.6	42.6	35.2	16.7	54	3.62	0.83	5
Lack of understanding amongst workers	1.9	9.3	31.5	44.4	13.0	54	3.57	0.90	6
Lack of sufficient training and education on quality	5.6	3.7	37.0	37.0	16.7	54	3.55	1.00	7
Lack of clear objectives from top management	11.1	7.4	13.0	53.7	14.8	54	3.53	1.17	8
Insufficient communication network	1.9	1.9	55.6	33.3	7.4	54	3.42	0.74	9
Lack of support from top management towards quality improvement	13.0	14.8	18.5	27.8	25.9	54	3.38	1.36	10
Top management in the maintenance department does not have sufficient knowledge of maintenance activities.	1.9	1.9	61.1	27.8	7.4	54	3.37	0.73	11
Workers lack expertise in management of quality	1.9	22.2	37.0	20.4	18.5	54	3.31	1.07	12
Resistance from supervisors to implement approved ideas	44.4	5.6	1.9	25.9	22.2	54	2.75	1.72	13
OVERALL						54	3.53	1.05	

4.7 Analysis of factors that ensure effective implementation of TQM

4.7.1 Level of practice of TQM success factors

This section sought to investigate the level of practice of TQM success factors within the maintenance department. Respondents were required to rate their level of practice using a five-point Likert scale where; 1 = very low, 2 = low, 3 = moderate, 4 = high and 5 = very high. Responses from each campus are presented separately.

4.7.1.1 Level of practice of TQM success factors at Bellville Campus

The mean scores obtained in Bellville campus for the level of practice of TQM factors ranged from 3.88 for training and education of maintenance workers, to 3.23 for top management involvement. Appendix H1 indicates that all of the TQM success factors are practiced in the

maintenance department except for continuous improvement of the maintenance process, with a mean score of 3.41, empowerment of maintenance workers, with a mean score of 3.41, adequate communication networks, with a mean score of 3.35, and top management involvement, to which the respondents assigned a moderate level of practice.

4.7.1.2 Level of practice of TQM success factors at Cape Town Campus

The findings from Appendix H2 show that training and education of maintenance workers was ranked first, with a mean score of 4.00, followed by the use of statistical methods, with a mean score of 3.88. Commitment from top maintenance management was ranked third, with a mean score of 3.82. The mean scores for the remaining TQM factors range from 3.76 for benchmarking of maintenance process, to 3.47 for commitment and involvement of workers. It is evident from the above that, there is a moderate level of practice of TQM success factors in the Cape Town maintenance department.

4.7.1.3 Level of practice of TQM success factors at Mowbray Campus

In Mowbray, the mean scores obtained for the level of practice of TQM success factors ranged from 3.85 to 2.28. Respondents ranked empowerment of maintenance workers first, with a mean score of 3.85; top management involvement was ranked second, with a mean score of 3.71, followed by commitment to the satisfaction of stakeholder needs, also with a mean score of 3.71. The mean scores for the remaining TQM factors ranged from 3.57 for the use of statistical methods to 2.28 for adequate communication networks. Appendix H3 indicates that respondents identified a low level of practice of the TQM success factors.

4.7.1.4 Level of practice of TQM success factors at Wellington Campus

As shown in Appendix H4, the mean scores obtained in Wellington for the level of practice of the TQM success factors ranged from 4.00, for training and education of maintenance workers, to 3.00, for adequate communication network within the maintenance department. All the respondents responded in the moderate to high range. Training and education of maintenance workers appears to have the highest level of practice, with a mean score of 4.00, followed by empowerment of maintenance workers, with a mean score of 3.80. The use of statistical methods also had a mean score of 3.80. Adequate communication network was ranked as the least practiced TQM success factor, with a mean score of 2.28.

4.7.1.5 Level of practice of TQM success factors at Granger Bay Campus

Findings from Appendix H5 are that training and education of maintenance workers, the use of statistical methods and commitment to the satisfaction of the school stakeholders were ranked first, with mean scores of 4.75. The mean scores for the remaining success factors ranged from 4.62 to 4.00. Responses ranged from high to low. It is evident from Appendix H5 that respondents identified a high level of practice of TQM success factors.

4.7.1.6 Level of practice of TQM success factors at all Campuses

Table 4.16: Level of practice of TQM success factors (Total)

TQM success factors	1	2	3	4	5	Total	Mean	SD	Rank
	%	%	%	%	%				
Training and education of maintenance workers	0	22.2	13.0	14.8	50.0	54	3.92	1.24	1
The use of statistical methods	1.9	11.1	20.4	29.6	37.0	54	3.88	1.09	2
Commitment to the satisfaction of the school stakeholders	5.6	7.4	25.9	24.1	37.0	54	3.79	1.18	3
Commitment from top maintenance management	7.4	11.1	24.1	14.8	42.6	54	3.74	1.32	4
Benchmarking of maintenance processes	3.7	11.1	24.1	33.3	27.8	54	3.70	1.10	5
Top management involvement	3.7	5.6	35.2	31.5	24.1	54	3.66	1.02	6
Empowerment of maintenance workers	3.7	5.6	33.3	38.9	18.5	54	3.62	0.97	7
Continuous improvement of maintenance processes	3.7	7.4	37.0	37.0	14.8	54	3.51	0.96	8
Commitment and involvement of workers	11.1	7.4	14.8	61.1	5.6	54	3.42	1.09	9
Adequate communication network	9.3	3.7	31.5	53.7	1.9	54	3.35	0.95	10
OVERALL						54	3.66	1.09	

In a study carried out by Badri and Davis (1995:314), data was obtained from 424 quality management personnel in the United Arab Emirates on the validity and reliability of eight critical TQM success factors practiced in the organisation. Findings from the study provided concrete evidence that training and education, customer satisfaction, use of statistics for measurement and evaluation and top management involvement were found to be the most successfully implemented TQM factors. Respondents further indicated that these success factors were the most reliable and valid critical success factors of TQM. A similar study was done by Owlia and Aspinwall (1997:530) for the same purpose. The study obtained data from 124 people and involved the quality of education in Europe, India, Australia and the United States. The results indicated that commitment from top management, education and training and student focus were the most practiced and reliable CSF's of TQM.

Tang and Zairi's (1998:675) survey on the implementation of TQM in financial services and higher education produced similar results. Employee training, leadership, process improvement, benchmarking and employee involvement were confirmed to have the highest level of practice. Similarly, Bayraktar, *et al*. (2008:583) examined 11 CSF's of TQM in a

higher education institution. A sample of 144 academics from 22 institutions of higher learning provided the data for the survey and their perception regarding the extent of practice of CSF's was tested.

The findings of the study confirmed leadership, training and education, use of statistics for process control, focus on students and other stakeholders were the most practiced CSF's. Kanji and Malek (1999:137) conducted an exploratory study on TQM practices at institutions of higher learning in the US and Malaysia. Findings of the study suggest that top management support, use of statistics for measurement and evaluation, employee involvement and stakeholders focus are the most practiced CSF's.

4.7.2 Statement on TQM success factors

This section sought to explore the knowledge of the respondents about the extent to which TQM success factors were practiced. Respondents were required to describe their level of agreement with 10 statements on the practice of TQM success factors using a five-point Likert scale where; 1 = strongly disagree, 2 = disagree, 3 = somewhat agree, 4 = agree and 5 = strongly agree. Responses from each campus are presented separately.

4.7.2.1 Perception of TQM success factors at Bellville Campus

Appendix I1 shows that the mean scores obtained for all the responses are above the midpoint average. This indicates that respondents tend to agree with all the statements. The success factor "Involvement of top management promotes growth within the maintenance department" was ranked first, with a mean score of 4.58, while "benchmarking of maintenance processes helps to drive specific performance improvements within the maintenance department" was ranked second, with a mean score of 4.41. This was followed by "continuous improvement of maintenance processes promotes the progress and development of the maintenance department", with a mean score of 4.41. The mean score for the remaining statements ranged from 4.35 to 4.11. "Training and education of maintenance workers assists in the achievement and improvement of maintenance activities" was the lowest-ranked statement, with a mean score of 4.11.

4.7.2.2 Perception of TQM success factors at Cape Town Campus

Appendix I2 presents responses from respondents in Cape Town campus with regards to their knowledge of the practice of TQM. The mean scores of all the responses were above average, indicating that respondents were in agreement with all the statements. The statement "top management involvement promotes growth within the maintenance department" was ranked first, with a mean score of 4.58. The statement "the use of statistical

methods enhances easier monitoring and control of maintenance processes" was ranked second, with a mean score of 4.52. This was followed by "benchmarking of maintenance processes helps to drive specific performance improvements within the maintenance department", with a mean score of 4.35. The mean scores for the remaining responses ranged from 4.29 to 4.00.

4.7.2.3 Perception of TQM success factors at Mowbray Campus

Appendix I3 indicates that respondents ranked the statement "top management involvement promotes growth within the maintenance department" first, with a mean score of 4.57, followed by "benchmarking of maintenance processes helps to drive specific performance improvements within the maintenance department" and "empowerment of maintenance workers encourages the use of their expertise and knowledge to improve the maintenance activities", with mean scores of 4.42 each. The statement "the use of statistical methods enhances easier monitoring and control" was also ranked second, with a mean score of 4.42. The mean scores for the remaining statements ranged from 4.28 to 3.14. Looking at the mean scores obtained, it can be deduced that respondents tended to agree with all of the statements.

4.7.2.4 Perception of TQM success factors at Wellington Campus

The responses obtained from Wellington indicate that respondents strongly agreed that training and education of maintenance workers assists in the achievement and improvement of maintenance activities, as this factor attained a mean score of 5.00. The statement "the use of statistical methods enhances easier monitoring and control of maintenance activities" was ranked second, with a mean score of 4.80, and this was followed by "top management involvement promotes growth within the maintenance department" and "benchmarking of maintenance processes helps to drive specific performance improvements within the maintenance department" with mean scores of 4.60. Appendix I4 shows that the mean scores for the remaining statements ranged from 4.20 to 3.80. It is evident that respondents agreed with all the statements regarding of TQM success factors.

4.7.2.5 Perception of TQM success factors at Granger Bay Campus

Appendix I5 presents responses from respondents in Granger Bay campus. The mean scores obtained ranged from 5.00 to 4.75. This indicates that respondents were in general agreement with all the statements regarding TQM success factors.

4.7.2.6 Perception of TQM success factors at all Campuses

Table 4.17 shows the aggregate responses from all respondents across all the campuses. The mean scores obtained ranged from 4.57 to 4.16. The statement “benchmarking of maintenance processes helps to drive specific performance improvements within the maintenance department” was ranked first, with a mean score of 4.57. The statement “top management involvement promotes growth within the maintenance department” was ranked second, with a mean score of 4.57 and S.D of 0.68, followed by the statement “use of statistical methods enhances easier monitoring and control of maintenance processes”, which had a mean score of 4.51. The mean scores for the remaining statement ranged from 4.33 to 4.16. This indicates that respondents were in general agreement with all the statements on TQM success factors.

These findings are consistent with the findings of Curry and Kadasah (2002), McAdam and Jackson (2002), Curry and Magad (2003), Yang (2004), Hill and Wilkinson (1995); Ross (1999), as well as Evan and Lindsay (2001). These authors carried out studies on the key elements required for the successful implementation of TQM by exploring different perspectives. Baidoun (2000:87), Saylor (1996), and Hacket and Spurgeon (1998) view the involvement of top management as a major requirement for the successful implementation of TQM. Zairi (2005:217) suggests that the commitment and involvement of workers is a major aspect of the TQM effort. However, for an organisation to be successful, workers should be involved in making decisions, so as to assist with providing improvements in operations and processes.

A study carried out by Ahire and Waller (1996:36) holds that the empowerment of workers cannot be said to be effective, if workers haven’t received training in the management of quality. Burati and Oswald (1992), Chase (1993), and Oakland (2000) identify training of employees as an important factor for the improvement of any process, and for TQM to be successful. Saylor (1996) and Powell (1995) argue that the commitment to ensuring customer satisfaction is key to total management of quality. Shibani, Saidani and Sagoo (2012:18) support these findings by emphasising that the focus on both internal and external customer satisfaction is a requirement for the successful practice of TQM.

Table 4.17: Statement regarding TQM success factors (Total)

TQM success factors	1	2	3	4	5	Total	Mean	SD	Rank
	%	%	%	%	%				
Benchmarking of maintenance processes helps to drive specific performance improvements within the maintenance department	0	0	7.4	27.8	64.8	54	4.57	0.63	1
Top management involvement promotes growth within the maintenance department	0	1.9	5.6	25.9	66.7	54	4.57	0.68	2
The use of statistical methods enhances easier monitoring and control of maintenance processes	0	0	11.1	25.9	63.0	54	4.51	0.69	3
Empowerment of maintenance workers encourages the use of their expertise and knowledge to improve the maintenance activities	0	0	16.7	27.8	55.6	54	4.33	0.76	4
Commitment to the satisfaction of the school stakeholders is the most important requirement for the sustainability of the maintenance department	0	0	14.8	38.9	46.3	54	4.31	0.72	5
Continuous improvement of maintenance processes promotes the progress and development of maintenance department	0	0	20.4	27.8	51.9	54	4.31	0.79	6
Training and education of maintenance workers assists in the achievement and improvement of maintenance activities	3.7	1.9	11.1	29.6	53.7	54	4.27	0.99	7
Adequate communication network facilitates exchange of information within the maintenance department	3.7	1.9	11.1	35.2	48.1	54	4.22	0.98	8
Commitment and involvement of workers enhances the level of decision-making in the maintenance department	3.7	3.7	9.3	37.0	46.3	54	4.18	1.01	9
Commitment from top maintenance management	0	0	27.8	27.8	44.4	54	4.16	0.84	10
OVERALL						54	4.34	0.81	

The findings of Kanji (1993), indicate that proper communication is an important factor in making TQM achievable. An adequate communication network facilitates the exchange of ideas between the management, workers and external stakeholders (Sanders, 1994). A study carried out by Yossef (2006:84) shows that 19 factors are perceived as being critical for TQM to be successfully implemented. Ten of these factors were recognised as critical factors. These factors revolved around the involvement of top management, quality management structures to ensure achievement of quality standards, statistical evaluation for proper monitoring of activities, empowerment and involvement of workers, clear and consistent communication, proper and detailed identification of customer needs, continuous improvement and problem solving based on facts, training of employees and commitment of employees. These findings align with the results obtained from this study.

4.8 Testing of hypotheses

4.8.1 Test for normality

Table 4.18 shows that perception of the practice of TQM (hypotheses 1) has a significance of 0.06 in the Shapiro-Wilk test, suggesting that there was a normal distribution. The importance of TQM practices (hypotheses 1) has a significance level of 0.64, indicating that there was a normal distribution. Extent of TQM practices (hypothesis 1) has a significance of 0.00 suggesting that the distribution was not normal. Therefore, hypothesis 1 was tested with the ANOVA and Kruskal-Wallis test.

For the challenges experienced in implementation of TQM (hypotheses 2) the test for normality indicates that 0.00 was obtained as the significance level, suggesting that there was a non-normal distribution. The impact of TQM challenges has a significance of 0.36, indicating a normal distribution. However, for hypotheses 2, the Kruskal-Wallis test and ANOVA test was adopted. The normality of level of practice of TQM success factors (hypotheses 3) was 0.00, and perception on TQM success (hypotheses 3) was 0.00, indicating a non-normal distribution. The Kruskal-Wallis test was applied to test hypotheses 3.

Table 4.18: Test for normality

Hypotheses	Factors	Kolmogorov-Smirnov			Shapiro-Wilk			Test
		Statistic	df	Sig.	Statistic	df	Sig.	
1	Perception of the practice of TQM	0.13	54	0.17	0.93	54	0.06	ANOVA
1	Importance of TQM practices	0.08	54	0.20	0.98	54	0.64	ANOVA
1	Extent of TQM practices	0.16	54	0.01	0.87	54	0.00	Kruskal-Wallis
2	Challenges experienced in TQM implementation	0.25	54	0.00	0.73	54	0.00	Kruskal-Wallis
2	Impact of TQM challenges	0.06	54	0.20	0.97	54	0.36	ANOVA
3	Level of practice of TQM success factors	0.20	54	0.00	0.89	54	0.00	Kruskal-Wallis
3	Perception of TQM success factors	0.15	54	0.03	0.90	54	0.00	Kruskal-Wallis

4.8.2 Implementation of TQM

The hypothesis on the implementation of TQM is stated as follows:

H1. There is no statistical difference in workers' affiliated campuses, workers' positions and their perception of the extent of TQM practices in the maintenance of school building facilities.

4.8.2.1 Practice of TQM

4.8.2.1.1 Workers' affiliated campuses perception of the practice of TQM subjected to ANOVA test

Table 4.19 and Table 4.20 present the results of the ANOVA test carried out to determine whether there is any variance (s2) between the workers' affiliated campuses with regards to their perception of the practice of TQM. The highest campus ranked was Wellington, with a mean score of 4.67, followed by Granger Bay, with a mean score of 4.65. Mowbray was ranked third, with a mean score of 4.84, followed by Cape Town, with a mean score of 4.60. Bellville was ranked the lowest, with a mean score of 4.50.

Table 4.19: Descriptive: practice of TQM perceived by workers' affiliated campuses

Campuses	N	Mean	Std.Dev	Std.Error	95% Confidence Interval for Mean		Mean Minimum	Mean Maximum
					Lower Bound	Upper Bound		
Wellington	5	4.67	0.25	0.11	4.36	4.98	4.29	4.93
Granger Bay	8	4.65	0.24	0.08	4.44	4.85	4.29	4.93
Mowbray	7	4.64	0.15	0.05	4.50	4.78	4.43	4.86
Cape Town	17	4.60	0.19	0.04	4.50	4.70	4.14	4.93
Bellville	17	4.50	0.30	0.07	4.34	4.66	3.93	4.93
TOTAL	**54**	**4.59**	**0.24**	**0.03**	**4.52**	**4.65**	**3.93**	**4.93**

Table 4.20: Analysis of variance (ANOVA): practice of TQM in workers' affiliated campuses

Practice of TQM	Sum of squares	Df	Mean Square	F	Sig.
Between groups	0.21	4	0.53	0.88	**0.47**
Within groups	2.92	49	0.60		
TOTAL	313	53			

Table 4.20 shows that the significance level obtained from the ANOVA test was 0.47, indicating that there was no statistical difference between workers' affiliated campuses and their perception of the practice of TQM. The finding from this study is supported by Sudhakar and Geetanjali (2016:14). The t-test was carried out to find variations in the average responses between the various campuses of the college in the perception of stakeholders on the practice of TQM. The results from the t-test conducted revealed that a 5% level of significance was discovered, indicating no significant variance in the responses between the

affiliated campuses. Therefore, there is not enough evidence to reject the null hypothesis. Hypothesis H1 is, however, accepted.

4.8.2.1.2 Workers' position regarding the perception of the practice of TQM, subjected to ANOVA

In Table 4.21, the results of the descriptive test with regard to the perception of the practice of TQM relating to the position of workers is shown. Top management, with a mean score of 4.84 was ranked highest, followed by labourer, with a mean score of 4.61. Clerk of works was ranked third, with a mean score of 4.58, followed by technician, with a mean score of 4.56. Others (4.51) and foreman (4.50) were ranked lowest. The result from the ANOVA test conducted is presented in Table 4.22. It indicates a significance level of 0.20, which implies that there was no statistical significant difference between the workers' positions and their perception of the practice of TQM.

Findings in the present study are consistent with the findings of Al-Quarti (2007), who conducted a survey of the opinion of faculty members on the level of practice of TQM in the educational process at Kuwait University. Findings from the study indicate that faculty members disagreed that TQM was fully implemented in the University, despite the availability of adequate resources. The findings suggested that there was no statistical difference in the responses of the faculty members as regard to gender, position, nationality, age and years of experience.

Contrary to the findings of Atieno, Patrick and Ogweno (2014:8), it was revealed that a significant difference existed in the responses of the top management team, academic heads of departments, lecturers, support staff and students regarding their perceptions on the practice of TQM. The results of the study reveal that top management argued that TQM was practiced correctly, while the lecturers, support staff and students thought otherwise.

Table 4.21: Descriptive: workers' positions in the practice of TQM

Practice of TQM	N	Mean	Std.Dev	Std.Error	95% Confidence Interval for Mean		Mean Minimum	Mean Maximum
					Lower Bound	Upper Bound		
Top Management	6	4.84	0.09	0.03	4.74	4.94	4.71	4.93
Labourer	8	4.61	0.18	0.06	4.46	4.76	4.29	4.79
Clerk of Works	5	4.58	0.27	0.12	4.23	4.93	4.14	4.86
Technician	13	4.56	0.33	0.09	4.36	4.76	3.93	4.93
Supervisor	9	4.55	0.21	0.07	4.38	4.72	4.29	4.86
Others	4	4.51	0.12	0.06	4.32	4.71	4.36	4.64
Foreman	9	4.50	0.19	0.06	4.35	4.65	4.29	4.79
TOTAL	**54**	**4.59**	**0.24**	**0.03**	**4.52**	**4.6577**	**3.93**	**4.93**

Table 4.22: Analysis of variance (ANOVA): workers' positions in the practice of TQM

Practice of TQM	Sum of squares	Df	Mean Square	F	Sig.
Between groups	0.49	6	0.08	1.47	0.20
Within groups	2.64	47	0.05		
TOTAL	**3.13**	**53**			

4.8.2.2 Importance of TQM practices

4.8.1.2.1 Workers' affiliated campuses perception of the importance of TQM subjected to ANOVA

The ANOVA test was carried out to determine if there was a statistical difference between the perceptions of workers' affiliated campuses on the importance of TQM. Table 4.23 shows the descriptive test on the importance of TQM practices as perceived by workers' affiliated campuses. Granger Bay was ranked highest, with a mean score of 4.69 followed by Mowbray, with a mean score of 4.50. Cape Town and Wellington were ranked lowest, with mean scores of 4.49 and 4.41 respectively. Table 4.24 presents results from the ANOVA test carried out. It was revealed that there was no statistical difference ($p = 0.14$) between the workers' affiliated campuses and their perception of the importance of TQM practices.

Table 4.23: Descriptive: importance of TQM practices as perceived by workers' affiliated campuses

Practice of TQM	N	Mean	Std.Dev	Std.Error	95% Confidence Interval for Mean		Mean Minimum	Mean Maximum
					Lower Bound	Upper Bound		
Granger Bay	8	4.69	0.17	0.06	4.55	4.83	4.45	4.90
Mowbray	7	4.60	0.16	0.06	4.45	4.75	4.26	4.74
Bellville	17	4.50	0.28	0.07	4.35	4.65	4.00	5.00
Cape Town	17	4.49	0.19	0.04	4.39	4.59	3.97	4.74
Wellington	5	4.41	0.16	0.07	4.20	4.61	4.16	4.61
TOTAL	**54**	**4.53**	**0.22**	**0.03**	**4.47**	**4.59**	**3.97**	**5.00**

Table 4.24: Analysis of variance (ANOVA): importance of TQM in workers' affiliated campuses

Practice of TQM	Sum of squares	Df	Mean Square	F	Sig.
Between groups	0.35	4	.088	1.78	0.14
Within groups	2.42	49	.049		
TOTAL	**2.77**	**53**			

4.8.2.2.2 Workers' position regarding the perception on the importance of TQM practices subjected to ANOVA test

The study presents results of the ANOVA test carried out on workers' positions and their perceptions of the importance of TQM. Descriptives of workers' positions and their perceptions of the importance of TQM practices are shown in Table 4.25. The highest ranked position was top management, with a mean score of 4.69, followed by others, with a mean score of 4.63. Clerk of works and foreman were ranked lowest, with mean scores of 4.45 and 4.44 respectively. The ANOVA test carried out revealed a significance level of 0.22, which indicates that there was no statistical difference between workers' positions as regards their perception of the importance of TQM practices (see Table 4.26). Therefore, the hypothesis that there is no significance between workers' affiliated campuses and the workers' positions regarding their perception of the importance of TQM practices cannot be rejected.

Table 4.25: Descriptive: workers' positions in the importance of TQM practices

Practice of TQM	N	Mean	Std.Dev	Std.Error	95% Confidence Interval for Mean		Mean Minimum	Mean Maximum
					Lower Bound	Upper Bound		
Top Management	6	4.69	0.21	0.08	4.46	4.91	4.42	4.87
Others	4	4.63	0.30	0.15	4.15	5.11	4.26	5.00
Supervisor	9	4.62	0.16	0.05	4.50	4.75	4.39	4.90
Technician	13	4.49	0.24	0.06	4.34	4.63	4.00	5.00
Labourer	8	4.46	0.19	0.06	4.30	4.62	4.23	4.74
Clerk of Works	5	4.45	0.22	0.09	4.18	4.73	4.16	4.71
Foreman	9	4.44	0.24	0.08	4.25	4.63	3.97	4.74
TOTAL	**54**	**4.53**	**0.22**	**0.03**	**4.47**	**4.59**	**3.97**	**5.00**

Al-Amri and Bon's (2012:70) hypothesised that there are no significant differences at the level of significance for the faculty members regarding their perception of the importance of

total quality management in Yemeni universities according to the variable of workers' positions. The one-way analysis of variance test was for differences in the responses of the respondents. The results obtained indicate that there was no statistical variance in the responses of the respondents.

Table 4.26: Analysis of variance (ANOVA): workers' positions in the importance of TQM practices

Practice of TQM	Sum of squares	Df	Mean Square	F	Sig.
Between groups	0.42	6	0.07	1.43	0.22
Within groups	2.34	47	0.05		
TOTAL	**2.77**	**53**			

4.8.2.3 Extent of TQM practice

4.8.2.3.1 The perception of workers' affiliated campuses of the extent of TQM practice subjected to Kruskal-Wallis test.

The test statistics for each campus group are shown in Table 4.27. The results for the test of statistics is reported as H (4) = 4.04; p = 0.40. The result from the test of statistics indicates that no statistical difference exists between the workers' affiliated campuses on their perception on how well TQM is practiced. In a study carried conducted by Serafimovska and Ristova (2010:26) it was discovered that the extent to which TQM is practiced could vary between different branches of an organisation.

A similar study was conducted by Al-Amri and Bon (2012:67) on the areas of TQM in Yemini universities. A t-test was carried out to determine the variances that exist in the responses obtained at the different colleges of a university. Findings from the study indicate that there was no significant difference in the perception of university workers regarding the areas of TQM in Yemeni Universities. This confirms the hypothesis for the current study.

Table 4.27: Test statistics related to the extent of TQM practices of workers' affiliated campuses

Total (N)	54
Test statistic	4.04
Degree of freedom	4
Asymp. Sig	0.40

4.8.2.3.2 Workers' positions on the extent of TQM practice subject to the Kruskal-Wallis test

In a Table 4.28, the test of statistics for workers' positions is shown and reports H (6) = 5.03; p = 0.53. The results from the test of statistics show that there is no significant statistical difference between the groups.

A similar study was conducted by Jersey (2004) and provided results contrary to the findings of this study. Jersey (2004) aimed to investigate the extent of application of TQM at Birzeit University. The study measured the level of satisfaction of faculty members, administrative staff and students as regard to the application of TQM in the institution. The study revealed a significant difference between the response of faculty members and students regarding the relationship of the university with students and satisfaction with the administrative and academic processes. There was a low level of satisfaction amongst students**.** Contrary to the findings in Jersey's study, there was no variance in the response of respondents for the current study.

Furthermore, Dettman's (2004:101) study to ascertain the perception of university employees on the implementation of the Malcolm Baldridge Quality (MBNQA) framework at the University of Wisconsin Stout contradicts the findings of the current study. The data obtained was analysed using the ANOVA test. The study sought to investigate what differences existed in the perceptions of support staff, faculty members and administrators on the extent to which the university fulfilled the MBNQA criteria.

The result of the ANOVA test revealed a significant difference between groups. Therefore, a Tukey post-hoc test was carried out to determine where the difference lay between the respondents. The post-hoc test revealed that there was a statistical difference in the responses of the administrative positions when compared to the responses of the support staff and faculty staff. The test indicated that administrative staff had a more positive perception on how well leadership, information and analysis, and process management was practiced, unlike the other groups of employees.

Table 4.28: Test statistics related to the extent of TQM practices of workers' positions

Total (N)	54
Test statistic	5.03
Degree of freedom	6
Asymp. Sig	0.53

4.8.3 Challenges experienced in the implementation of TQM

The hypotheses concerning the challenges experienced in the implementation of TQM are stated as follows:

H2. There is no statistical difference in workers' affiliated campuses and positions regarding their perception of the challenges faced during the implementation of TQM in the maintenance of school buildings.

4.8.3.1 Frequency of challenges experienced in TQM implementation

4.8.3.1.1 Workers' affiliated campuses perception of the challenges experienced in the implementation of TQM subjected to the Kruskal-Wallis test

The results in Table 4.29 show that no statistical difference exists in workers' affiliate campuses on the challenges experienced during TQM implementation (H (4) = 9.08 ; p = 0.59). The asymp. Sig (p-value) was 0.05. Therefore, the hypothesis is rejected.

Table 4.29: Test statistics related to the challenges experienced in the implementation of TQM in workers' affiliated campuses

Total (N)	54
Test statistic	9.08
Degree of freedom	4
Asymp. Sig	0.59

4.8.3.1.2 Workers' positions on the challenges experienced in the implementation of TQM practice subject to the Kruskal-Wallis test

Table 4.30 shows the test of statistics in workers' positions on the challenges experienced during implementation of TQM. The test revealed no significant difference amongst the groups (H (6) =12.80; p= 0.46). The asymp. Sig (p-value) was 0.46, indicating that there was no variance in the responses of workers based on their positions. A study conducted by Suleman and Gul (2015: 128) on the challenge to successful TQM implementation in public secondary schools differs from tthe findings of the current study.

Perceptions of principals and teachers were examined regarding the extent to which challenges to TQM implementation were experienced. Responses of both groups on the challenges experienced were similar, except for "lack of co-operation and insubordination of the workforce". The responses of the principals were more positive than the responses of the teachers.

Table 4.30: Test statistics related to the challenges experienced in the implementation of TQM in workers' positions

Total (N)	54
Test statistic	7.69
Degree of freedom	8
Asymp. Sig	0.46

4.8.3.2 Impact of challenges experienced in the implementation of TQM

4.8.3.2.1 Workers' affiliated campuses perception of the impact of challenges experienced in the implementation of TQM subjected to the ANOVA test

It is apparent from the descriptive on the impact of TQM challenges as perceived by workers' affiliated campuses, shown in Table 4.31, that Cape Town was ranked highest, with a mean score of 3.76, followed by Bellville, with a mean score of 3.51. Respondents ranked Mowbray third, with a mean score of 3.39. Wellington and Granger Bay were ranked lowest, with mean scores of 3.33 and 3.31 respectively. The data in Table 4.32 indicates that, after conducting the analysis of variance test, a significance level of 0.43 was found. This shows that there is no statistical difference in the impact of TQM challenges between workers' affiliated campuses.

Table 4.31: Descriptive: impact of TQM challenges as perceived by workers' affiliated campuses

Impact of challenges	N	Mean	Std.Dev	Std.Error	95% Confidence Interval for Mean		Mean Minimum	Mean Maximum
					Lower Bound	Upper Bound		
Cape Town	17	3.76	0.68	0.16	3.41	4.12	2.62	4.85
Bellville	17	3.51	0.58	0.14	3.21	3.81	2.31	4.69
Mowbray	7	3.39	0.88	0.33	2.57	4.21	2.38	4.62
Wellington	5	3.33	0.88	0.39	2.24	4.43	2.38	4.38
Granger Bay	8	3.31	0.18	0.06	3.16	3.46	3.08	3.62
TOTAL	**54**	**3.53**	**0.65**	**0.08**	**3.35**	**3.71**	**2.31**	**4.85**

Table 4.32: Analysis of variance (ANOVA): impact of TQM challenges on workers' affiliated campuses

Practice of TQM	Sum of squares	Df	Mean Square	F	Sig.
Between groups	1.65	4	0.41	0.96	0.43
Within groups	21.03	49	0.42		
TOTAL	**22.68**	**53**			

4.8.3.2.2 Workers' positions on the impact of challenges experienced in the implementation of TQM subjected to the ANOVA test

From Table 4.33, results of the descriptive test on the impact of TQM challenges related to workers' positions are shown. Foreman was ranked first, with a mean of 4.04, followed by other positions, with a mean score of 3.92, then clerk of works, with a mean score of 3.60. Labourer and top management were ranked lowest, with mean scores of 3.17 and 3.08 respectively. The results from the ANOVA test carried out, as seen in Table 4.34, indicate that a significance level of 0.03 was obtained, which is less than 0.05. These findings suggest that there is a significant difference between workers' positions as regard to the impact of TQM challenges in the maintenance of school buildings. Therefore, the hypothesis cannot be accepted.

Table 4.33: Descriptive: impact of TQM challenges in workers' positions

Impact of challenges	N	Mean	Std.Dev	Std.Error	95% Confidence Interval for Mean		Mean Minimum	Mean Maximum
					Lower Bound	Upper Bound		
Foreman	9	4.04	0.44	0.14	3.69	4.38	3.54	4.85
Others	4	3.92	1.11	0.55	2.15	5.69	2.31	4.69
Clerk of Works	5	3.60	0.45	0.20	3.02	4.17	3.08	4.23
Technician	13	3.60	0.58	0.16	3.25	3.95	2.62	4.38
Supervisor	9	3.32	0.58	0.19	2.88	3.77	2.62	4.69
Labourer	8	3.17	0.72	0.25	2.56	3.78	2.38	4.08
Top Management	6	3.08	0.26	0.10	2.81	3.36	2.77	3.31
TOTAL	**54**	**3.53**	**0.65**	**0.08**	**3.35**	**3.71**	**2.31**	**4.85**

Table 4.34: Analysis of variance (ANOVA): workers' positions on the impact of TQM challenges

Impact of challenges	Sum of squares	Df	Mean Square	F	Sig.
Between groups	5.64	6	0.94	2.59	0.03
Within groups	17.04	47	0.36		
TOTAL	**22.685**	**53**			

A post-hoc analysis was conducted to investigate where the statistical variance lies between the workers' positions. A post-hoc procedure is designed to compare the combination of different groups. The Games-Howell post-hoc procedure was adopted, because the population variance for the positions differs. According to Field (2003:459) the Games-Howell test is the most powerful but liberal procedure, used when sample sizes are small. It is also suitable for an unequal sample size.

Table 4.35: Analysis of post-hoc test for workers' positions on the impact of TQM challenges

Impact of challenges		Mean Difference	Std. Error	Sig.	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Top Management	Supervisor	-0.23	0.22	0.93	-1.01	0.54
	Foreman	-0.95	0.18	0.00	-1.58	-0.31
	Clerk of Works	-0.51	0.23	0.40	-1.47	0.44
	Technician	-0.51	0.19	0.17	-1.15	0.13
	Labourer	-0.08	0.27	1.00	-1.11	0.94
	Administrator	-0.83	0.56	0.75	-4.05	2.38
Supervisor	Top Management	0.23	0.22	0.93	-0.54	1.01
	Foreman	-0.71	0.24	0.11	-1.55	0.11
	Clerk of Works	-0.27	0.28	0.95	-1.29	0.74
	Technician	-0.27	0.25	0.92	-1.12	0.56
	Labourer	0.15	0.32	0.99	-0.95	1.26
	Administrator	-0.59	0.58	0.92	-3.63	2.43
Foreman	Top Management	0.95	0.18	0.00	.317	1.58
	Supervisor	0.71	0.24	0.11	-0.11	1.55
	Clerk of Works	0.44	0.25	0.61	-0.52	1.40
	Technician	0.43	0.21	0.44	-0.27	1.15
	Labourer	0.86	0.29	0.13	-0.18	1.92
	Administrator	0.11	0.57	1.00	-3.01	3.25
Clerk of Works	Top Management	0.51	0.23	0.40	-0.44	1.47
	Supervisor	0.27	0.28	0.95	-0.74	1.29
	Foreman	-0.44	0.25	0.61	-1.40	0.52
	Technician	-0.03	0.26	1.00	-0.96	0.95
	Labourer	0.42	0.32	0.84	-0.74	1.59
	Administrator	-0.32	0.59	0.99	-3.35	2.70
Technician	Top Management	0.51	0.19	0.17	-0.13	1.15
	Supervisor	0.27	0.25	0.92	-0.56	1.12
	Foreman	-0.43	0.21	0.44	-1.15	0.27
	Clerk of Works	0.03	0.26	1.00	-0.95	0.96
	Labourer	0.43	0.30	0.78	-0.62	1.48
	Administrator	-0.31	0.57	0.99	-3.42	2.78
Labourer	Top Management	0.08	0.27	1.00	-0.94	1.11
	Supervisor	-0.15	0.32	0.99	-1.26	0.95
	Foreman	-0.86	0.29	0.13	-1.92	0.18
	Clerk of Works	-0.42	0.32	0.84	-1.59	0.74
	Technician	-0.43	0.30	0.78	-1.48	0.62
	Administrator	-0.75	0.61	0.85	-3.67	2.17

Impact of challenges		Mean Difference	Std. Error	Sig.	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Administrator	Top Management	0.83	0.56	0.75	-2.35	4.05
	Supervisor	0.59	0.58	0.92	-2.43	3.63
	Foreman	-0.11	0.57	1.00	-3.25	3.01
	Clerk of Works	0.32	0.59	0.99	-2.70	3.35
	Technician	0.31	0.57	0.99	-2.78	3.42
	Labourer	0.75	0.61	0.85	-2.17	3.67

Results from the post-hoc test are presented in Table 4.35. Findings reveal that the only groups that differed significantly were top management and foreman.

4.8.4 Factors for effective implementation of TQM

The hypotheses on the factors for the effective implementation of TQM are stated as follows:

H3. There is no statistical difference in workers' affiliated campuses and positions regarding their perception of the factors that ensure successful implementation of TQM in the maintenance of school building facilities.

4.8.4.1 Level of practice of TQM success factors

4.8.4.1.1 Level of practice of TQM success factors in workers' affiliated campuses subjected to the Kruskal-Wallis test

In Table 4.36, the test of statistics for the level of practice in workers' affiliated campuses is presented as H (4) = 8.40; p = 0.07. The test revealed a significance level of 0.07, indicating that there is no significant difference in the perception of workers' affiliated campuses of the level of practice of TQM success factors.

Table 4.36: Test of statistics related to level of practice of TQM success factors in workers' affiliated campuses

Total (N)	54
Test statistic	8.40
Degree of freedom	4
Asymp. Sig	0.07

4.8.4.1.2 Level of practice of TQM success factors in workers' positions subjected to Kruskal-Wallis test

The test of statistics for the level of practice of TQM success factors in workers' perceptions is presented in Table 4.37. The result indicates H (8) = 7.88; p = 044. Findings reveal that there is no statistical difference in the perception of TQM success factors as regards workers' positions as a result of the Asymp.sig (p-value) of 0.01 obtained. The findings from

the current study differ from Atieno *et al.* (2014:16). A correlation analysis was conducted for the responses of students, lecturers, administrators and top management on level of implementation of TQM success factors. The results from the study indicated that top management and administrators agreed with each other on the level at which TQM success factors were implemented, while there was a disparity in the responses of the lecturers and students.

Table 4.37: Test of statistics related to the level of TQM success factors in workers' positions

Total (N)	54
Test statistic	7.88
Degree of freedom	8
Asymp. Sig	0.44

4.8.4.2 Perception of TQM success factors

4.8.4.2.1 Workers' affiliated campuses perception of TQM success factors subjected to Kruskal-Wallis test

The results from the test of statistics for the perception of workers' affiliated campuses of TQM success factors are presented in Table 4.38. The results are shown as H (4) = 12.23; p = 0.01. A significance level of 0.01 was obtained. This indicates a significant difference in the perception of workers' affiliated campuses of TQM success factors.

The current study is supported by the findings of Sudhakar and Geentaji (2016:15). Student's perceptions regarding the practice of TQM success factors were tested within and between groups of institutions with the one-way analysis of variance. The mean difference between and within the groups was calculated with the F-ratio. A significance level of 0.05 was discovered. The study revealed that all the critical factors play a crucial role in the implementing of TQM with respect to different colleges. The study found that in one of the institutions, there was a significant difference regarding the perception of the practice of customer satisfaction from other institutions.

Table 4.38: Test of statistics related to TQM success factors in workers' affiliated campuses

Total (N)	54
Test statistic	12.23
Degree of freedom	4
Asymp. Sig	0.01

The Dunn-Bonferroni post-hoc method was used to compare the combination of different groups following a significant Kruskal-Wallis test. A pairwise comparison was conducted amongst and between the groups to determine where the significant difference lay. Results obtained from the post-hoc test are presented in Table 4.39. Findings reveal that a significant difference exists between respondents in Mowbray and Granger Bay (p = 0.02), Bellville and Granger Bay (p=0.02), and between Cape Town and Granger Bay (p = 0.03) regarding their perception on TQM success factors.

Table 4.39: Post-hoc test

Sample 1- Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig	Adj. Sig.
Mowbray vs Bellville	4.40	7.03	0.62	0.53	1.00
Mowbray vs Cape Town	5.02	7.03	0.71	0.47	1.00
Mowbray vs Wellington	-7.28	9.16	0.79	0.42	1.00
Mowbray vs Granger Bay	-25.59	8.10	3.03	0.00	0.02
Bellville vs Cape Town	-0.61	5.37	0.11	0.90	1.00
Bellville vs Wellington	-2.88	7.96	0.36	0.71	1.00
Bellville vs Granger Bay	-20.19	6.71	3.00	0.00	0.02
Cape Town vs Wellington	-2.26	7.96	2.84	0.77	1.00
Cape Town vs Granger Bay	-19.57	6.71	2.91	0.00	0.03
Wellington vs Granger Bay	-17.31	8.92	1.94	0.05	0.52

4.8.4.2.2 Perception of TQM success factors in workers' positions subjected to Kruskal-Wallis test

The Kruskal-Wallis test was used to determine whether any significant difference exist between the perceptions of workers on TQM success factors, based on their positions. The results of the test of statistics in Table 4.40 show H (8) = 14.30; p=0.07. The findings revealed that no significant difference exists among the groups, since a significance level of 0.07 was obtained. Atieno *et al.* (2014:16) compared the perception of top management, administrators, lecturers and students regarding the practice of TQM success factors in higher learning institutions. Findings from the study revealed a high correlation between the responses of all the groups. This indicates that there was a similar perception about the practice of TQM success factors. The findings from this study support the results obtained for the current study.

Table 4.40: Test of statistics related to TQM success factors in workers' positions

Total (N)	54
Test statistic	14.30
Degree of freedom	8
Asymp. Sig	0.07

4.9 Chapter Summary

The responses obtained from the questionnaire were analysed. Closed-ended questions were interpreted using the Statistical Package for Social Sciences (SPSS) by means of frequencies, descriptive statistics and inferential statistics. The reliability of scaled questions was tested with the use of Cronbach's alpha coefficient. The value of the co-efficient was 0.84, indicating that the responses to scaled questions were reliable. Findings from the analysis were discussed and linked to the literature review.

Regarding the extent to which TQM was practiced, it was discovered that the maintenance department implemented the key elements of TQM in their maintenance activities. Results indicate that people involvement, process approach, customer focus and system management are the most implemented TQM practices. The Kruskal-Wallis test was conducted to determine if there were significant differences between responses from the workers' affiliated campuses and their positions regarding how well TQM was practiced.

It was evident that the causes of rework do not differ significantly between project types. It was evident that the extent of TQM practices does not differ amongst the workers' affiliated campuses and positions. Respondents indicated that there was a high frequency of challenges in their implementation of TQM. The Kruskal-Wallis test was conducted to examine whether a significant difference existed in the responses obtained amongst the workers' affiliated campuses and workers' positions. Findings from the test carried out indicated that there was no significant variance amongst the groups.

Respondents expressed a feeling of agreement regarding the practice of TQM success factors. Findings revealed that respondents felt benchmarking of the maintenance process for specific performance improvements was the most important element for TQM to be implemented successfully. The Kruskal-Wallis test was applied to examine the significant difference between workers' affiliated campuses, positions and their perceptions on the practice of TQM success factors.

Findings from the Kruskal-Wallis test revealed that there was a significant difference amongst the workers' affiliate campuses. The Dunn-Bonferroni post-hoc method was applied to perform a pairwise comparison amongst the different campuses to determine where the difference lay. Findings revealed that a significant difference exists between respondents in Mowbray and Granger Bay, Bellville and Granger Bay, and Cape Town and Granger Bay regarding their perception of TQM success factors. It was discovered that no significant

difference existed in the workers' positions regarding their perception of the practice of TQM success factors.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter draws conclusions, discusses the testing of hypotheses, highlights the limitations encountered during the study and offers recommendations for future research.

A total of three hypotheses were tested against the findings. The conclusions are drawn from the findings of the questionnaire survey. Practical implications and outcomes of the study are discussed in the recommendation section.

5.2 Conclusions

The aim of this study was to develop a framework for the effective implementation of TQM in the maintenance of tertiary school building facilities. To achieve this aim, specific objectives were formulated, and these are outlined below.

5.2.1 To investigate the extent of TQM practices in the maintenance of tertiary institution building facilities

The literature review established the importance of TQM practices and the extent to which TQM was practiced in tertiary institutions. Although there was a variation in the responses of the different campuses, the variation was of no significance. It was discovered that the staff of the university's maintenance department agreed that the practice of TQM was important in the maintenance of its buildings.

The findings also revealed that respondents ranked people involvement, process approach, and customer focus and system management as the most implemented TQM practices in the maintenance of their school buildings. Factual approach to decision-making was ranked the least implemented TQM practice. It is worth noting that respondents ranked people involvement as the most important and most implemented TQM practice. The Department of Trade and industry (2011) identified people involvement as the practice that forms the basis of TQM.

5.2.2 To determine the challenges faced during the implementation of TQM in the maintenance of tertiary institution buildings

The purpose of this objective was to determine the challenges experienced by the maintenance department and also investigate the impact these challenges had on the implementation of TQM during the maintenance of the school buildings. It was highlighted in the literature that lack of clear instructions from top management, lack of funding and

resources, resistance from supervisors and lack of understanding amongst workers were the main challenges frequently experienced. It is apparent from the study that non-involvement of maintenance workers in the decision-making process concerning issues that directly affect them was the most frequently experienced challenge.

The study also found that the maintenance department lacked human and financial resources and quality training and education. Findings show that the lack of understanding amongst workers and lack of vision within maintenance departments rarely affected the implementation of TQM in their building maintenance activities. Several studies in the literature indicate that the barriers experienced have an impact on the implementation of TQM. Similarly, this study found that the lack of human and financial resources had the greatest impact on the implementation of TQM during their building maintenance activities.

5.2.3 To determine the factors that ensure the effective implementation of TQM in the maintenance of tertiary institution buildings

The literature review suggested that for TQM to be successfully implemented in any organisation, certain specific factors that impact its success must be carried out. It also became apparent that knowledge and exploration of these factors improve the TQM practices and outcomes. In this study, respondents were required to indicate which critical success factors were most practiced. Findings revealed that TQM success factors which were significantly evident were training and education of maintenance workers' use of statistical methods for monitoring and controlling of the maintenance process, and commitment to satisfaction of school stakeholders and commitment from top management. The least evident success factors were commitment and involvement of workers and adequate communication networks.

Respondents also suggested that benchmarking of maintenance processes was the most important success factor in the implementation of TQM in the maintenance of their school buildings. It was revealed that benchmarking helps to drive specific performance improvements within the maintenance department.

5.2.4 Hypotheses testing

- H1. There is no statistical difference in workers' affiliated campuses, workers' positions and their perception of the extent of TQM practices in the maintenance of school building facilities.

The study found that there was significant variance in the responses obtained from the different campuses and the groups of workers in various positions and their perception of how well TQM is practiced. Therefore, the hypotheses could be rejected.

- H2. There is no statistical difference in workers' affiliated campuses, workers' positions and their perception of the challenges faced during the implementation of TQM in the maintenance of school buildings.

Respondents indicated that challenges were experienced during the implementation of TQM and these challenges had a significant impact on their maintenance activities. The results obtained from the hypothesis testing revealed that no statistical difference existed in workers' affiliate campuses and their perception of the challenges experienced during TQM implementation. It was also discovered that no significant difference existed among the group of workers' positions.

- H3. There is no statistical difference in workers' affiliated campuses, workers' positions and their perception of the factors that ensure successful implementation of TQM in the maintenance of school building facilities.

Respondents agreed that the application of critical success factors ensured successful implementation of TQM in their maintenance activities. The test carried out on the hypothesis revealed that there was no significant difference in the perception of workers' affiliated campus or workers' positions on the level of practice of TQM success factors. A statistical difference was discovered in the perception of workers' affiliated campuses regarding TQM success factors. The follow-up analysis conducted revealed that differences existed between Mowbray and Granger Bay, Bellville and Granger Bay, and Cape Town and Granger Bay.

5.2.5 Framework for the effective implementation of TQM in the maintenance of tertiary institution buildings.

The study proposes a framework that could ensure the effective implementation of TQM in the maintenance of tertiary school buildings. It is indicated that in-depth understanding of TQM, the adoption of the TQM success factors and constant practice of all the TQM parameters will result in an effective implementation of TQM in the building maintenance management practices of tertiary institutions.

Given that statistically significant differences between groups were tested, it is suggested that measures of intervention should be taken to address the differences in situations where variances are discovered.

The work position of respondents and their affiliated campuses has been adopted to test for statistically significant differences between the various groups in Hypotheses 1, 2 and 3. Findings from the study indicate that there were no statistically significant differences found between the affiliated campuses and workers' positions and their perception of the extent to which TQM was practiced in the maintenance of their buildings, it is suggested that standards of practices should be maintained and continuous improvement of TQM practices should be implemented. A permanent objective of continuous improvement should be present during the implementation of maintenance activities. It should be understood that no process is perfect; therefore, further improvements can and should be made. The rule of doing things right the first time should be applied, as it ensures processes conform to the specifications of the stakeholders.

However, in terms of perceptions of challenges experienced during the implementation of TQM and the factors that ensure effective implementation of TQM, statistically significant differences were found between the affiliated campuses and workers' positions. The framework suggests measures for immediate intervention and long-run interventions. Measures for intervention in this regard should take the various campuses and positions held by workers into consideration.

5.2.5.1 Immediate interventions related to affiliated campuses

It is suggested that the TQM success factors should be applied religiously during the implementation of TQM, most especially by balancing training and application of all TQM parameters across all the campuses. The framework also suggests that the TQM success factors should be prioritised by the maintenance department to ensure an effective implementation or actualisation in the maintenance of its buildings.

5.2.5.2 Immediate interventions related to workers' positions

Employees should be continually trained on the developments of TQM. Staff should be updated on new quality trends for effective implementation of TQM. Responsibilities should be clearly stated and employees should be inducted properly regarding TQM implementation.

5.2.5.3 Long run interventions related to affiliated campuses

Benchmarking through development of best practices and standards to be followed in all campuses is suggested. Best practices for the maintenance processes should be identified. Thorough analysis of the processes leading to these best practices should be conducted and standards and improved processes should be developed. Comparisons between similar maintenance activities and performances should be conducted to improve performances, with the aim of achieving the best.

5.2.5.4 Long run interventions related to workers' positions

Given that a statistically significant difference exists between the various groups of workers' positions, it is evident that discrepancies exist in the perception of the various groups concerning the challenges experienced and the factors required for effective TQM implementation.

The proposed framework suggests the involvement of all members of the workforce from top management to lower maintenance management. It is essential for employees at all levels to be fully involved in all activities, in order to apply their abilities and skill for the maximum benefit of the maintenance department. By participating in all activities and processes, new knowledge is acquired and a sense of accomplishment is achieved by brainstorming and problem-solving. Team work is achieved through the commitment of all employees. The strengths and weaknesses of some employees are complemented by the strengths and weaknesses of others, and inputs and outputs are improved. Efforts should be made to develop and maintain an environment conducive to achieving excellent performance, total participation and growth. Strategic agendas on manpower development, such as quality staff recruitments, staff recognition and rewards and career development should be conducted.

Top management's personal relationship and involvement in creating and maintaining customer focus should be examined. A leadership structure that sets clear goals and promotes performance excellence should be encouraged. Top management has the role of championing for TQM. A participative management style, incorporating inputs from stakeholders and employees with an adequate feedback system, should be practiced.

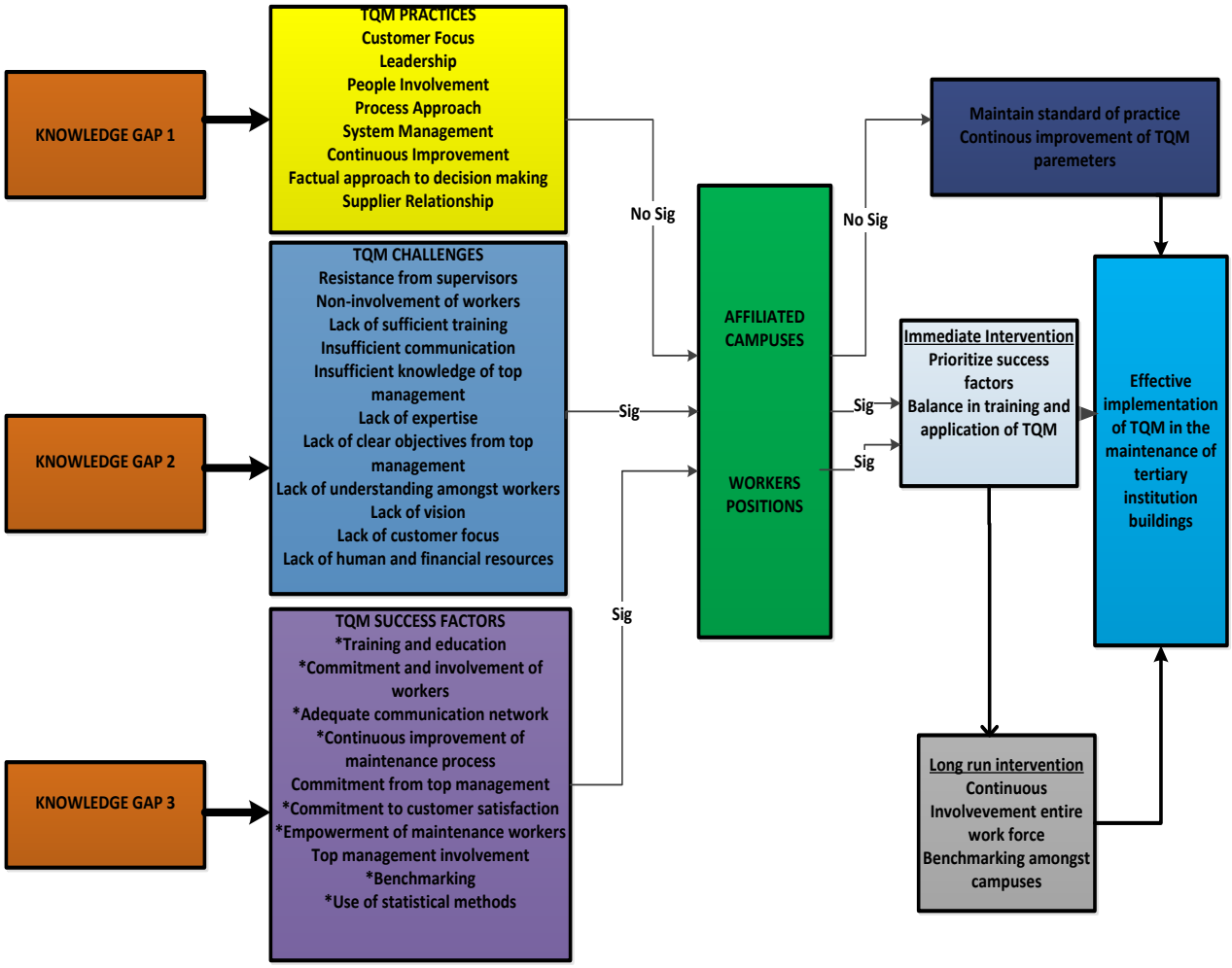

Figure 0.1: Proposed framework for the effective implementation of TQM in the maintenance of tertiary school buildings

5.5 Limitations

The scope of the research was limited to a tertiary institution in the Western Cape province of South Africa. One of the challenges encountered during the study was getting respondents to participate in the study. Some respondents declined to complete the questionnaires administered. Also, some were not interested at all, given that they were not exposed to the issues being studied. Efforts were made to ensure that a large number of questionnaires were duly completed and returned by visiting the offices in person and making telephone calls.

Furthermore, the questionnaire survey design addressed questions based on the principles and concepts of TQM. Technical aspects of the application of TQM were not considered,

except in cases where the researcher tried to measure quality activities adopted by the maintenance department.

5.6 Recommendations

This study focused on investigating the level of adoption of TQM. Discoveries were made only on the level and extent of practice of the pre-requisites for TQM, as well as challenges in implementing TQM in tertiary institutions in South Africa. Findings from the study revealed that TQM was successfully implemented in the maintenance of tertiary school buildings. It also pinpointed the shortcomings in the implementation programme. Based on the findings and conclusions from the study, the following recommendations are made:

1. Low morale of employees is a great barrier to implementing TQM. A proper structure should be put in place to ensure empowerment of employees. Therefore, it is strongly recommended that top management should create attractive packages and also provide proper educational and training facilities to empower employees.
2. Training programmes for management and staff should be organised to promote thorough understanding of the tenets of TQM. Skills for teamwork are also necessary.
3. Direct involvement of top management should be encouraged. Leadership from top authorities is essential for any TQM programme and could be a driver or inhibitor of success.
4. The TQM programme should not be forced on employees. Top management should educate employees on TQM practices by making these attractive and necessary in order for them to be accepted wholeheartedly by the employees.
5. Ensure that activities and processes are carried out right the first time. Proper planning should be carried out carefully.
6. An effective communication network is important. Memos and new letters are good ways to disseminate information within the maintenance department to keep employees informed and get them involved.

5.7 Further Studies

The researcher hopes the research can be extended to other tertiary institutions, since just one tertiary institution was studied. Chances of obtaining an accurate and thorough outcome on the implementation of TQM in South Africa will be increased, and comparative studies can be conducted. It is suggested that research can be extended to primary and secondary schools and comparisons can be carried out simultaneously. The results for this study are drawn from the maintenance of school buildings and the scope of this study is a tertiary

institution of learning in South Africa, so unfortunately focusing on other sectors is beyond the scope of this research. Therefore, these issues can only be addressed by conducting further research.

Finally, it is suggested that longitudinal studies on the implementation of TQM should be carried out. New trends can be identified in the application of TQM in maintenance of school buildings by conducting continuous but periodic studies, spaced two years apart, for example.

REFERENCES

Abbott, A. 1995. Sequence Analysis: New methods for old ideas. *Annual Review of Sociology, 93-113.*

Abdul Azeez, A.D., Abbas A., & Mansur, D. 2014. An Analysis of the Level of Professionalism of Personnel in the Application of Total Quality Management Approach in Building Maintenance Practices. *Journal of Engineering and Architecture*, 2(2): 243-255.

Abdulazeez, A., Abumelha, M. & Almaleh, A. 2015. Total Quality Management Implementation and Challenges. *International Journal of Computer Systems (IJCS)*, 558-563.

Abu–Hassan, A., Khalid, A. & Eziaku, O. 2011 Total Quality Management Practice in Large Construction Companies: A Case of Oman. *J. World Applied Sciences*, 15(2):285-296.

Adegelu, I.O. 2011. The relationships between diversification strategies and financial performance and growth amongst established South African Contracting firms. Msc. Thesis. University of the Witwatersrand.

Adenuga, O.A. 2012. Maintenance Management Practices in Public Hospital Built Environment: Nigeria Case Study. *Journal of Sustainable Development in Africa*, 185-200.

Adinolfi, P. 2003. Total Quality Management in public healthcare: A study of Italian and Irish hospitals. *Total Quality Management*, 14(1):141-150.

Aghily, O .2001. *Methodology for the integrated total quality management: Point of view*, Dar Wael publication, Amman: Jordan.

Ahire, S.L., Golher, D. & Waller, A. 1996. Development and Validation of TQM Implementation Constructs, *Decision Science*, 23-56.

Al-Amri, A.H. & Bon, A. T. 2012. Measuring the Total Quality Management in the Yemeni Universities: From the Perspectives of Faculty Members. *International Journal of Research and Reviews in Applied Sciences, 10*(1):37–45

Altahayneh, Z.L. 2014. Implementation of Total Quality Management in colleges of physical education in Jordan. *International Journal of Business and Social Science*, 5(3):109-117.

Ali, N.A. & Zairi, M. 2005. Service quality in higher education, *Working Paper Series*, 1-21.

Al-Musawi, N. 2003. Developing an instrument for measuring total quality management in institutions of higher education. *Educational Journal*, 89- 115.

Al-Saket, A. 2003. A case study of total quality management in a manufacturing and construction firm, Doctoral dissertation, Rand Afrikaans University.

AI-Zubaidi, H. 1993. 'Maintenance modelling of a major hospital complex', PhD, thesis. Department of Mathematics and Computer Science, University of Salford.

Amar, K. & Zain, Z. 2002. Barriers to implementing TQM in Indonesian manufacturing organisations, *The TQM Magazine*, 367-372, MCB UP Limited.

Ammar, A. 2003. 'A Case Study Total Quality Management in a Manufacturing and Construction Firm', Unpublished MSc Thesis. Rand Afrikaans University.

Amusan, L. & Bamisile, M. 2006. An Approach to Application of Total Quality Management in Building Maintenance operation. *Unpublished*.

Antony, J., Leung, K., Knowles, G. & Gosh, S. 2002. Critical success factors of TQM implementation in Hong Kong industries *International Journal of Quality and Reliability Management*, 19(5):551-566.

Arshida, M.M. & Agil, S.O. 2012. Critical Success Factors for Total Quality Management Implementation within the Libyan Iron and Steel Company. Tun Abdul Razak University, Graduate School of Business.

Ashford, N.A., 2000. An innovation-based strategy for a sustainable environment. In *Innovation-oriented environmental regulation*, 67-107. Physica, Heidelberg.

Ashworth, A.C. 1994. *Cost studies of Building*. London: Longman Scientific & Technical Company Ltd.

Ater, J.A. 2013. Challenges facing the implementation of total quality management practices in public secondary schools in Kenya (A survey of schools in Migori County), Doctoral dissertation.

Atieno, M.E. & Simatwa, E.M.W. 2012. Challenges Faced by Newly Appointed Principals in the Management of Public Secondary Schools in Bondo District, Kenya: An Analytical Study. *Educational Research*, 3(4):388-401

Au, G. & Choi, I. 1999. Facilitating implementation of total quality management through information technology. *Information & management*, *36*(6):287-299.

Badah, A. 2003.Total Quality Management: A Proposed Model for administrative development and its potential application in Jordanian universities. (PhD Thesis), Amman Arab University for Graduate Studies, Amman: Jordan.

Badri, M. & Davis, D. 1995. A Study of Measuring the Critical Factors of Quality Management. *International Journal of Quality and Reliability Management*, 12(2**).**

Bahri S., Hamzah D. & Yusuf M.R. 2012. Implementation of Total Quality Management and Its Effect on Organizational Performance of Manufacturing Industries Through Organizational Culture in South Sulawesi, Indonesia. *Journal of Business and Management* 5(1):10-24

Baidoun S. 2003. An Empirical Study of Critical Factors of TQM in Palestinian Organizations. *Logistics Information Management* 16 (2):156-171.

Bank, J. 1992. *The essence of Total Quality Management*. New York: Prentice Hall.

Bastidas, P. 1998. Maintenance manual for school buildings in the Caribbean (online) America: Organization of American States.

Bayraktar, E. Tatoglu, E. & Zaim, S. 2008. An Instrument for Measuring the Critical Factors of TQM in Turkish Higher Education. *Total Quality Management*, 19(6):551-574.

Ben-Daya, M. & Duffuaa, S.O. 1995. Maintenance and quality: the missing link, *Journal of Quality in Maintenance Engineering*, 1(1):20-26.

Black, S. A., & Porter, L.J. 1996. Identification of the Critical Factors of TQM. *Decision ISS & MLB September 24-26, 2013 MLB 258 Sciences*, 27(1):1-21.

Blumberg, B., Cooper, D.R., & Schindler, P.S. 2005. *Business research methods*. London, McGraw-Hill.

Bostingl, J.J. 2001. Schools of quality- 3rd edition. Thousand Oaks, California: Corwin Press. Brigham, S.E. 1993.Lessons we can learn from industry, *Change*, 25(3):42-47.

British Standards Institution (BSI).1993. *Glossary of Terms Used in Terotechnology*, BSI, London.

Broh, R.A. 1980. *Quality for Higher profits*. Prentice-Hall: McGraw Hill Publisher.

Brown, M.G., Hitchcock, D.E. & Willard, M.L. 1994. *Why TQM fails and what to do about it,* Irwin,Burr Ridge, Illinois.

Bryman, A. 2004. *Social research methods*. Oxford, Oxford University Press.

Burati, J.L., Matthews, M.F., & Kalidindi, S.N. 1992.Quality management organizations and techniques. *Journal of Construction Engineering and Management*, 118(1):112-128.

Buys, F. & Nkado, R. 2006. A Survey of Maintenance Management Systems in South

African Tertiary Institutions. *Construction Management and Economics*, 997-1005.
Cartwright, J. 1999. *Cultural transformation: nine factors for continuous business improvement.* London: Prentice Hall.
Ceronio, S.F. 1996. Achieving Total Quality Management in a South African manufacturing environment. DCom. thesis, Rand African University, Johannesburg.
Chaffee, E. & Sherr, L. 1992. *Quality: Transforming post-secondary education ASHE-ERIC higher education report*. Washington, D.C. (ERIC Document Reproduction Service No, ED 351 922).
Chaka, T. 2008. *School Governance. Issues in Education Policy No. 2.* Johannesburg: Centre for Education Policy Development.
Chapman, C. 2000. The public and private faces of excellence. *Quality World*, 26(5):30-32.
Chartered Institute of Building. 1990). *Maintenance Management — a Guide to Local Practice,* Chartered Institute of Building.
Chase, G.W. 1993. Effect of Total Quality Management process for Construction. *Journal of Management in Engineering*, 9(4).
Chen, W.H. 1997. The human side of total quality management in Taiwan: leadership and human resource management. *International Journal of Quality & Reliability Management*, 14(1):24-45.
Chepkpech, A. 2015. Factors influencing the implementation of Total Quality Management in manufacturing firms: a case of Bidco Oil Refineries Limited, Thika, Kenya. MA. Thesis. University of Nairobi.
Cho, H.J. & Pucik, V. 2005. Relationship between innovativeness, quality, growth, profitability,
and market value. *Strategic management Journal* 555-575.
Crawford, E. & Shutler, P. 1999. Total Quality Management in Education: Problems and issues for the classroom teacher. *International Journal of Educational Management* 13(2):67-73
Creswell, J.W. & Clark, V.L.P. 2007. Designing and conducting mixed methods research.
Crosby, P.B. 1984. *Quality without tears*. Mc Grow-Hill. New York. N.Y
Collis, J., Hussey, R., Crowther, D., Lancaster, G., Saunders, M. & Lewis, P. 2003. *Business Research Methods*: Palgrave Macmillan, New York.
Cornesky, R. A., Baker, R. B., Cavanugh, C., Etling, N., Lukert, M., McCool, S., & Mckay, B.M. in, Paul, A., Thomas, C., Wagner, P. & Darling, J. 1992. *Using Deming to improve quality in colleges and universities*. Madison, WI: Magna.
Curry, A. & Kadasah, N. 2002. Focusing on Key elements of TQM: Evaluation for Sustainability. *The TQM Magazine***,** 14(4):207-216
Dahlgaard, J.J. & Dahlgaard, S. 2006. Lean production, six sigma quality, TQM and company culture – a critical review*. TQM Magazine,* 2: 66-76.
Dale, B.G. 1999. *Managing Quality*. Third edition. Blackwell publishers Inc. Malden MA
De Knop, P., Van Hoecke, J., & De Bosscher, V. 2004. Quality management in sports clubs. *Sport Management Review,* 7(1):57–77.
Deming, W.E. 1988. *Out of the crisis*: Quality, Productivity and competitive position. Cambridge
University Press, Cambridge.
Demirbag, M., Tatoglu, E., Tekinkus, M. & Zaim, S. 2006. An analysis of the relationship between TQM implementation and organisational performance: evidence from Turkish SMEs'. *Journal of Manufacturing Technology Management*, 17(6):829-847
Denscombe, M. 2007. *The Good Research Guide.* McGraw-Hill Education.

Dettman, P.E. 2004. Administrators, Faculty, And Staff/Support Staff's Perceptions of MBNQA Educational Criteria Implementation at the University of Wisconsin Stout (Doctoral dissertation). Blacksburg, Virginia

Douglas, T.J. & Judge, W.Q. 2001. Total quality management implementation and competitive advantage: the role of structural control and exploration. *Academy of Management Journal*, 44(1): 158-69.

Edwards, A.W.F. 1992. Likelihood. Expanded edition.

Elliott, A.C. & Woodward, W.A. 2007. Statistical Analysis Quick Reference Guidebook: With SPSS Examples. SAGE.

Ethier, W.J. 1982. National and international returns to scale in the modern theory of international trade. *The American Economic Review*, *72*(3):389-405.

Evans, J.R., & Lindsay, W.M. 1996. The Management and Control of Quality (3rd Ed.). Minneapolis, West.

Ewell, P.T. 1991. Assessment and TQM: In search of convergence. In L.A. Sheer & D.J. Teeter (Eds.), *Total Quality Management in Higher Education. New Directions for Institutional Research Number 71*:53-62. San Francisco: Jossey-Bass.

Feigenbaum, A.V. 1991. *Total quality control* (4th ed.), New York: McGraw-Hill.

Fellows, F. & Liu, M. 2008. *Research methods for Construction* (4th ed.), Wiley Blackwell.

Field, A. 2013. *Discovering Statistics Using IBM SPSS Statistics* (4th ed.), SAGE.

Flick, U. 2011. Introducing Research Methodology: A Beginner's Guide to Doing a Research Project. SAGE.

Fotopoulos, C.B., & Psomas, E.L. 2009. The impact of "soft" and "hard" TQM elements on quality management results. *International Journal of Quality & Reliability Management*, 26(2):150-163.Fox, W. & Bayat, M.S. 2007. *A Guide to Managing Research*. Juta & Co. Ltd. Cape Town.

Freed, J. A., Klugman, M., & Fife J. D .199. Total quality management on campus: Implementation, experiences and observations. *Paper presented at the annual meeting of the Association for The Study of Higher Education*. Tucson, Arizona. (ERIC Document Reproduction Service No, 375-734.

Galgano, A. 1994. *Company-wide Quality Control*, Productivity Press, Portland, OR.

Garvin, D.A. 1998. The processes of organization and management. *MIT Sloan Management Review*, *39*(4):33.

Geraerds, W.M.J. 2000. Developments in Maintenance. *VDI BERICHTE*, *3*-12.

Gilmore, H. L. 1974. *Product Conformance Cost*, Quality Progress. June: 16

Guimaraes, T. 1994. Assessing employee turnover intentions before/after TQM, *International Journal of Quality & Reliability Management*, 14(1):46-63.

Hackett, M. & Spurgeon, P. 1998. Developing our leaders in the future, *Health Manpower Management*, 24(5):170-177.

Hackman, J., & Wageman, R. 1995. Total Quality Management: Empirical, Conceptual, and Practical Issues. *Administrative Science Quarterly, 40*(2):309-342.

Hafeez, H., Malak, N. & Abdelmeguid, H. 2006. A framework for TQM to achieve Business Excellence. *Journal of Total Quality Management & Business Excellence*, 17(9):1213-1229.

Hamidi, Y. & Zamanparvar, A. 2008. Quality management in health systems of developed and developing countries; which approaches and models are appropriate? *JRHS*, 8(2):40-50.

Hannan, B. 1999. Quality Systems, *Business Date*, 7(3)):1-4.

Hansson, J. & Klefsjo, B. 2003. A core value model for implementing total quality

management in small organizations. *TQM Magazine*, 13: 71-81.
Hassan, M. & Kerr, R.M. 2003. The relationship between TQM practices and organizational performance in service organizations, *The TQM Magazine*, 15(4): 286-291.
Haupt, T.C. & Whiteman, D.E. 2004. Inhibiting factors of implementing total quality management on construction sites. *The TQM Magazine*, *16*(3):166-173.
Hazzard, T.1993. The strengths and weaknesses of total quality management in higher education, *Total quality management in higher education*, 18(3):61-75.
Hennink, M., Hutter, I., & Bailey, A. 2011. *Qualitative research methods*. London: Sage.
Hill, S. & Wilkinson, A. 1995. In search of TQM, *Employee Relations*, 17(3):8-25.
Hirtz, P. D. 2002. Effective leadership for Total Quality Management. Doctoral dissertation: University of Missouri - Rolla.
Ho, S. K & Fung, C.K. 1994. Developing a TQM model, The TQM magazine, 6(6):24-30.
Hutton, T. & Lloyd, H.1993. Mothballing Buildings Proactive Maintenance and Conservation on a Reduced Budget*. Structural Survey*, 11(4):335-342.
Huq, Z. & Martin, T.N.2005. Workforce culture in TQM /CQI implementation in hospitals. *Health Care Manage Rev*, 25(3):80-932.
Hoyle, D. 2001. ISO 9000: *Quality system handbook*, Butterworth-Heinemann. Oxford.
Idris, F. & Ali, K. 2008. The impacts of leadership style and best practices on company performances: Empirical evidence from business firms in Malaysia, *Total Quality Management and Business Excellence*, 19(1-2):163-171.
Idris, M. & Zairi, M. 2006. Sustaining TQM: A Synthesis of Literature and Proposed Research Framework, *Total Quality Management & Business Excellence*, 17(9):1245 – 1260.
Ishikawa, K. 1985. *What is total quality control? The Japanese way*, Prentice-Hall**.**
Jeryes, I. 2004. Total Quality Management and its potential application at Birzeit University. (Master Thesis), Al-Quds University Al-Qud: Palestine.
Johnson, S. & Kleiner, B. 2013. TQM can encompass success Industrial Management, 55(2):27-30.
Joiner, T. 2005. Total Quality Management and performance: The role of organization support and co-worker support, *IJQRM*, 24(6):617-627.
Joyce, M. E. 1995*. How to lead your business beyond TQM: Making World Class Performance a Reality*. London: Pitman.
Jusoh, A., R.Z. Yusoff and Shahimi M. (2008). Malaysian *Determining TQM practises in university*
Rand, D. Activities using factor analysis: research experience of universities. Journal Kemanusiaan.
Juran, J. (1988). *Juran on Planning for Quality*, Free Press, New York, NY.
Kanji, G. & Sa., P. 2001. Kanji's business scorecard, *Total Quality Management,* 13(1):13-27.
Kanji, G. & Malek, A.1999. Total Quality Management in UK Higher Education.
Kasango, C. & Moono, M. 2010. Factors that lead to successful TQM implementation : a case study on Zambian Tourism Industry, BSc. Thesis, Laurea University of Applied Science.
Kenya Institute of Management (2009). Total Quality Management: Theory, Concepts and Practice. Macmillan Publishers.
Khawas, E. 1993. Campus trends 1993. Washington, D.C.: American Council on Education. Institutions, *Total Quality Management*, 10(1):129–153.
Klenke, K. 2008. *Qualitative research in the study of leadership*. Bingley, UK, Emerald Group

Pub.
Koch, J.V. and Fisher, J.L. 1998. Higher education and total quality management, *Total Quality Management*. 9(8):659-68.
Kohn, A. (1993). Turning learning into a business: concerns about total quality, *Educational Leadership*, 51(1):58-61.
Kosgei, J.M. 2014. Challenges Facing the Implementation of Total Quality Management in Secondary Schools: A Case of Eldoret East District, Kenya, *Global Journal of Human Resource Management*, 3 (1):12-18.
Kumar, R. 2011. Evaluation of Two Instrumental Methods of Comparing Writing Paper. *Journal of Forensic Sciences*, 56: 514–517.
Lakhal, L, Pasin, F. & Liman, M.2006. Quality management practices and their impact on performance. *International Journal of Quality and Reliability management*, 23(6):625-646.
Lakhe, R. & Mohanty, R. 1994. Total Quality Management Concepts, Evolution and Acceptability in Developing Economies. *International Journal of Quality & Reliability Management.*11 (9).
Lateef, O.A., Khmidi, M.F. & Idrus, A. 2010. Building maintenance management in a Malaysian University campus: A case study. *Australian Journal of Construction Economics and Building*, 10(1/2).
Langford, J. 1990. *Advance Project Management Techniques*. McGraw Hill Publishers Ltd Englewood Cliffs: 123-126
Leedy, P.D., & Ormrod, J.E. 2010. *Practical research: planning and design*. Upper Saddle River, NJ, Merrill.
Lewis, R.G and Smith, D.H. 1994. *Total Quality in Higher Education*. St. Lucie Press
Lowe, G. 1995. *Communication science 1*. Cape Town: Kagiso Tertiary.
Ludwig-Becker, M. 1999. Quality management principles as top team performance practices ISO 9000 criteria re-interpreted. *Team Performance Management: An International Journal*, *5*(7):207-211.
Malkin, J. 1992. *Hospital interior architecture: creating healing environments for special patient populations*. New York, Toronto.
Marchesa, T. 1993. TQM: A time for ideas. *Change 25*(3):10-13.
Maree, K. & Pietersen, J. 2007. *Surveys and the use of questionnaires*. Van Schaik, Pretoria, 155-171.
Martinez-Lorente, A.R., Dewhurst, F.W & Dale, B.G. 1998. Total Quality Management: Origins and Evolution of the Term, *The TQM Magazine,* 10(5): 378-386.
Masters, R. 1996. Overcoming barriers to TQM's success. *Quality Progress* 29 (5):53-55.
McAdam, R. & Jackson, N. 2002. A sectoral study of ISO 9000 and TQM transitions: the UK and Irish brewing sector. *Integrated Manufacturing Systems.* 13: 255-263.
McCulloch, M. 1993. Total quality management: its relevance for higher education, *Quality Assurance in Education*, 1(2).
Mete, B.S. 2004. Critical Issues for TQM implementation in Higher Education. *The TQM Magazine*, 16.
Mishra, M.P. & Pandey, A. 2013. Barriers in implementing total quality management in Higher Education. *Journal of Education & Research for Sustainable Development*, *1*(1):1-11.
Mobegi, F.O, Ondigi, B. & Oburu, P.O. 2010. Secondary school head teachers 'quality assurance strategies and challenges in Gucha district, Kenya. Maseno University, Unpublished research paper.

Mosadeghrad, A. (2014) Why TQM programmes fail? A pathology approach, *The TQM Journal*, 26(2):160-187

Moser, J.P. 1991. Point fourteen: Take action to accomplish the transformation. In R. Miller (Ed.), *Applying the Deming Method to Higher Education: For More Effective Human Resource Management* (pp. 123-130). Washington, D. C.: The College and Personnel Association.

Moser, C. & Kalton, G. 1989. *Survey methods in social investigation*. London, Gower.

Mukherjee, A. & Malhotra, N. 2006. Does role clarity explain employee-perceived service quality? A study of antecedents and consequences in call centres, *International Journal of Service Industry Management*, 17(5): 444-473.

Munoz, M.A. 1999.*Total Quality Management in Higher Education*: Lessons learned from an Information Technology Office.

Murphey J.F. 2009. Total Quality Management: An Assessment of Implementation in Florida's Municipal Police Agencies.

Nadim, Z.S. & Al-Hinai, A. H. 2016. Critical success factors in Higher Education Institutions Context, *International Journal of Applied Sciences and Management,* 1(2):147-156.

Nagi, E. & Cheng, T. 1997. Identifying potential parries to total quality management using principal component analysis and correspondence analysis. *International Journal of Quality & Reliability Management*, 14(4) University Press NAID.

Naoum, S. 2007*. Dissertation Research and Writing for Construction Students*, Routledge.

Ngware, M.W., Wamukury, D.K., & Odebero, S.O. 2006. Total Quality Management in secondary schools in Kenya: Extent of practice, *Quality Assurance in Education*, 14(4):339-362.

Nhlapo, V. 2009. A Whole School Approach to Facilities Maintenance. Unpublished PhD Thesis, North-West University, South Africa.

Oakland, J. 1989. *Total Quality Management*, Oxford, Heinemann Professional Publishing, Ltd.

Oakland, J. & Marosszeky, M. 2006.*Total quality in the construction supply chain*. Jordan Hill, Oxford: Elsevier Ltd.

Obaid, A. 2005. Identifying the barriers affecting quality in maintenance within Libyan manufacturing organisations (public sector*)* (Doctoral dissertation, University of Salford).

Olanrewaju, A.A. 2010. Qualitative Analysis of Criteria in University Building Maintenance in Malaysia. Australasian *Journal of Construction Economics and Building,* 10(3):51-61

Olawunmi, O. 1992*. A Critical Appraisal of Man, Material and Equipment in the Private and Public Sectors*. Ibadan: Ibadan. University Press Ltd.

Oluwatoyin, A. & Oluseun, A. 2008.Total Quality Management. A test of the Effect of TQM on Performance and Stakeholder Satisfaction. Blekinge Institute of Technology, School of Management.

Owlia, M. & Aspinwall, E. 1997. TQM in Higher Education – A Review, International *Journal of Quality and Reliability Management*, 14(5):527-543.

Owolabi, J.D., Amusan, L.M., Oloke, C.O., Olusanya, O., Tunji-Olayeni, P.F., Dele, O., Peter Joy, N. & Omuh, I.O. 2014. Causes and effect of delay on project construction delivery time. International *Journal of Education and Research*, 2(4):197-208.

Pallant, A. 2006. *SPSS Survival Manual,* Open University Press, Buckingham.

Peters, T. 1984. Strategy follows structure: Developing distinctive skills. *California Management Review,* 26(3):111–125.

Pheng, L.S. & Hong, S.H. 2005. Strategic quality management for the construction

Industry, *Total Quality Management*, 17(1):35–53.
Pheng, L.S. & Teo A.J. 2004. Implementing Total Quality Management in Construction Firms. J.*Management in Engineering ASCE.*
Pineda, A. 2013.Total Quality Management in Educational institutions: Influences on customer satisfaction. *Asian Journal of Management Sciences and Education*, 2 (3):3134.
Pirsing, M.R. 1974. *Zen and the Art of Motorcycle Maintenance*, Bantam.
Prajogo, D. & Amrik S. 2006. The integration of TQM and technology/R&D management in determining quality and innovation performance, *Omega***,** 34 (3), 296-312.
Prince, R.C. & Gaskill G.P. 1990. TQM in Research and Practice. *Proc. of the 3rd International Conference,* TQM-3 London, UK.
Powell, T.C. 1995. Total quality management as competitive advantage: a review and empirical study*, Strategic Management Journal*,16:15-37.
Prajogo D.I., Sohal A.S. 2003. The relationship between TQM practices, quality performance, and innovation performance, *The International Journal of Quality Reliability Management* 20(8):901-918.
Rahman, Z. 2014. Identification and adoption of total quality management practices in Indian information and communication technology and banking industries: an empirical study, Proceedings of 3rd International Conference on Sustainability and Management Strategy (ICSMS-2014).
Ramesh, N. & Ravi, A. 2016. 5S route for safety management. *International Journal of Business Excellence*, 10(3):283-300.
Reazanu, O.A. 2011. The implementation of quality management in higher education, *Procedia-Social and Behavioral Sciences*, 11:1046:1050.
Reid, R.D & Sanders, N.R. 2007*. Operation Management*. USA: WILEY.
Reeves, C.A. & Bednar, D.A. 1993. What prevents TQM implementation in healthcare organizations? *Quality Progress*, 26 (4): 41
Rohitratana, K. & Boon-itt, S. 2001. Quality standard implementation in the Thai seafood Processing of industry. *British Food Journal*.103 (9).
Ross, J. E. 1993. *Total Quality Management: Text, Cases, and Readings.* Boca Raton: St. Lucie Press.
Sadıkoglu, E. & Zehir C. 2010. Investigating the effects of innovation and employee performance on the relationship between total quality management practices and firm performance: An empirical study of Turkish firms.
Salagean, H.C., Balc, B. & Garbacea, R.D. 2014. The existing barriers in implementing Total Quality Management. *Annals of Faculty of Economics*, 1(1):1234-1240.
Sallis, E. 2002. *Total Quality Management in Education,* 3rd ed. London: Kogan Page.
Savolainen, T. 2000. Leadership strategies for gaining business excellence through total quality management: A Finnish case study. *Total Quality Management, 11*(2): 211-226.
Schmint, W.H & Finnigan, J.P. 1993. *TQ Manager: A practical guide for managing in a Total Quality Organization*, Wiley.
Serafimovska, H. & Ristova, E. 2010. The impact of the leadership on achieving Total Quality Management, *MTM International Virtual Journal*, 5(3): 3-6.
Sergiovanni, T. J. 2001. *The Principalship*: A reflective practice perspective. Boston, MA: Allyn and Bacon.
Senge, P.M .1994. *The fifth discipline: The Art and practice of the learning organization*: Random House.
Seymour, D., & Low, S. 1990. The Quality Debate. *Construction Management and*

Economics, 8(1):13- 29.
Sherr, L. A. & Teeter, D. J. (eds). 1991. *Total quality management in higher education. New Directions for Institutional Research.* 71San Francisco: Jossey-Bass.
Silverman, D. 2006*. Interpreting Qualitative Data: Methods of Analysing Talk, Text and Interaction.* LONDON: Sage.
Simpeh, F. 2013. Current maintenance strategies of University Building Facilities in Western Cape, South Africa. MTech thesis. Cape Peninsula University of Technology.
Shibani, A., Saidani, M., & Sagoo, A. 2012. Critical Success Factors for implementing Total Quality Management in Libyan Organizations, *International Conference on Industrial Engineering and Operations Management Istanbul, Turkey,*80-89.
Shin, D., Kalinnowski, J.G., & El-Enein, G.A. 1998. Critical implementation issues of total quality management. *S.A.M. Advanced Management Journal,* 3(1):10-14.
Skiti, V.V.B. 2009. Barriers in implementing Total Quality Management in Kraaifontein public health care facility in the Western Cape. Mini Masters of Business Administration, University of Stellenbosch.
Soltani, E., Van der Meer, R. & Williams, T.M. 2005. A contrast HRM and TQM approaches to performance management: Some evidence. *British Journal of Management*. 16(10): 211-230.
Steeples, M.M. 1992. *The Corporate Guide to the Malcolm Baldrige National Quality Award*. Business One Irwin, Homewood, IL.
Struwig, F.W. & Stead, G. B. 2001. *Planning, designing and reporting research*. Cape Town: Pearson Education South Africa.
Sudhakar, A. & Geetanjali, J.V. 2016. Stakeholders' perception of TQM practices in Higher Education: A Study, *International Journal of Educational Administration*, 8(1):7-19.
Suleman, Q. & Gul, R. 2015. Managerial Challenges Faced by Fresh Directly Appointed Secondary School Heads in Kohat Division, Pakistan. *Research on Humanities and Social Sciences*, 5 (5): 91-104
Szuba, T. & Young, R. 2003. Planning guide for maintaining school facilities. Washington D.C: *National Forum on Education Statistics*.
Tamimi, N. & Sebastianelli, R. 1998. The barriers to total quality management. *Quality Progress*, 31 (6):57-60.
Tang, K. & Zairi, M. 1998. Benchmarking Quality Implementation in a Service Context: A Comparative Analysis of Financial Services and Institutions of Higher Education. Part III, *Total Quality Management,* 9(8):669-679.
Tang, Z., Chen, X. & Wu, Z. 2010. Using Behaviour Theory to Investigate Individual-Level Determinants of Employee Involvement in TQM. *Total Quality Management & Business Excellence*, 21(12):1231-1260.
Temponi, C. 2005. Continuous improvement framework: implications for academia, *Quality Assurance in Education*, 13(1):17-36.
Terziovski, M. & Samson, D. 1999. The link between total quality management practice and organisational performance, International Journal of Quality management & Reliability Management, 16(3):226-237.
Thomas, F.S. 2008. Simultaneous consideration of TQM and ISO 9000non performance and motivation: An empirical study of Spanish companies. *International Journal of production Economics*, 113(1): 23-39.
Thomson, N. 1996. *Using TQM: A new teaching model;* Northwest Missouri State University, ERIC, No. ED 405835.
Townsend, P.L. & Gebhardt, J.E. 1990. *Commit to Quality*. New York: John Wiley & Sons

Tuchman, A. 1994. The yellow brick road: Total quality management and the restructuring of organizational culture. *Organizational Studies*. 30(5): 727-751.

Uline, C.L., Wolsey, T.D., Tschannen-Moran, M. & Lin, C.D. 2010. Improving the physical and social environment of school: A question of equity. *Journal of school leadership, 20(5):597-632.*

Venkateswarlu, P. & Nilakant, V. 2005. Adoption and persistence of TQM programmes–case studies of five New Zealand organizations. *Total Quality Management & Business Excellence*, 16, 807-825.

Vieira, R. 2009. *Paradigmas teóricos da investigação em Contabilidade*. In Major, M. J. e Vieira, R. (Orgs.), Contabilidade e Controlo de Gestão. Teoria, metodologia e prática, Lisboa: Escolar Editora.

Wali, S. & Boujelbene V. 2011. Cultural Influences on TQM Implementation and Financial Performance in Tunisian Firms.

Walliman, N.S.R. 2006. *Your Research Project: A Step-by-step Guide for First-Time Researchers*. London: Sage Publications.

Wallin, D.L., & Ryan, J.R. 1994. *Essentialism: Common sense quality improvement*. Washington, D.C.: American Association of Community Colleges.

Walsh, A., Hughes, H. & Maddox, D. 2002. TQM continuous improvement: is the philosophy a reality. *Journal of European Industrial Training*, MCB UP Ltd.

Welman, J.C., Kruger, S.J. & Mitchell, B. 2007. *Research Methodology* 3rd Ed., Oxford University Press, Cape Town.

Westcott, R.T. 2013. *The certified manager of quality/organizational excellence handbook*. ASQ Quality Press.

Xaba, M.I. 2012. The possible cause of school governance challenges in South Africa. *South African Journal of Education*, 31:201-211.

Yang, C.C. 2003. The establishment of a TQM system for the health care industry. *The TQM Magazine*, 15(2):93-98.

Yasin, M. & Alavi, J. 2007. The effectiveness of quality improvement initiatives in service operational context, *The TQM Magazine*, 19(4):354-367.

Yasin, M. & Wafa, M. 2002. *Effective strategic and operational practices of manufacturing, service and public-sector organizations: an empirical examination*, *Systems Research and Behavioral Science,* 19(6):589-98.

Yen, H.J., Krumwiede, D.W. & Sheu, C. 2002. A cross-cultural comparison of top management personality for TQM implementation, *Total Quality Management*, 13(3):335-346.

Yin, K.R. 2005. *Case Study Research: Design and Methods*, SAGE.

Youssef, S .2006. Total Quality Management Framework for Libyan Process and Manufacturing industries PhD thesis, Cranfield University.

Youssef, A. & Zaira, M. 1995. Quality function deployment: a main pillar for successful total quality management and product development, *International Journal of Quality & Reliability Management*, 12(6):9-23.

Yudof, M.G., & Busch-Vishniac, I.J. 1996. Total quality: Myth or management in universities? *Change 28*(6):19-27.

Yung, W.C. 1997. The values of TQM in the revised ISO 9000 quality system, *International Journal of Operations & Production Management*, 17(2):221-230.

Zabadi, A.M. (1998). Implementing Total Quality Management (TQM) on the Higher Education Institutions–A Conceptual Model. Journal of Finance and Economics, 1(1):42-

60.
Zaire, M. & Simintiras, A.C. 1991. The Sales Link in the Customer Supplier Chain. *Productivity*, 32(3): 427-434.
Zairi, M. 2002. Managing Excellence Leadership. *The TQM Magazine*, 11(4):215-220
Zakuan, N., Muniandy, S., Saman, N.Z. & MdArif, M.S. 2012. Critical Success Factors of Total Quality Management Implementation In Higher Education Institution: A Review, *International Journal of Academic Research in Business and Social Sciences* 2(12):692-699.
Zehir, C., Ertosun, Ö.G., Zehir, S. & Müceldilli, B. 2012. Total quality management practices effects on quality performance and innovative performance. *Procedia-Social and Behavioral Sciences*, *41*:.273-280.
Zhang, Z. 2002. Implementation of Total Quality Management, an Empirical Study of Chinese Manufacturing Firms". PhD thesis. Faculty of Management and Organization of the University of Groningen, Netherland.
Zulkarnain, S.H. Zawawi, E.M.A, Rahman, M.Y.A Mustafa, N.K.F. 2011. A Review of Critical Success Factors in Building Maintenance Management Practice for University Sector. *World Academy of Science and Engineering and Technology*. 77:195-199.

APPENDICES
APPENDIX A- PERMISSION LETTER

Cape Peninsula University of Technology

Office of the Deputy Vice Chancellor:
Research, Technology Innovation & Partnerships
Bellville Campus
P O Box 1906
Bellville 7535
Tel: 021-9596242
Email: NhlapoC@cput.ac.za

09 February 2017

Miss Akinlolu Mariam Temisola
Flat 212B, Postgraduate Residence,
Cape Peninsula University of Technology,
Bellville
Cape Town, South Africa.

Email: akanlolumariam@gmail.com

Dear Miss Akinlolu

RE: PERMISSION TO CONDUCT RESEARCH AT CPUT

The Institutional Ethics Committee received your application entitled "Framework for the effective implementation of Total Quality Management in the maintenance of tertiary school building facilities" together with the dossier of supporting documents.

Permission is herewith granted for you to do research at the Cape Peninsula University of Technology.

Wishing you the best in your study.

Sincerely

APPROVED
Chair Senate Ethics Committee
13 FEB 2017
Cape Peninsula University of Technology
Sign: .....

PO Box 1906 Bellville 7535 South Africa
086 123 2788

APPENDIX B- QUESTIONNAIRE SURVEY

Faculty of Engineering
Department of Construction
Management and Quantity Surveying
P.O. Box 1906, Bellville 7535, South Africa

21st February 2016

Dear Sir / Madam,

RE: PARTICIPATION IN A SURVEY

You are invited to participate in a research survey that aims to develop a "Framework for the effective implementation of Total Quality Management in the maintenance of school buildings" in South Africa. It is a research study undertaken by a Masters student towards fulfilling a Master of Construction degree in the Department of Construction Management and Quantity Surveying at Cape Peninsula University of Technology.

All members of the school building maintenance are encouraged to participate in the study. Please answer each question carefully. The survey takes about 20 minutes to complete. All information obtained from participants will be kept strictly confidential and will be only used for research purposes.

Declaration by participant:

By signing below, I (name)…….. agree to take part in this study and is aware that no compensation will be provided for participating.

Signature…….

Date……..….

Please complete the survey and return to:

Mariam Temisola Akinlolu
Cape Peninsula University of Technology
Email: akinlolumariam@gmail.com
Mobile: 0840503384

This questionnaire consists of 4 (four) main sections. Please read the questions carefully before answering them.

SECTION A: PROFILE OF RESPONDENT

1.0 Kindly indicate which of the following best describes your position?

☐ Top Management ☐ Supervisor ☐ Foreman ☐ Clerk of works

☐ Technician ☐ Labourer ☐ Other (Specify)……

1.1 How long have you been in your present position? **……**

1.2 Kindly indicate the number of years of work experience that you have **……**

1.3 Please indicate your gender?

☐ Female ☐ Male

1.4 Please indicate your highest formal qualification:

☐ Matric Certificate ☐ Diploma ☐ Postgraduate diploma

☐ Bachelor's degree ☐ Honour's degree ☐ Master's degree

☐ Doctorate degree ☐ Other (Please specify): **……**

SECTION B: EXTENT OF TQM OF PRACTICE

This section aims to investigate the extent of TQM practices in the maintenance of your buildings.

2**.** Do you implement Total Quality Management in the maintenance of your school buildings?

Yes ☐ No ☐ Unsure ☐

3. In your opinion, how important do you think the practice of TQM is during the maintenance of your buildings?

Not important at all	Unimportant	Moderately important	Important	Very important	Unsure

4. The following statements are presented for your evaluation. Please place an (X) or a (√) in the appropriate column per item to choose the response which best describes your level of agreement on how TQM is applied in the maintenance of your school buildings. **Please use the following scales: 1 = strongly disagree, 2 = disagree, 3 = somewhat agree, 4 = agree, 5 = strongly agree, U = unsure**

	Statement on the practice of TQM	Strongly disagree	Disagree	Somewhat agree	Agree	Strongly Agree	Unsure
4.1	The department focuses on the achievement of stakeholder's satisfaction when carrying out its activities.	1	2	3	4	5	U
4.2	The department aims at understanding and acting upon needs of the stakeholders.	1	2	3	4	5	U
4.3	The development of a relationship with the internal school stakeholders is considered as a vital element.	1	2	3	4	5	U
4.4	Value is added to the processes during the maintenance activities.	1	2	3	4	5	U
4.5	Costs of resources consumed during the maintenance process are measured.	1	2	3	4	5	U
4.6	All maintenance activities are done right the first time.	1	2	3	4	5	U
4.7	Mistakes are eliminated to save time and cost when carrying out activities.	1	2	3	4	5	U
4.8	In the maintenance process, all parties should be satisfied.	1	2	3	4	5	U
4.9	Efforts should be made to satisfy all school stakeholders.	1	2	3	4	5	U
4.10	More focus should be placed on prevention to avoid repetition of mistakes.	1	2	3	4	5	U
4.11	Mistakes should be analysed to determine the root cause of any failures.	1	2	3	4	5	U
4.12	Appropriate preventive procedures should be carried out to avoid repetition.	1	2	3	4	5	U
4.13	Appropriate corrective procedures should be carried out to avoid repetition.	1	2	3	4	5	U
4.14	Everyone should be involved in the execution of activities.	1	2	3	4	5	U

5. Kindly rate how important these practices are to your building maintenance activities by placing an (X) or a (√) in the appropriate column per item. **Please use the following scales: 1= Not important at all, 2= Unimportant, 3=moderately important, 4= Important, 5= Very important, U= Unsure.**

	Importance of TQM practices to your maintenance activities	Not important at all	Unimportant	Moderately important	Important	Very Important	Unsure
	Customer Focus	1	2	3	4	5	U
5.1	The school stakeholders should be the focus of all maintenance activities.	1	2	3	4	5	U
5.2	Satisfaction of stakeholders should be achieved by conforming to specifications.	1	2	3	4	5	U
5.3	Stakeholder inputs should be actively and regularly sought to identify their needs.	1	2	3	4	5	U
5.4	Stakeholder needs should be effectively disseminated and understood	1	2	3	4	5	U
5.5	Expectations of the stakeholders should be taken into consideration	1	2	3	4	5	U
	Leadership	1	2	3	4	5	U
5.6	Top management must develop clear objectives to guide maintenance activities.	1	2	3	4	5	U
5.7	Effective strategies should be developed to control maintenance activities.	1	2	3	4	5	U
5.8	The maintenance department should establish an appropriate management structure.	1	2	3	4	5	U
5.9	Contingency plans should be developed to control maintenance activities.	1	2	3	4	5	U
5.10	Top management should encourage members of the maintenance team	1	2	3	4	5	U
5.11	Top management should consistently pay attention to members of the maintenance team.	1	2	3	4	5	U
	People Involvement	1	2	3	4	5	U
5.12	The participation of everyone in the maintenance activities assists in increasing productivity.	1	2	3	4	5	U
5.13	The involvement of all workers is important to the ultimate success of maintenance	1	2	3	4	5	U
5.14	Satisfaction of the maintenance workers should be measured regularly.	1	2	3	4	5	U
5.15	A work environment that contributes to the safety of the employees should be maintained.	1	2	3	4	5	U

	Importance of TQM practices to your maintenance activities	Not important at all	Unimportant	Moderately important	Important	Very important	Unsure
	Process Approach	1	2	3	4	5	U
5.16	Related maintenance activities should be managed effectively as a process.	1	2	3	4	5	U
5.17	Resources for executing maintenance activities should be managed as a process.	1	2	3	4	5	U
5.18	Objectives for all maintenance processes should be clearly defined.	1	2	3	4	5	U
5.19	All maintenance processes based on the interest of all maintenance of all parties involved should be managed.	1	2	3	4	5	U
	System Management	1	2	3	4	5	U
5.20	Systems and processes should be well identified and understood.	1	2	3	4	5	U
5.21	Maintenance activities should be managed in order to contribute to the effectiveness of the maintenance department.	1	2	3	4	5	U
5.22	Clear instructions should be available within the department.	1	2	3	4	5	U
	Continuous Improvement	1	2	3	4	5	U
5.23	Maintenance processes should be continuously improved.	1	2	3	4	5	U
5.24	Improvement teams should be available in the maintenance department.	1	2	3	4	5	U
5.25	Programmes for upgrading the continuous improvement process of the maintenance department should be implemented.	1	2	3	4	5	U
	Factual approach to decision-making	1	2	3	4	5	U
5.26	The maintenance team should ensure that data on performance measures is gathered.	1	2	3	4	5	U
5.27	Data to improve the maintenance department's decision-making process should be continually analysed.	1	2	3	4	5	U
5.28	Statistical methods should be used to analyse data.	1	2	3	4	5	U
	Supplier Relationship	1	2	3	4	5	U
5.29	A mutually favourable relationship should exist between the maintenance department and its suppliers.	1	2	3	4	5	U
5.30	Regular supplier audits should be conducted.	1	2	3	4	5	U
5.31	The maintenance department should ensure suppliers can maintain quality standards and meet quality specifications.	1	2	3	4	5	U

6. To what extent do you observe the following TQM practices in the maintenance of your buildings? Respond by placing an (X) or a (√) in the appropriate column per item. **Please use the following scales: 1= Never, 2= Rarely, 3= Sometimes, 4= Often, 5= Always, U=Unsure.**

	Extent of TQM practice during the maintenance of your buildings.	Never	Rarely	Sometimes	Often	Always	Unsure
	Customer Focus	1	2	3	4	5	U
6.1	Regard the stakeholders as the focus of your maintenance activities.	1	2	3	4	5	U
6.2	Satisfy stakeholders by conforming to their specifications.	1	2	3	4	5	U
6.3	Stakeholder inputs are encouraged in the implementation of maintenance activities.	1	2	3	4	5	U
6.4	The expectations of stakeholders are considered during your maintenance activities.	1	2	3	4	5	U
6.5	Stakeholder needs are effectively disseminated and understood within the maintenance team.	1	2	3	4	5	U
	Leadership	1	2	3	4	5	U
6.6	Top management develops clear objectives to guide maintenance activities.	1	2	3	4	5	U
6.7	Effective strategies are developed to control maintenance activities.	1	2	3	4	5	U
6.8	Contingency plans are developed to control maintenance activities.	1	2	3	4	5	U

	Extent of TQM practice during the maintenance of your buildings.	Never	Rarely	Sometimes	Often	Always	Unsure
6.9	The maintenance department puts in place an appropriate management structure.	1	2	3	4	5	U
6.10	Top management encourages members of the maintenance team through empowerment	1	2	3	4	5	U
6.11	Top management consistently pays attention to members of the maintenance team	1	2	3	4	5	U
	People Involvement	1	2	3	4	5	U
6.12	Everyone in the department participates in the execution of maintenance activities.	1	2	3	4	5	U
6.13	All workers are involved in the maintenance process to ensure the ultimate success of maintenance activities	1	2	3	4	5	U
6.14	Satisfaction of the maintenance workers are measured regularly	1	2	3	4	5	U
6.15	The maintenance department contributes to the safety of the maintenance workers.	1	2	3	4	5	U
	Process Approach	1	2	3	4	5	U
6.16	Related maintenance activities are managed effectively as a process.	1	2	3	4	5	U
6.17	Resources for executing maintenance activities are managed as a process.	1	2	3	4	5	U
6.18	Objectives for all maintenance processes are clearly defined.	1	2	3	4	5	U
6.19	Maintenance processes based on the interest of all maintenance of all parties involved are effectively managed	1	2	3	4	5	U
	System Management	1	2	3	4	5	U
6.20	Systems and maintenance processes are well identified and understood.	1	2	3	4	5	U
6.21	Maintenance activities are managed in order to contribute to the effectiveness of the maintenance department.	1	2	3	4	5	U
6.22	Clear instructions are available within the department.	1	2	3	4	5	U
	Continuous Improvement	1	2	3	4	5	U
6.23	Continuous improvement of all services and processes is practiced.	1	2	3	4	5	U
6.24	Improvement teams are available in all departments.	1	2	3	4	5	U
6.25	Programmes for upgrading the continuous improvement process of the maintenance department are implemented.	1	2	3	4	5	U
	Factual approach to decision-making	1	2	3	4	5	U
6.26	The maintenance team ensures that data on performance measures is gathered.	1	2	3	4	5	U
6.27	Data to improve the maintenance department's decision-making process is continually analysed.	1	2	3	4	5	U
6.28	Statistical methods are used to analyse data.	1	2	3	4	5	U
	Supplier Relationship	1	2	3	4	5	U
6.29	A mutually favourable relationship exists between the maintenance department and its suppliers	1	2	3	4	5	U
6.30	Regular supplier audits are conducted.	1	2	3	4	5	U
6.31	The maintenance department ensures that suppliers can maintain quality standards and meet quality specifications	1	2	3	4	5	U

SECTION C: CHALLENGES EXPERIENCED DURING THE IMPLEMENTATION OF TQM.

This section aims to determine the challenges or barriers faced during the implementation of TQM in the maintenance of your buildings.

7. Do you experience challenges in the implementation of TQM during the maintenance of your school buildings?

Yes ☐ No ☐ Unsure ☐

8. Kindly rate, how often you experience these challenges in the implementation of TQM in the maintenance of your buildings by placing an (X) or a (√) in the appropriate column per

item. **Please use the following scales: 1= Never, 2= Rarely, 3= Sometimes, 4= Often, 5= Always, U=Unsure.**

	Challenges experienced during the implementation of TQM	Never	Rarely	Sometimes	Often	Always	Unsure
8.1	Resistance from supervisors to implement approved ideas during the execution maintenance activities.	1	2	3	4	5	U
8.2	Non-involvement of maintenance workers in the decision-making process.	1	2	3	4	5	U
8.3	Lack of sufficient training and education on quality in the maintenance department.	1	2	3	4	5	U
8.4	Insufficient communication network within the maintenance department.	1	2	3	4	5	U
8.5	Top management in the maintenance department does not have sufficient knowledge of maintenance activities.	1	2	3	4	5	U
8.6	Maintenance workers are not involved the formulation of policies that directly affect their jobs.	1	2	3	4	5	U
8.7	Workers lack expertise in management of quality in their maintenance activities.	1	2	3	4	5	U
8.8	Lack of support from top management towards the improvement of the quality maintenance process.	1	2	3	4	5	U
8.9	Lack of clear objectives from top management to guide maintenance activities.	1	2	3	4	5	U
8.10	Lack of understanding amongst between workers during the execution maintenance activities.	1	2	3	4	5	U
8.11	Lack of vision within the maintenance department.	1	2	3	4	5	U
8.12	Lack of focus on school stakeholders in the implementation of maintenance activities.	1	2	3	4	5	U
8.13	Lack of human and financial resources to support maintenance activities.	1	2	3	4	5	U

9. Kindly rate the challenges that have the greatest impact on the implementation of TQM during the maintenance of your school buildings by placing an (X) or a (√) in the appropriate column per item**. Please use the following scales: 1= Very low, 2= Low, 3= Moderate, 4=High, 5=Very High, U=Unsure.**

	Impact of challenges experienced during the implementation of TQM	Very low	Low	Moderate	High	Very High	Unsure
9.1	Resistance from supervisors to implement approved ideas during the execution maintenance activities.	1	2	3	4	5	U
9.2	Non-involvement of maintenance workers in the decision-making process.	1	2	3	4	5	U
9.3	Lack of sufficient training and education on quality in the department.	1	2	3	4	5	U
9.4	Insufficient communication network within the maintenance department.	1	2	3	4	5	U
9.5	Top management in the maintenance department does not have sufficient knowledge of maintenance activities.	1	2	3	4	5	U
9.6	Maintenance workers are not involved the formulation of policies that directly affect their jobs.	1	2	3	4	5	U
9.7	Workers lack expertise in management of quality in their maintenance activities.	1	2	3	4	5	U
9.8	Lack of support from top management towards the improvement of the quality maintenance process.	1	2	3	4	5	U
9.9	Lack of clear objectives from top management to guide maintenance activities.	1	2	3	4	5	U
9.10	Lack of understanding amongst between workers during the execution maintenance activities.	1	2	3	4	5	U
9.11	Lack of vision within the maintenance department.	1	2	3	4	5	U
9.12	Lack of focus on school stakeholders in the implementation of maintenance	1	2	3	4	5	U
9.13	Lack of human and financial resources to support maintenance activities.	1	2	3	4	5	U

SECTION D: FACTORS THAT ENSURE THE EFFECTIVE IMPLEMENTATION OF TQM

This section aims to determine the factors that ensure the effective implementation of TQM in the maintenance of your buildings.

10. How would you rate the practice of the following TQM success factors in your department? **Please use the following scales: 1 = Very low, 2= Low, 3= Moderate, 4=High, 5=Very High, U=Unsure.**

	Factors that ensure the effective implementation of TQM	Very low	Low	Moderate	High	Very high	Unsure
10.1	Training and education of maintenance workers for the achievement and improvement of maintenance activities.	1	2	3	4	5	U
10.2	Commitment and involvement of workers to enhance the level of decision-making in the maintenance department.	1	2	3	4	5	U
10.3	Adequate communication network to facilitate the exchange of information within maintenance department.	1	2	3	4	5	U
10.4	Continuous improvement of maintenance processes to promote the progress and development of maintenance department.	1	2	3	4	5	U
10.5	Commitment from top maintenance management to enhance the success of maintenance activities by ensuring all decisions are made adequately and timely.	1	2	3	4	5	U
10.6	Commitment to the satisfaction of the school stakeholders for the sustainability of the maintenance department.	1	2	3	4	5	U
10.7	Empowerment of maintenance workers by encouraging the use of their expertise and knowledge to improve the maintenance activities.	1	2	3	4	5	U
10.8	Top management involvement with the aim of promoting growth within the maintenance department.	1	2	3	4	5	U
10.9	Benchmarking of maintenance processes to drive specific performance improvements within the maintenance department.	1	2	3	4	5	U
10.10	The use of statistical methods for easier monitoring and control of maintenance processes.	1	2	3	4	5	U

11. Rate your level of agreement or disagreement with the following statements. **Please use the following scales: 1=Strongly disagree, 2 = Disagree, 3= Somewhat agree, 4= Agree, 5= Strongly Agree, U= Unsure**

	Statement on TQM success factors	Strongly disagree	Disagree	Somewh at agree	Agree	Strongly agree	Unsure
11.1	Training and education of maintenance workers assists in the achievement and improvement of maintenance activities.	1	2	3	4	5	U
11.2	The commitment and involvement of workers enhances the level of decision-making in the maintenance department.	1	2	3	4	5	U
11.3	An adequate communication network facilitates the exchange of information within maintenance department.	1	2	3	4	5	U
11.4	Continuous improvement of maintenance processes promotes the progress and development of maintenance department.	1	2	3	4	5	U
11.5	Commitment from top maintenance management facilitates the success of maintenance activities by ensuring all decisions are made adequately and timely.	1	2	3	4	5	U
11.6	Commitment to the satisfaction of the school stakeholders is the most important requirement for the sustainability of the maintenance department.	1	2	3	4	5	U

	Statement on TQM success factors	Strongly disagree	Disagree	Somewhat agree	Agree	Strongly agree	Unsure
11.7	Empowerment of maintenance workers encourages the use of their expertise and knowledge to improve the maintenance activities.	1	2	3	4	5	U
11.8	The involvement of top management promotes growth within the maintenance department.	1	2	3	4	5	U
11.9	Benchmarking of maintenance processes helps to drive specific performance improvements within the maintenance department.	1	2	3	4	5	U
11.10	The use of statistical methods enhances easier monitoring and control of maintenance processes.	1	2	3	4	5	U

APPENDIX C1- Perception of the practice of TQM (Bellville)

Statement	1	2	3	4	5	Total	Mean	SD	Rank
	%	%	%	%	%				
Department focuses on achievement of stakeholder satisfaction	0	0	0	5.6	25.9	17	4.82	0.39	1
Appropriate corrective procedures should be done	0	0	0	5.6	25.9	17	4.82	0.39	2
Development of a relationship with internal stakeholders is vital	0	0	0	11.1	20.4	17	4.65	0.49	3
Cost of resources consumed is measured	0	0	0	11.1	20.4	17	4.65	0.49	4
Appropriate prevention procedures should be done	0	0	1.9	9.3	20.4	17	4.58	0.61	5
Everyone should be involved in the activities	0	0	1.9	9.3	20.4	17	4.58	0.61	6
Department understands stakeholder needs	0	0	0	14.8	16.7	17	4.53	0.51	7
Value is added to maintenance processes	0	0	1.9	11.1	18.5	17	4.53	0.62	8
More focus should be placed on prevention	0	0	1.9	13.0	16.7	17		0.62	9
Efforts should be made to satisfy all stakeholders	0	0	3.7	9.3	18.5	17	4.47	0.71	10
Mistakes should be analysed	0	0	5.6	7.4	18.5	17	4.41	0.79	11
All parties should be satisfied	0	0	5.6	13.0	13.0	17	4.24	0.75	12
Mistakes are eliminated to save time and cost	0	0	7.4	11.1	13.0	17	4.18	0.80	13
Maintenance activities are done right the first time	1.9	1.9	1.9	11.1	14.8	17	4.12	1.16	14
OVERALL						17	4.50	0.63	

APPENDIX C2- Perception of the practice of TQM (Cape Town)

Statement	1	2	3	4	5	Total	Mean	SD	Rank
	%	%	%	%	%				
Appropriate prevention procedures should be done	0	0	0	1.9	29.6	17	4.94	0.24	1
Department understands stakeholder needs	0	0	0	3.7	27.8	17	4.80	0.33	2
Mistakes should be analysed	0	0	0	7.4	24.1	17	4.76	0.43	3
Everyone should be involved in the execution of activities	0	0	0	7.4	24.1	17	4.76	0.43	3
Everyone should be involved in the execution of activities	0	0	0	7.4	24.1	17	4.76	0.43	3
More focus should be placed on prevention	0	0	1.9	3.7	25.9	17	4.76	0.56	5
Department focuses on achievement of stakeholder satisfaction	0	0	0	9.3	22.2	17	4.70	0.46	6
Appropriate corrective procedures should be carried out	0	0	3.7	1.9	25.9	17	4.70	0.68	7
Development of a relationship with stakeholders is vital	0	0	0	11.1	20.4	17	4.65	0.49	8
Value is added to maintenance processes	0	0	0	13.0	18.5	17	4.58	0.50	9
Efforts should be made to satisfy all stakeholders	0	0	1.9	9.3	20.4	17	4.58	0.61	10
All parties should be satisfied	0	0	5.6	9.3	16.7	17	4.35	0.78	11
Cost of resources consumed is measured	0	0	3.7	14.8	13.0	17	4.29	0.68	12
Mistakes are eliminated to save time and cost	0	1.9	1.9	13.0	14.8	17	4.29	0.68	12
All maintenance activities are done right the first time	1.9	0	5.6	7.4	16.7	17	4.17	1.13	14
OVERALL						17	4.60	0.56	

APPENDIX C3- Perception of TQM practice (Mowbray)

Statement	1	2	3	4	5	Total	Mean	SD	Rank
	%	%	%	%	%				
Appropriate corrective procedures should be carried out	0	0	0	0	13.0	7	5.00	0.00	1
Everyone should be involved in the execution of activities	0	0	0	0	13.0	7	5.00	0.00	1
Department focuses on achievement of stakeholder satisfaction	0	0	0	1.9	11.1	7	4.85	0.37	3
Mistakes should be analysed	0	0	0	1.9	11.1	7	4.85	0.37	3
Appropriate prevention procedures should be carried out	0	0	0	1.9	11.1	7	4.85	0.37	3
Development of a relationship with internal stakeholders is vital	0	0	0	3.7	9.3	7	4.71	0.48	6
Mistakes are eliminated to save time and cost	0	0	1.9	0	11.1	7	4.71	0.75	7
In the maintenance process, all parties should be satisfied	0	0	1.9	0	11.7	7	4.71	0.75	7
More focus should be placed on prevention	0	0	1.9	0	11.1	7	4.71	0.75	7
Department understands and acts upon stakeholder needs	0	0	0	5.6	7.4	7	4.57	0.53	10
Efforts should be made to satisfy all stakeholders	0	0	3.7	0	9.3	7	4.42	0.97	11
Cost of resources consumed is measured	0	0	1.9	5.6	5.6	7	4.28	0.75	12
All maintenance activities are done right the first time	0	0	1.9	5.6	5.6	7	4.28	0.75	12
Value is added to maintenance processes	0	0	1.9	9.3	1.9	7	4.00	0.57	14
OVERALL						7	4.64	0.53	

APPENDIX C4- Perception of the practice of TQM (Wellington)

Statement	1	2	3	4	5	Total	Mean	SD	Rank
	%	%	%	%	%				
Appropriate corrective procedures should be done	0	0	0	0	9.3	5	5.00	0.00	1
Appropriate prevention procedures should be done	0	0	0	0	9.3	5	5.00	0.00	1
Department focuses on achievement of stakeholder satisfaction	0	0	0	1.9	7.4	5	4.80	0.44	3
Department understands stakeholder needs	0	0	0	1.9	7.4	5	4.80	0.44	3
Cost of resources consumed is measured	0	0	0	1.9	7.4	5	4.80	0.44	3
More focus should be placed on prevention	0	0	0	1.9	7.4	5	4.80	0.44	3
Everyone should be involved in the execution of activities	0	0	0	0	9.3	5	4.80	0.44	3
Efforts should be made to satisfy all stakeholders	0	0	0	1.9	7.4	5	4.80	0.47	8
Mistakes should be analysed	0	0	1.9	0	7.4	5	4.70	0.89	9
In the maintenance process, all parties should be satisfied	0	0	0	3.7	5.6	5	4.60	0.54	10
Mistakes are eliminated to save time and cost	0	0	1.9	0	7.4	5	4.60	0.90	11
Development of a relationship with internal stakeholders is vital	0	0	0	5.6	3.7	5	4.40	0.54	12
Value is added to maintenance processes	0	0	1.9	5.6	1.9	5	4.00	0.70	14
All maintenance activities are done right the first time	0	0	1.9	1.9	5.6	5	4.40	0.89	14
OVERALL						5	4.67	0.51	

APPENDIX C5- Perception of the practice of TQM (Granger Bay)

Statement	1	2	3	4	5	Total	Mean	SD	Rank
	%	%	%	%	%				
Department understands and acts upon stakeholder needs	0	0	0	0	14.8	8	5.00	0.00	1
Department focuses on achievement of stakeholder satisfaction	0	0	0	1.9	13.0	8	4.87	0.35	2
In the maintenance process, all parties should be satisfied	0	0	0	1.9	13.0	8	4.87	0.35	2
Efforts should be made to satisfy all stakeholders	0	0	0	1.9	13.0	8	4.87	0.35	2
Appropriate corrective procedures should be carried out	0	0	0	1.9	13.0	8	4.87	0.35	3
Everyone should be involved in the execution of activities	0	0	0	1.9	13.0	8	4.87	0.35	3
Development of a relationship with internal stakeholders is vital	0	0	0	3.7	11.1	8	4.75	0.46	7
More focus should be placed on prevention	0	0	0	3.7	11.1	8	4.75	0.46	7
Mistakes should be analysed	0	0	0	3.7	11.1	8	4.75	0.46	7
Appropriate prevention procedures should be carried out	0	0	0	3.7	11.1	8	4.75	0.46	7
Value is added to maintenance processes	0	0	0	11.1	3.7	8	4.25	0.46	11
Mistakes are eliminated to save time and cost	0	0	5.6	0	9.3	8	4.25	1.03	12
Cost of resources consumed is measured	0	0	0	13.0	1.9	8	4.12	0.35	13
All maintenance activities are done right the first time	0	0	1.9	9.3	3.7	8	4.12	0.64	14
OVERALL						8	4.64	0.43	

APPENDIX D1- Importance of TQM practices (Bellville)

TQM practices	1	2	3	4	5	Total	Mean	SD	Sub-rank	Rank
	%	%	%	%	%					
People Involvement										
Participation of everyone assists productivity	0	0	0	14.8	16.7	17	4.52	0.51	16	
Involvement of workers is important for success	0	0	0	13.0	18.5	17	4.58	0.50	9	
Satisfaction of workers should be regularly measured	0	0	0	9.3	22.2	17	4.70	0.46	4	
Environment should contribute to employee safety	0	0	0	9.3	22.2	17	4.70	0.46	4	
OVERALL							4.62	0.48		1
Factual approach to decision-making										
Data on performance measures is gathered	0	0	0	5.6	25.9	17	4.82	0.39	1	
Data on decision-making is analysed	0	0	0	13.0	18.5	17	4.58	0.50	9	
Statistical methods should be used for data analysis	0	0	3.7	9.3	18.5	17	4.47	0.71	22	
OVERALL							4.62	0.53		2
Customer focus										
Stakeholders should be the focus of all activities	0	0	0	14.8	16.7	17	4.52	0.51	16	
Stakeholder satisfaction should be achieved	0	0	0	14.8	16.7	17	4.52	0.51	16	
Stakeholder inputs should be regularly sought	0	0	0	9.3	22.2	17	4.70	0.46	4	
Stakeholder needs should be effectively disseminated	0	0	1.9	3.7	25.9	17	4.76	0.56	3	
Stakeholder expectations should be considered	0	0	1.9	13.0	16.7	17	4.47	0.62	20	
OVERALL							4.59	0.53		3
Leadership										
Develop clear objectives	0	0	0	9.3	22.2	17	4.70	0.46	4	
Effective strategies should be developed	0	0	1.9	9.3	20.4	17	4.58	0.61	14	
Establish appropriate management structure	0	0	1.9	11.1	18.5	17	4.52	0.62	19	
Contingency plans should be developed	0	0	3.7	14.8	13.0	17	4.29	0.68	26	
Top management should encourage through empowerment	0	0	1.9	13.0	16.7	17	4.47	0.62	20	
Top management should pay attention to members	0	0	0	13.0	18.5	17	4.58	0.50	9	
OVERALL							4.52	0.59		4
Process approach										
Related activities should be managed as a process	0	0	0	3.7	27.8	17	4.80	0.33	2	
Resources should be managed as a process	0	0	0	11.1	20.4	17	4.62	0.49	8	
Objectives should be clearly defined	0	0	13.0	18.5	0	17	4.58	0.50	9	
Interest of all parties should be managed	0	0	7.4	14.8	9.3	17	4.05	0.74	29	
OVERALL							4.51	0.51		5
Continuous improvement										
Processes should be continually improved	0	0	1.9	16.7	13.0	17	4.35	0.60	25	
Improvement teams should be available	0	0	9.3	7.4	14.8	17	4.17	0.88	28	
Programmes for enhancing continuous improvement should be implemented	0	0	3.7	5.6	22.2	17	4.58	0.71	15	
OVERALL							4.36	0.73		6
System Management										
Sys should be well identified	0	0	5.6	14.8	11.1	17	4.17	0.72	27	
Activities should be managed for effectiveness	0	0	3.7	11.1	16.7	17	4.41	0.71	24	
Clear instructions should be available	0	0	3.7	9.3	18.5	17	4.47	0.71	22	
OVERALL							4.35	0.71		7
Supplier relationship										
Mutually fav. relationship with suppliers	5.6	0	0	9.3	16.7	17	4.00	1.50	30	
Regular supplier audits should be conducted	0	0	0	13.0	18.5	17	4.58	0.50	9	
Ensure suppliers can maintain qty. standards	5.6	0	0	9.3	16.7	17	4.00	1.50	31	
OVERALL							4.19	1.6		**8**

APPENDIX D2- Importance of TQM practices (Cape Town)

TQM practices	1 %	2 %	3 %	4 %	5 %	Total	Mean	SD	Sub-rank	Rank
Leadership										
Top management must develop clear objectives	0	0	0	7.4	24.1	17	4.76	0.43	2	
Effective strategies should be developed	0	0	1.9	3.7	25.9	17	4.76	0.56	4	
Maintenance department should establish an appropriate structure	0	0	0	1.9	29.6	17	4.94	0.24	1	
Contingency plans should be developed	0	0	1.9	5.6	24.1	17	4.70	0.58	8	
Top management should encourage members through empowerment	0	0	3.7	5.6	22.2	17	4.58	0.71	15	
Top management should pay attention	0	0	1.9	3.7	25.9	17	4.76	0.56	4	
OVERALL							4.75	0.41		1
Customer focus										
Stakeholders should be focus of all activities	0	0	0	14.8	16.7	17	4.52	0.51	16	
Stakeholder satisfaction should be achieved	0	0	0	14.8	16.7	17	4.52	0.51	16	
Stakeholder inputs should be regularly sought	0	0	0	13.0	18.5	17	4.58	0.50	14	
Stakeholder needs should be disseminated	0	0	0	7.4	24.1	17	4.76	0.43	2	
Stakeholder expectations should be considered	0	0	0	9.3	22.2	17	4.70	0.46	6	
OVERALL							4.61	0.50		2
Process approach										
Related activities should be managed	0	0	3.7	3.7	24.1	17	4.64	0.70	13	
Resources should be managed as a process	0	0	1.9	14.8	14.8	17	4.41	0.61	22	
Obj. should be clearly defined	0	0	1.9	7.4	22.2	17	4.64	0.60	12	
Processes based on interest of all parties should be managed	0	0	5.6	5.6	20.4	17	4.47	0.79	20	
OVERALL							4.54	0.63		3
System Management										
Sys and processes should be well identified	0	0	3.7	13.0	14.8	17	4.35	0.70	25	
Activities should be managed for effectiveness	0	0	1.9	5.6	24.1	17	4.70	0.58	8	
Clear instructions should be available	0	0	5.6	5.6	20.4	17	4.47	0.79	20	
OVERALL							4.50	0.69		4
People involvement										
Participation of everyone assists productivity	0	0	11.1	7.4	13.0	17	4.05	0.89	28	
Involvement of workers is important for success	0	0	3.7	7.4	20.4	17	4.52	0.71	18	
Satisfaction of workers should be measured	0	0	0	9.3	22.2	17	4.70	0.46	6	
Work environment should be maintained	0	0	1.9	5.6	24.1	17	4.70	0.58	8	
OVERALL							4.49	0.68		5
Continuous improvement										
Processes should be continually improved	0	0	1.9	16.7	13.0	17	4.35	0.60	24	
Improvement teams should be available	0	0	3.7	9.3	18.5	17	4.47	0.71	19	
Programmes for improving continuous imp. should be implemented	0	0	0	11.1	20.4	17	4.64	0.49	11	
OVERALL							4.48	0.60		6
Factual approach to decision-making										
Ensure data on performance measures is gathered	0	0	5.6	7.4	18.5	17	4.41	0.79	23	
Data to improve decision-making is continually analysed	0	0	3.7	24.1	3.7	17	4.00	0.50	29	
Statistical methods should be used for analysis	0	0	1.9	22.2	7.4	17	4.17	0.52	27	
OVERALL							4.19	0.60		7
Suppler relationship										
Mutually fav. Relationship with suppliers	3.7	5.6	0	9.3	13.0	17	3.70	1.49	31	
Regular supplier audits should be conducted	1.9	0	1.9	11.1	16.7	17	4.29	1.04	26	
Ensure suppliers can maintain qty. standards.	0	0	7.4	9.3	14.8	17	4.00	1.22	30	
OVERALL							3.99	1.25		**8**

APPENDIX D3- Importance of TQM practices (Mowbray)

TQM practices	1 %	2 %	3 %	4 %	5 %	Total	Mean	SD	Sub - rank	Rank
Leadership										
Top management must develop clear objectives	0	0	0	3.7	9.3	7	4.71	0.48	7	
Effective strategies should be developed	0	0	0	5.6	7.4	7	4.57	0.53	18	
Maintenance department should establish an appropriate management structure	0	0	0	0	13.0	7	5.00	0.00	1	
Contingency plans should be developed	0	0	0	1.9	11.1	7	4.85	0.37	3	
Top management should encourage members	0	0	1.9	1.9	9.3	7	4.57	0.78	19	
Top management should pay attention	0	0	0	1.9	11.1	7	4.85	0.37	3	
OVERALL							4.74	0.42		1
Process approach										
Related activities, should be managed	0	0	1.9	1.9	9.3	7	4.57	0.78	19	
Resources should be managed as a process	0	0	0	7.4	5.6	7	4.42	0.53	24	
Objectives should be clearly defined	0	0	0	0	13.0	7	5.00	0.00	1	
Processes based on interest of all parties should be managed	0	0	0	1.9	11.1	7	4.85	0.37	3	
OVERALL							4.71	0.42		2
Customer focus										
Stakeholders should be the focus of all activities	0	0	0	3.7	9.3	7	4.71	0.48	7	
Stakeholder satisfaction should be achieved	0	0	0	3.7	9.3	7	4.71	0.48	7	
Stakeholder inputs should be regularly sought	0	0	0	3.7	9.3	7	4.71	0.48	7	
Stakeholder needs should be disseminated	0	0	0	5.6	7.4	7	4.57	0.53	16	
Stakeholder expectations should be considered	0	0	0	1.9	11.1	7	4.85	0.37	3	
OVERALL							4.71	0.46		3
Continuous improvement										
Processes should be continually improved	0	0	0	3.7	9.3	7	4.71	0.48	7	
Improvement teams should be available	0	0	1.9	0	11.1	7	4.71	0.75	15	
Programmes for improving continuous imp. should be implemented	0	0	0	3.7	9.3	7	4.71	0.48	7	
OVERALL							4.71	0.57		4
Supplier relationship										
Mutually fav. Relationship with suppliers	0	1.9	1.9	1.9	7.4	7	4.14	1.21	30	
Regular supplier audits should be conducted	0	0	1.9	1.9	9.3	7	4.57	0.78	19	
Ensure suppliers can maintain qty. standards.	0	0	0	3.7	9.3	7	4.71	0.48	7	
OVERALL							4.47	0.82		5
Factual approach to decision-making										
Ensure data on performance measures is gathered	0	0	0	9.3	3.7	7	4.28	0.48	27	
Data to improve decision-making is continually analysed	0	0	0	5.6	7.4	7	4.57	0.53	16	
Statistical methods should be used for analysis	0	0	0	7.4	5.6	7	4.42	0.53	24	
OVERALL							4.42	0.51		6
People involvement										
Participation of everyone assists productivity	0	0	3.7	5.6	3.7	7	4.00	0.81	31	
Involvement of workers is important for success	0	0	1.9	1.9	9.3	7	4.57	0.78	19	
Satisfaction of workers should be regularly measured	0	0	0	3.7	9.3	7	4.71	0.48	14	
Work environment that contributes to employee safety should be maintained	0	1.9	0	9.3	0	7	4.42	1.13	26	
OVERALL							4.42	0.80		7
System management										
Sys and processes should be well identified	0	0	1.9	5.6	5.6	7	4.28	0.75	28	
Activities should be managed for effectiveness	0	0	1.9	5.6	5.6	7	4.28	0.75	28	
Clear instructions should be available	0	0	1.9	1.9	9.3	7	4.57	0.78	19	
OVERALL							4.37	0.76		8

APPENDIX D4- Importance of TQM practices (Wellington)

TQM practices	1 %	2 %	3 %	4 %	5 %	Total	Mean	SD	Sub-rank	Rank
Customer focus										
Stakeholders should be the focus of all activities	0	0	0	3.7	5.6	5	4.60	0.54	11	
Stakeholder satisfaction should be achieved	0	0	0	0	9.3	5	5.00	0.00	1	
Stakeholder inputs should be regularly sought	0	0	0	0	9.3	5	5.00	0.00	1	
Stakeholder needs should be effectively disseminated	0	0	0	0	9.3	5	5.00	0.00	1	
Stakeholder expectations should be considered	0	0	1.9	1.9	5.6	5	4.40	0.89	15	
OVERALL							4.80	0.18		1
People involvement										
Participation of everyone assists productivity	0	0	0	0	0	5	5.00	0.00	1	
Involvement of workers is important for success	0	0	0	0	0	5	5.00	0.00	1	
Satisfaction of workers should be regularly measured	0	0	0	1	1.9	5	4.60	0.89	13	
Employee safety should be maintained	0	0	0	0	0	5	4.60	0.54	11	
OVERALL							4.80	0.35		2
Process approach										
Related activities should be managed as a process	0	0	0	0	0	5	5.00	0.00	1	
Resources should be managed as a process	0	0	0	0	0	5	5.00	0.00	1	
Objectives should be clearly defined	0	0	0	0	0	5	5.00	0.00	1	
Processes based on interest should be managed	0	0	0	3	5.6	5	3.60	0.89	29	
OVERALL							4.65	0.22		3
Continuous improvement										
Processes should be continually improved	0	0	0	1	1.9	5	4.60	0.89	13	
Improvement teams should be available	0	0	0	2	3.7	5	4.00	1.00	28	
Programmes for improving continuous imp. should be implemented	0	0	0	0	0	5	4.80	0.44	9	
OVERALL							4.46	0.77		4
Leadership										
Top management must develop clear obj.	0	0	0	0	0	5	4.20	0.44	20	
Effective strategies should be developed	0	0	0	1	1.9	5	4.40	0.89	15	
Maintenance department should establish an appropriate management structure	0	0	0	1	1.9	5	4.40	0.89	15	
Contingency plans should be developed	0	0	0	2	3.7	5	4.20	1.09	26	
Top management should encourage members through empowerment	0	0	0	1	1.9	5	4.20	0.83	24	
Top management should pay attention to members	0	0	0	0	0	5	4.80	0.44	9	
OVERALL							4.36	0.74		5
System management										
Sys and processes should be well identified	0	0	0	0	0	5	4.20	0.44	20	
Activities should be managed for effectiveness	0	0	0	1	1.9	5	4.20	0.83	24	
Clear instructions should be available	0	0	0	1	1.9	5	4.40	0.89	15	
OVERALL							4.26	0.72		6
Factual approach to decision-making										
Ensure data on performance measures is gathered	0	0	0	1	1.9	5	4.40	0.89	15	
Data to improve decision-making is continually analysed	0	0	0	0	0	5	4.20	0.44	22	
Statistical methods should be used for data analysis	0	0	0	0	0	5	4.00	0.00	27	
OVERALL							4.20	0.44		7
Supplier relationship										
Mutually fav. Relationship with suppliers	3.7	0	0	0	0	5	3.00	1.87	30	
Regular supplier audits should be conducted	0	0	0	0	0	5	4.20	0.44	22	
Ensure suppliers can maintain qty. standards.	1.9	1	1.9	1	1.9	5	2.80	1.30	31	
OVERALL							3.33	1.20		**8**

APPENDIX D5- Importance of TQM practices (Granger Bay)

TQM practices	1 %	2 %	3 %	4 %	5 %	Total	Mean	SD	Sub-rank	Rank
Customer focus										
Stakeholders should be the focus of all activities	0	0	0	0	14.8	8	5.00	0.00	1	
Stakeholder satisfaction should be achieved by conforming to specification	0	0	0	0	14.8	8	5.00	0.00	1	
Stakeholder needs should be regularly sought	0	0	0	0	14.8	8	5.00	0.00	1	
Stakeholder needs should be effectively disseminated	0	0	0	0	14.8	8	5.00	0.00	1	
Stakeholder expectations should be considered	0	0	0	1.9	13.0	8	4.87	0.35	15	
OVERALL							4.97	0.07		1
People involvement										
Participation of everyone assists	0	0	0	3.7	11.1	8	4.72	0.46	21	
Involvement of workers is important for success	0	0	0	0	14.8	8	5.00	0.00	1	
Satisfaction of workers should be regularly measured	0	0	0	1.9	13.0	8	4.87	0.35	12	
Work environment that contributes to employee safety should be maintained	0	0	0	0	14.8	8	5.00	0.00	1	
OVERALL							4.89	0.20		2
Leadership										
Maintenance department should establish an appropriate management structure	0	0	0	0	14.8	8	5.00	0.00	1	
Contingency plans should be developed	0	0	0	1.9	13.0	8	4.87	0.35	12	
Top management should encourage members through empowerment	0	0	0	3.7	11.1	8	4.75	0.46	17	
Top management must develop clear objectives	0	0	1.9	1.9	11.1	8	4.62	0.74	26	
Effective strategies should be developed	0	0	0	0	14.8	8	5.00	0.00	1	
Top management should pay attention to members	0	0	1.9	0	13.0	8	4.75	0.70	18	
OVERALL							4.83	0.37		3
Continuous improvement										
Processes should be improved	0	0	0	0	14.8	8	5.00	0.00	1	
Improvement teams should be available	0	0	1.9	0	13.0	8	4.75	0.70	178	
Programmes for improving continuous imp. should be implemented	0	0	1.9	0	13.0	8	4.75	0.70	18	
OVERALL							4.83	0.46		4
Process approach										
Related activities, should be managed as a process	0	0	0	0	14.8	8	5.00	0.00	1	
Resources should be managed as a process	0	0	0	0	14.8	8	5.00	0.00	1	
Objectives should be clearly defined	0	0	0	1.9	13.0	8	4.87	0.35	12	
Processes based on interest of all parties should be managed	0	0	3.7	3.7	7.4	8	4.25	0.88	28	
OVERALL							4.78	0.31		5
System Management										
Systems and processes should be well identified	0	0	3.7	5.6	5.6	8	4.82	0.83	16	
Activities. should be managed	0	0	5.6	0	9.3	8	4.25	1.03	29	
Clear instructions should be available	0	0	1.9	1.9	11.1	8	4.62	0.74	24	
OVERALL							4.56	0.87		6

TQM practices	1	2	3	4	5	Total	Mean	SD	Sub-rank	Rank
	%	%	%	%	%					
Factual approach to decision-making										
Ensure data on performance measures is gathered	0	0	1.9	0	13.0	8	4.62	0.74	24	
Data to improve decision-making is continually analysed	0	0	1.9	1.9	11.1	8	4.62	0.51	22	
Statistical methods should be used for data analysis	0	0	1.9	3.7	9.3	8	4.50	0.75	27	
OVERALL							4.53	0.67		**7**
Supplier relationship										
Mutually favourable relationship with suppliers	3.7	1.9	0	3.7	5.6	8	3.37	1.76	31	
Regular supplier audits should be conducted	0	0	0	5.6	9.3	8	4.62	0.51	22	
Ensure suppliers can maintain qty. standards.	1.9	3.7	0	1.9	7.4	8	3.62	1.68	30	
OVERALL							3.87	1.32		**8**

APPENDIX E1- Extent of TQM practice (Bellville)

TQM practices	1	2	3	4	5	Total	Mean	SD	Sub-rank	Rank
	%	%	%	%	%					
Process Approach										
Related maintenance activities are managed effectively	0	0	1.9	5.6	24.1	17	4.70	0.58	1	
Resources are managed as a process	0	0	3.7	5.6	22.2	17	4.58	0.71	2	
Objectives are clearly defined	0	0	3.7	7.4	20.4	17	4.52	0.71	3	
Processes are effectively managed	0	3.7	5.6	14.8	7.4	17	3.82	0.95	17	
OVERALL							4.41	0.66		1
Customer focus										
Regard stakeholders as the focus	0	0	9.3	9.3	13.0	17	4.11	0.85	8	
Satisfy stakeholders by conforming to specification	5.6	1.9	5.6	7.4	11.1	17	3.51	1.50	27	
Stakeholder inputs are encouraged	0	0	5.6	9.3	16.7	17	4.35	0.78	4	
Stakeholder expectations are considered	0	0	9.3	14.8	7.4	17	3.94	0.74	11	
Stakeholder needs are understood	0	0	5.6	14.8	11.1	17	4.17	0.72	7	
OVERALL							4.02	0.92		2
Leadership										
Top management develops clear objectives	3.7	5.6	1.9	9.3	11.1	17	3.58	1.46	23	
Effective strategies are developed to control maintenance	3.7	5.6	3.7	5.6	13.0	17	3.58	1.50	24	
Contingency plans are developed to control maintenance	1.9	3.7	1.9	11.1	13.0	17	3.94	1.24	14	
Maintenance department puts in place appropriate management structures	0	1.9	1.9	13.0	14.8	17	4.29	0.84	5	
Top management encourages members through empowerment	1.9	1.9	0	14.8	13.0	17	4.11	1.11	9	
Top management consistently pays attention to members	1.9	0	1.9	13.0	14.8	17	4.23	1.03	6	
OVERALL							3.95	1.19		3
System Management										
Systems and maintenance processes are well identified and understood	1.9	0	5.6	20.4	3.7	17	3.76	0.90	21	
Activities are managed in order to contribute to effectiveness	0	0	9.3	13.0	9.3	17	4.00	0.79	10	
Clear instructions are available	1.9	0	11.1	3.7	14.8	17	3.94	1.19	15	
OVERALL							3.90	0.96		4
People Involvement										
Everyone participates in the execution of activities	0	1.9	9.3	14.8	5.6	17	3.76	0.83	20	
All workers are involved in the maintenance process	0	1.9	5.6	16.7	7.4	17	3.94	0.82	13	
Satisfaction of workers is measured regularly	1.9	1.9	7.4	9.3	11.1	17	3.82	1.18	19	
Maintenance department contributes to the safety of workers	1.9	1.9	3.7	14.8	9.3	17	3.88	1.11	16	
OVERALL							3.85	0.94		5
Supplier Relationship										
A mutually favourable relationship exists between the department and suppliers	0	0	9.3	14.8	7.4	17	3.94	0.74	11	
Regular supplier audits are conducted	0	5.6	7.4	14.8	3.7	17	3.52	0.94	25	
Maintenance department ensures all suppliers can maintain quality standards and meet specifications	1.9	0	5.6	14.8	5.6	17	3.82	0.95	17	
OVERALL							3.76	0.88		6
Continuous Improvement										
Continuous improvement of all services and processes is practiced	1.9	1.9	13.0	5.6	9.3	17	3.58	1.17	22	

TQM practices	1	2	3	4	5	Total	Mean	SD	Sub-rank	Rank
	%	%	%	%	%					
Improvement teams are available in all departments	1.9	1.9	9.3	14.8	3.7	17	3.52	1.00	26	
Programmes for upgrading the continuous improvement process is implemented	1.9	5.6	3.7	16.7	3.7	17	3.47	1.12	28	
OVERALL							3.52	1.09		
Factual approach to decision										
Ensure data on performance measures is gathered	3.7	11.1	5.6	9.3	1.9	17	2.82	1.18	31	
Data to improve decision-making is continually analysed	1.9	7.4	13.0	7.4	1.9	17	3.00	1.00	30	
Statistical methods are used to analyse data	1.9	5.6	11.1	5.6	7.4	17	3.35	1.22	29	
OVERALL							3.16	1.13		8

APPENDIX E2- Extent of TQM practice (Cape Town)

TQM practices	1 %	2 %	3 %	4 %	5 %	Total	Mean	SD	Sub - rank	Rank
People Involvement										
Everyone participates in the execution of activities	1.9	0	3.7	7.4	18.5	17	3.88	1.05	15	
All workers are involved in the maintenance process	0	0	1.9	16.7	13.0	17	4.35	0.60	5	
Satisfaction of workers is measured regularly	0	0	3.7	9.3	18.5	17	4.47	0.71	2	
Maintenance department contributes to the safety of workers	0	3.7	1.9	11.1	14.8	17	4.17	1.01	9	
OVERALL							4.29	0.84		1
Process Approach										
Related maintenance activities are managed effectively	0	1.9	0	5.6	24.1	17	4.47	1.00	3	
Resources are managed as a process	0	0	7.4	3.7	20.4	17	4.41	0.87	4	
Objectives are clearly defined	0	0	5.6	11.1	14.8	17	4.29	0.77	6	
Processes based on interest of all parties are effectively managed	0	5.6	3.7	18.5	3.7	17	3.64	0.93	21	
OVERALL							4.20	0.89		2
Customer focus										
Regard stakeholders as the focus	1.9	0	13.0	13.0	0	17	3.52	0.94	26	
Satisfy stakeholders by conforming to specification	3.7	3.7	1.9	9.3	13.0	17	3.76	1.73	18	
Stakeholder inputs are encouraged	0	0	3.7	7.4	20.4	17	4.52	0.71	1	
Stakeholder expectations are considered	0	1.9	7.4	7.4	14.8	17	4.11	0.99	11	
Stakeholder needs are effectively disseminated and understood	0	1.9	1.9	18.5	9.3	17	4.11	0.78	10	
OVERALL							4.00	1.03		3
Continuous Improvement										
Continuous improvement of all services and processes is practiced	0	1.9	7.4	9.3	13.0	17	4.05	0.96	13	
Improvement teams are available in all departments	0	1.9	13.0	9.3	7.4	17	3.70	0.91	19	
Programmes for upgrading the continuous improvement process is implemented	0	3.7	7.4	14.8	5.6	17	3.70	0.91	19	
OVERALL							3.81	0.93		4
System Management										
Systems and maintenance processes are well identified and understood	0	0	13.0	18.5	0	17	3.58	0.50	22	
Activities are managed in order to contribute to effectiveness	1.9	3.7	7.4	16.7	1.9	17	3.41	1.00	29	
Clear instructions are available	0	1.9	9.3	9.3	11.1	17	3.94	0.96	14	
OVERALL							3.64	0.82		5
Leadership										
Top management develops clear objectives	11.1	7.4	1.9	9.3	1.9	17	2.47	1.41	**31**	
Effective strategies are developed	7.4	9.3	5.6	7.4	1.9	17	2.58	1.27	23	
Contingency plans are developed to control maintenance	0	1.9	7.4	7.4	14.8	17	3.82	1.18	16	
Maintenance department puts in place appropriate management structures	0	1.9	5.6	5.6	18.5	17	4.11	0.99	11	
Top management encourages members through empowerment	1.9	0	3.7	7.4	18.5	17	4.29	0.98	7	
Top management consistently pays attention to members	1.9	0	7.4	13.0	9.3	17	4.29	1.10	8	
OVERALL							3.59	1.29		6

TQM practices	1	2	3	4	5	Total	Mean	SD	Sub-rank	Rank
	%	%	%	%	%					
Supplier Relationship										
A mutually favourable relationship exists between the department and suppliers	0	3.7	5.6	16.7	5.6	17	3.76	0.90	17	
Regular supplier audits are conducted	0	5.6	11.1	11.1	3.7	17	3.41	0.93	28	
Maintenance department ensures all suppliers can maintain quality standards and meet specifications	0	3.7	11.1	13.0	3.7	17	3.52	0.87	24	
OVERALL							3.56	0.90		7
Factual approach to decision-making										
Ensure data on performance measures is gathered	0	11.1	14.8	1.9	3.7	17	2.94	0.96	30	
Data to improve decision-making is continually analysed	0	1.9	18.5	5.6	5.6	17	3.47	0.87	27	
Statistical methods are used to analyse data	0	1.9	16.7	7.4	5.6	17	3.52	0.87	24	
OVERALL							3.31	0.90		8

APPENDIX E3- Extent of TQM practice (Mowbray)

TQM practices	1	2	3	4	5	Total	Mean	SD	Sub-rank	Rank
	%	%	%	%	%					
Process Approach										
Related maintenance activities are managed effectively	0	0	3.7	3.7	5.6	7	4.14	0.89	16	
Resources are managed as a process	0	0	1.9	1.9	9.3	7	4.57	0.78	3	
Objectives are clearly defined	0	0	1.9	0	11.1	7	4.71	0.75	2	
Processes based on interest of all parties are effectively managed	0	0	1.9	3.7	7.4	7	4.42	0.78	5	
OVERALL							4.46	0.81		1
Customer focus										
Regard stakeholders as the focus	0	0	3.7	1.9	7.4	7	4.29	0.95	8	
Satisfy stakeholders by conforming to specification	1.9	0	0	3.7	7.4	7	4.14	1.46	20	
Stakeholder inputs are encouraged	0	0	0	1.9	11.1	7	4.85	0.37	1	
Stakeholder expectations are considered	0	0	1.9	5.6	5.6	7	4.28	0.75	11	
Stakeholder needs are effectively disseminated and understood	0	0	0	7.4	5.6	7	4.42	0.53	4	
OVERALL							4.39	0.81		2
Supplier Relationship										
A mutually favourable relationship exists between the department and suppliers	0	0	0	9.3	3.7	7	4.28	0.48	9	
Regular supplier audits are conducted	1.9	0	1.9	3.7	5.6	7	3.85	1.46	24	
Maintenance department ensures all suppliers can maintain quality standards and meet specifications	0	0	1.9	3.7	7.4	7	4.42	0.78	5	
OVERALL							4.18	0.90		3
System Management										
Systems and maintenance processes are well identified and understood	0	0	9.3	0	3.7	7	4.28	0.48	9	
Activities are managed in order to contribute to effectiveness	0	1.9	1.9	5.6	3.7	7	3.85	1.06	23	
Clear instructions are available	0	0	3.7	1.9	7.4	7	4.28	0.95	14	
OVERALL							4.13	0.83		4
People Involvement										
Everyone participates in the execution of activities	1.9	1.9	0	7.4	1.9	7	3.42	1.39	30	
All workers are involved in the maintenance process	0	1.9	0	5.6	5.6	7	4.14	1.06	19	
Satisfaction of workers is measured regularly	0	0	3.7	3.7	5.6	7	4.14	0.89	16	
Maintenance department contributes to the safety of workers	0	0	1.9	3.7	7.4	7	4.42	0.78	5	
OVERALL							4.03	1.11		5
Leadership										
Top management develops clear objectives	1.9	0	1.9	5.6	3.7	7	3.71	1.38	26	
Effective strategies are developed to control maintenance	5.6	1.9	0	3.7	1.9	7	2.57	1.71	31	
Contingency plans are developed to control maintenance	0	0	9.3	1.9	1.9	7	3.42	0.78	27	
Maintenance department puts in place appropriate management structures	0	0	3.7	3.7	5.6	7	4.14	0.89	16	
Top management encourages members through empowerment	0	0	1.9	5.6	5.6	7	4.28	0.75	11	
Top management consistently pays attention to members	0		1.9	5.6	5.6	7	4.28	0.75	1	
OVERALL							3.73	1.29		6

TQM practices	1	2	3	4	5	Total	Mean	SD	Sub-rank	Rank
	%	%	%	%	%					
Factual approach to decision-making										
Ensure data on performance measures is gathered	0	1.9	5.6	3.7	1.9	7	3.42	0.97	28	
Data to improve decision-making is continually analysed	0	1.9	1.9	3.7	5.6	7	4.00	1.15	21	
Statistical methods are used to analyse data	0	0	5.6	5.6	1.9	7	3.71	0.75	25	
OVERALL							3.71	0.96		7
Continuous Improvement										
Continuous improvement of all services and processes is practiced	1.9	0	3.7	5.6	1.9	7	3.42	1.27	29	
Improvement teams are available in all departments	1.9	1.9	3.7	1.9	3.7	7	3.28	1.49	15	
Programmes for upgrading the continuous improvement process is implemented	0	3.7	0	1.9	7.4	7	4.00	1.41	22	
OVERALL							3.56	1.39		8

APPENDIX E4- Extent of TQM practice (Wellington)

TQM practices	1 %	2 %	3 %	4 %	5 %	Total	Mean	SD	Sub-rank	Rank
Process approach										
Related maintenance activities are managed effectively	0	0	0	1.9	7.4	5	4.80	0.44	1	
Resources are managed as a process	0	0	1.9	0	7.4	5	4.60	0.89	5	
Objectives are clearly defined	0	0	1.9	1.9	5.6	5	4.40	0.89	7	
Processes based on interest of all parties are effectively managed	0	1.9	3.7	3.7	0	5	3.20	0.83	25	
OVERALL							4.25	0.76		1
People Involvement										
Everyone participates in the execution of activities	0	0	0	3.7	5.6	5	4.60	0.54	4	
All workers are involved in the maintenance process	0	0	3.7	1.9	3.7	5	4.00	1.00	15	
Satisfaction of workers is measured regularly	0	0	3.7	1.9	3.7	5	4.00	1.00	15	
Maintenance department contributes to the safety of workers	0	0	1.9	3.7	3.7	5	4.20	0.83	9	
OVERALL							4.20	0.84		2
System Management										
Systems and maintenance processes are well identified and understood	0	0	0	7.4	1.9	5	4.20	0.44	8	
Activities are managed in order to contribute to effectiveness	0	0	1.9	5.6	1.9	5	4.00	0.70	12	
Clear instructions are available	0	0	3.7	3.7	1.9	5	3.80	0.83	19	
OVERALL							4.00	0.65		3
Customer focus										
Regard stakeholders as the focus	0	0	7.4	0	1.9	5	3.40	0.89	24	
Satisfy stakeholders by conforming to specification	1.9	1.9	1.9	1.9	1.9	5	3.00	1.58	31	
Stakeholder inputs are encouraged	0	0	0	1.9	7.4	5	4.80	0.44	1	
Stakeholder expectations are considered	0	0	3.7	0	5.6	5	4.20	1.09	10	
Stakeholder needs are effectively disseminated and understood	0	0	0	3.7	5.6	5	4.60	0.54	4	
OVERALL							4.00	0.90		4
Continuous improvement										
Continuous improvement of all services and processes is practiced	0	0	3.7	1.9	3.7	5	4.00	1.00	15	
Improvement teams are available in all departments	0	0	3.7	5.6	0	5	3.60	0.54	22	
Programmes for upgrading the continuous improvement process is implemented	0	0	1.9	5.6	1.9	5	4.00	0.70	12	
OVERALL							3.86	0.74		5
Factual approach to decision-making										
Ensure data on performance measures is gathered	0	1.9	1.9	3.7	1.9	5	3.60	1.14	23	
Data to improve decision-making is continually analysed	0	0	3.7	1.9	3.7	5	4.00	1.00	15	
Statistical methods are used to analyse data	0	0	1.9	5.6	1.9	5	4.00	0.70	12	
OVERALL							3.86	0.94		6
Leadership										
Top management develops clear objectives	1.9	1.9	0	3.7	1.9	5	3.20	1.64	28	
Effective strategies are developed to control maintenance	1.9	0	3.7	1.9	1.9	5	3.20	1.48	27	
Contingency plans are developed to control maintenance	0	1.9	1.9	1.9	3.7	5	3.80	1.30	21	

TQM practices	1	2	3	4	5	Total	Mean	SD	Sub-rank	Rank
	%	%	%	%	%					
Maintenance department puts in place appropriate management structures	0	0	0	3.7	5.6	5	4.20	1.09	10	
Top management encourages members through empowerment	0	0	0	1.9	7.4	5	4.60	0.89	5	
Top management consistently pays attention to members	0	0	1.9	0	7.4	5	4.80	0.44	1	
OVERALL							3.80	1.28		7
Supplier relationship										
A mutually favourable relationship exists between the department and suppliers	0	0	3.7	3.7	1.9	5	3.80	0.83	19	
Regular supplier audits are conducted	1.9	1.9	0	3.7	1.9	5	3.20	1.64	28	
Maintenance department ensures all suppliers can maintain quality standards and meet specifications	0	3.7	1.9	1.9	1.9	5	3.20	1.30	26	
OVERALL							3.40	1.25		8

APPENDIX E5- Extent of TQM practice (Granger Bay)

TQM practices	1	2	3	4	5	Total	Mean	SD	Sub-rank	Rank
	%	%	%	%	%					
People Involvement										
Everyone participates in the execution of activities	0	0	0	3.7	11.1	8	4.75	0.46	7	
All workers are involved in the maintenance process	0	0	0	3.7	11.1	8	4.75	0.46	7	
Satisfaction of workers is measured regularly	0	0	0	0	14.8	8	5.00	0.00	1	
Maintenance department contributes to the safety of workers	0	0	0	0	14.8	8	5.00	0.00	1	
OVERALL							4.87	0.23		1
Process approach										
Related maintenance activities are managed effectively	0	0	0	0	14.8	8	5.00	0.00	1	
Resources are managed as a process	0	0	0	0	14.8	8	5.00	0.00	1	
Objectives are clearly defined	0	0	1.9	0	13.0	8	4.75	0.70	10	
Processes based on interest of all parties are effectively managed	0	1.9	7.4	3.7	1.9	8	3.37	0.91	22	
OVERALL							4.53	0.40		2
System Management										
Systems and maintenance processes are well identified and understood	0	0	0	14.8	0	8	4.00	0.00	16	
Activities are managed in order to contribute to effectiveness	0	0	0	13.0	1.9	8	4.12	0.35	15	
Clear instructions are available	0	0	1.9	0	13.0	8	4.75	0.70	10	
OVERALL							4.29	0.35		3
Continuous improvement										
Continuous improvement of all services and processes is practiced	0	0	0	5.6	9.3	8	4.62	0.51	12	
Improvement teams are available in all departments	0	0	0	14.8	0	8	4.00	0.00	16	
Programmes for upgrading the continuous improvement process is implemented	0	1.9	0	9.3	3.7	8	4.00	0.92	18	
OVERALL							4.20	0.47		4
Factual approach to decision-making										
Ensure data on performance measures is gathered	0	5.6	5.6	0	3.7	8	3.12	1.24	24	
Data to improve decision-making is continually analysed	0	0	7.4	3.7	3.7	8	3.75	0.88	20	
Statistical methods are used to analyse data	0	0	5.6	5.6	3.7	8	3.87	0.83	19	
OVERALL							3.58	0.98		5
Customer focus										
Regard stakeholders as the focus	3.7	0	11.1	0	0	8	2.50	0.92	27	
Satisfy stakeholders by conforming to specification	7.4	3.7	0	0	3.7	8	2.25	1.75	29	
Stakeholder inputs are encouraged	0	0	1.9	3.7	9.3	8	4.50	0.75	13	
Stakeholder expectations are considered	0	0	11.1	1.9	1.9	8	3.37	0.74	21	
Stakeholder needs are effectively disseminated and understood	1.9	0	0	0	13.0	8	4.50	1.41	14	
OVERALL							3.41	1.11		6

TQM practices	1	2	3	4	5	Total	Mean	SD	Sub-rank	Rank
	%	%	%	%	%					
Leadership										
Top management develops clear objectives	13.0	1.9	0	0	0	8	1.12	0.35	31	
Effective strategies are developed to control maintenance	9.3	3.7	1.9	0	0	8	1.50	0.75	30	
Contingency plans are developed to control maintenance	0	7.4	1.9	3.7	1.9	8	3.00	1.19	25	
Maintenance department puts in place appropriate management structures	0	0	0	3.7	11.1	8	4.75	0.46	7	
Top management encourages members through empowerment	0	0	0	1.9	13.0	8	4.87	0.35	5	
Top management consistently pays attention to members	0	0	0	1.9	13.0	8	4.87	0.35	5	
OVERALL							3.35	0.57		7
Supplier relationship										
A mutually favourable relationship exists between the department and suppliers	0	0	7.4	7.4	0	8	3.50	0.53	23	
Regular supplier audits are conducted	0	9.3	3.7	0	1.9	8	2.62	1.06	26	
Maintenance department ensures all suppliers can maintain quality standards and meet specifications	1.9	7.4	3.7	1.9	0	8	2.37	0.91	28	
OVERALL							2.83	0.83		8

APPENDIX F1- Frequency of challenges experienced (Bellville)

Challenges	1	2	3	4	5	Total	Mean	SD	Rank
	%	%	%	%	%				
Lack of support from top management	0	0	3.7	7.4	20.4	17	4.52	0.71	1
Non-involvement of maintenance workers in decision-making	0	0	3.7	9.3	18.5	17	4.47	0.71	2
Lack of sufficient training and education on quality	1.9	0	1.9	13.0	14.8	17	4.23	1.03	3
Lack of human and financial resources	0	0	5.6	9.3	31.5	17	4.11	0.69	4
Workers are not involved the formulation of policies	1.9	0	5.6	11.1	13.0	17	4.05	1.08	5
Workers lack expertise in management of quality	1.9	1.9	5.6	7.4	14.8	17	4.00	1.22	6
Lack of focus on school stakeholders	1.9	0	3.7	18.5	7.4	17	3.94	0.96	7
Insufficient communication network	1.9	0	5.6	14.8	9.3	17	3.94	1.02	8
Resistance from supervisors to implement approved ideas	1.9	1.9	5.6	9.3	13.0	17	3.94	1.19	9
Lack of clear objectives from top management	1.9	1.9	5.6	5.6	13.0	17	3.94	1.19	9
Top management in the maintenance department does not have sufficient knowledge of maintenance activities.	1.9	0	7.4	13.0	9.3	17	3.88	1.05	11
Lack of understanding amongst workers	1.9	0	13.0	9.3	7.4	17	3.64	1.05	12
Lack of vision within the maintenance department.	1.9	0	11.1	11.1	3.7	17	3.58	0.93	13
OVERALL						17	4.02	0.98	

APPENDIX F2- Frequency of challenges experienced (Cape Town)

Challenges	1	2	3	4	5	Total	Mean	SD	Rank
	%	%	%	%	%				
Non-involvement of maintenance workers in decision-making	0	0	0	11.1	20.4	17	4.64	0.49	1
Lack of sufficient training and education on quality	0	0	0	11.1	20.4	17	4.64	0.49	1
Lack of human and financial resources	0	0	0	11.1	20.4	17	4.64	0.49	1
Top management in the maintenance department does not have sufficient knowledge of maintenance activities.	0	0	3.7	7.4	20.4	17	4.52	0.71	4
Workers lack expertise in management of quality	0	0	3.7	9.3	18.5	17	4.47	0.71	5
Lack of focus on school stakeholders	0	0	3.7	9.3	18.5	17	4.47	0.71	5
Resistance from supervisors to implement approved ideas	0	0	3.7	13.0	14.8	17	4.35	0.70	7
Insufficient communication network	0	0	3.7	16.7	11.1	17	4.23	0.66	8
Lack of support from top management	0	0	9.3	7.4	14.8	17	4.17	0.88	9
Lack of clear objectives from top management	0	0	7.4	13.0	11.1	17	4.11	0.78	10
Lack of understanding amongst workers	0	0	7.4	13.0	11.1	17	4.11	0.78	10
Maintenance workers are not involved the formulation of policies	0	0	9.3	9.3	13.0	17	4.11	0.85	12
Lack of vision within the maintenance department.	0	3.7	9.3	11.1	7.4	17	3.70	0.98	13
OVERALL						17	4.32	0.71	

APPENDIX F3- Frequency of challenges experienced (Mowbray)

Challenges	1	2	3	4	5	Total	Mean	SD	Rank
	%	%	%	%	%				
Lack of human and financial resources	0	0	0	3.7	9.3	7	4.71	0.48	1
Non-involvement of maintenance workers in the decision-making	0	0	0	9.3	3.7	7	4.28	0.48	2
Lack of focus on school stakeholders	0	1.9	1.9	1.9	7.4	7	4.14	1.21	3
Lack of support from top management	0	0	5.6	1.9	5.6	7	4.00	1.00	4
Lack of sufficient training and education	1.9	1.9	0	3.7	5.6	7	3.71	1.60	5
Workers lack expertise in management of quality	1.9	1.9	0	3.7	5.6	7	3.71	1.60	5
Lack of understanding amongst workers	0	1.9	5.6	3.7	3.7	7	3.42	0.97	7
Lack of vision within the maintenance department.	0	3.7	3.7	3.7	1.9	7	3.28	1.11	8
Insufficient communication network	1.9	3.7	1.9	0	5.6	7	3.28	1.70	9
Lack of clear objectives from top management	3.7	0	5.6	1.9	1.9	7	2.85	1.46	10
Maintenance workers are not involved the formulation of policies	3.7	3.7	0	1.9	3.7	7	2.85	1.77	11
Resistance from supervisors to implement approved ideas	5.6	0	1.9	1.9	3.7	7	2.85	1.86	12
Top management in the maintenance department does not have sufficient knowledge of maintenance activities.	3.7	3.7	1.9	1.9	1.9	7	2.57	1.51	13
OVERALL						7	3.51	1.28	

APPENDIX F4- Frequency of challenges experienced (Wellington)

Challenges	1	2	3	4	5	Total	Mean	SD	Rank
	%	%	%	%	%				
Non-involvement of maintenance workers in decision	0	0	0	1.9	7.4	5	4.80	0.44	1
Lack of sufficient training and education on quality	1.9	0	0	0	7.4	5	4.80	1.78	2
Lack of human and financial resources	0	0	1.9	1.9	5.6	5	4.40	0.89	3
Insufficient communication network	0	0	1.9	3.7	3.7	5	4.20	0.83	4
Workers lack expertise in management of quality	0	0	3.7	1.9	3.7	5	4.00	1.00	5
Lack of clear objectives from top management	0	0	3.7	1.9	3.7	5	4.00	1.00	5
Top management in the maintenance department does not have sufficient knowledge of maintenance activities.	0	1.9	0	3.7	3.7	5	4.00	1.22	7
Lack of focus on school stakeholders	1.9	1.9	1.9	3.7	0	5	3.80	1.30	8
Lack of support from top management	0	0	5.6	0	5.6	5	3.80	1.09	9
Resistance from supervisors to implement approved ideas	1.9	0	0	3.7	3.7	5	3.80	1.64	10
Workers are not involved the formulation of policies	0	0	3.7	5.6	0	5	3.60	0.54	11
Lack of understanding amongst workers	0	0	5.6	3.7	0	5	3.40	0.54	12
Lack of vision within the maintenance department.	0	1.9	1.9	5.6	0	5	3.40	0.89	13
OVERALL						5	4.00	1.01	

APPENDIX F5- Frequency of challenges experienced (Wellington)

Challenges	1	2	3	4	5	Total	Mean	SD	Rank
	%	%	%	%	%				
Non-involvement of maintenance workers in decision-making	0	0	0	0	14.8	8	5.00	0.00	1
Lack of focus on school stakeholders	0	0	0	0	14.8	8	5.00	0.00	1
Lack of sufficient training and education on quality	0	0	0	1.9	13.0	8	4.87	0.35	3
Insufficient communication network	0	0	0	5.6	9.3	8	4.62	0.51	4
Lack of support from top management	0	0	1.9	3.7	9.3	8	4.50	0.75	5
Lack of human and financial resources	1.9	0	0	0	13.0	8	4.50	1.41	6
Lack of clear objectives from top management	0	0	3.7	1.9	9.3	8	4.37	0.91	7
Resistance from supervisors	0	0	0	13.0	1.9	8	4.12	0.35	8
Maintenance workers are not involved the formulation of policies	0	0	3.7	5.6	5.6	8	4.12	0.83	9
Lack of vision within the maintenance department.	0	0	3.7	7.4	3.7	8	4.00	0.75	10
Workers lack expertise in management of quality	0	0	5.6	3.7	5.6	8	4.00	0.92	11
Top management in the maintenance department does not have sufficient knowledge of maintenance activities.	0	0	9.3	5.6	0	8	3.37	0.51	12
Lack of understanding amongst workers	0	0	11.1	1.9	1.9	8	3.37	0.74	13
OVERALL							4.29	0.62	

APPENDIX G1- Level of impact of challenges experienced (Bellville)

Challenges	1	2	3	4	5	Total	Mean	SD	Rank
	%	%	%	%	%				
Non-involvement of maintenance workers in the decision-making	1.9	0	3.7	14.8	11.1	17	4.05	1.02	1
Lack of sufficient training and education on quality	1.9	0	7.4	14.8	7.4	17	3.82	1.01	2
Lack of vision within the maintenance department.	0	3.7	13.0	5.6	9.3	17	3.64	1.05	3
Lack of clear objectives from top management	3.7	0	3.7	20.4	3.7	17	3.64	1.11	4
Lack of human and financial resources	1.9	0	13.0	9.3	7.4	17	3.47	0.91	5
Insufficient communication network	1.9	0	14.8	11.1	3.7	17	3.47	0.94	6
Maintenance workers are not involved the formulation of policies	0	3.7	14.8	7.4	5.6	17	3.47	0.94	6
Lack of focus on school stakeholders	0	1.9	16.7	7.4	5.6	17	3.47	1.00	8
Lack of understanding amongst workers	1.9	0	14.8	9.3	5.6	17	3.52	1.00	9
Resistance from supervisors to implement approved ideas	7.4	1.9	1.9	14.8	5.6	17	3.29	1.39	10
Top management in the maintenance department does not have sufficient knowledge of maintenance activities.	1.9	1.9	18.5	5.6	3.7	17	3.23	0.97	11
Lack of support from top management towards quality improvement	3.7	3.7	11.1	9.3	3.7	17	3.17	1.18	12
Workers lack expertise in management of quality	1.9	3.7	18.5	3.7	3.7	17	3.11	0.99	13
OVERALL						17	3.48	1.03	

APPENDIX G2- Level of impact of challenges experienced (Cape Town)

Challenges	1	2	3	4	5	Total	Mean	SD	Rank
	%	%	%	5	%				
Non-involvement of maintenance workers in decision-making	0	0	1.9	16.7	13.0	17	4.35	0.60	1
Lack of focus on school stakeholders	0	0	11.1	9.3	11.1	17	4.00	0.86	2
Lack of understanding between workers	0	0	7.4	18.5	5.6	17	3.94	0.65	3
Lack of human and financial resources	0	1.9	11.1	5.6	13.0	17	3.94	1.02	4
Workers lack expertise in management of quality	0	3.7	7.4	9.3	11.1	17	3.88	1.05	5
Lack of sufficient training and education on quality	0	0	13.0	11.1	7.4	17	3.82	0.80	6
Lack of vision within the maintenance department.	0	3.7	7.4	11.1	9.3	17	3.82	1.01	7
Lack of support from top management	1.9	5.6	3.7	5.6	14.8	17	3.82	1.38	8
Maintenance workers are not involved the formulation of policies	0	1.9	11.1	13.0	5.6	17	3.70	0.84	9
Top management in the maintenance department does not have sufficient knowledge of maintenance activities.	0	0	14.8	14.8	0	17	3.52	0.51	10
Insufficient communication network	0	0	16.7	13.00	1.9	17	3.52	0.62	11
Lack of clear objectives from top management	5.6	1.9	3.7	11.1	9.3	17	3.52	1.46	12
Resistance from supervisors to implement approved ideas	11.1	1.9	0	9.3	9.3	17	3.11	1.76	13
OVERALL						17	3.76	0.96	

APPENDIX G3- Level of impact of challenges experienced (Mowbray)

Challenges	1	2	3	4	5	Total	Mean	SD	Rank
	%	%	%	%	%				
Lack of human and financial resources	0	0	3.7	3.7	5.6	7	4.14	0.89	1
Lack of focus on school stakeholders	0	0	5.6	1.9	5.6	7	4.00	1.00	2
Lack of vision within the maintenance department.	0	0	5.6	3.7	3.7	7	3.85	0.89	3
Maintenance workers are not involved the formulation of policies	0	0	5.6	3.7	3.7	7	3.85	0.89	3
Top management in the maintenance department does not have sufficient knowledge of maintenance activities.	0	0	7.4	1.9	3.7	7	3.71	0.95	5
Lack of support from top management towards quality improvement	0	3.7	1.9	3.7	3.7	7	3.57	1.27	6
Insufficient communication network	0	1.9	5.6	3.7	1.9	7	3.42	0.97	7
Lack of understanding amongst workers	0	1.9	5.6	5.6	0	7	3.28	0.75	8
Workers lack expertise in management of quality	0	5.6	1.9	1.9	3.7	7	3.28	1.38	9
Lack of clear objectives from top management	0	3.7	3.7	5.6	0	7	3.14	0.89	10
Lack of sufficient training and education on quality	1.9	3.7	3.7	1.9	1.9	7	2.85	1.34	11
Non-involvement of maintenance workers in the decision-making	5.6	1.9	0	1.9	3.7	7	2.71	1.88	12
Resistance from supervisors to implement approved ideas	7.4	1.9	0	0	3.7	7	2.28	1.88	13
OVERALL							3.39	1.15	

APPENDIX G4- Level of impact of challenges experienced (Wellington)

Challenges	1	2	3	4	5	Total	Mean	SD	Rank
	%	%	%	%	%				
Lack of vision within the maintenance department.	0	0	1.9	3.7	3.7	5	4.20	0.83	1
Lack of focus on school stakeholders	0	1.9	1.9	1.9	3.7	5	3.80	1.30	2
Lack of human and financial resources	0	1.9	1.9	1.9	3.7	5	3.80	1.30	3
Non-involvement of maintenance workers in decision	1.9	0	0	3.7	3.7	5	3.80	1.64	3
Insufficient communication network	0	0	3.7	5.6	0	5	3.60	0.54	5
Top management in the maintenance department does not have sufficient knowledge of maintenance activities.	0	0	5.6	3.7	0	5	3.40	0.54	6
Maintenance workers are not involved the formulation of policies	0	0	5.6	3.7	0	5	3.40	0.54	6
Lack of understanding amongst workers	0	1.9	1.9	5.6	0	5	3.40	0.89	8
Lack of clear objectives from top management	1.9	0	0	7.4	0	5	3.40	1.34	9
Lack of sufficient training and education on quality	1.9	0	3.7	3.7	0	5	3.00	1.22	10
Workers lack expertise in management of quality	0	5.6	1.9	1.9	0	5	2.60	0.89	11
Resistance from supervisors to implement approved ideas	5.6	0	0	0	3.7	5	2.60	2.19	12
Lack of support from top management towards the improvement of the quality	5.6	0	0	1.9	1.9	5	2.40	1.94	13
OVERALL						5	3.33	1.17	

APPENDIX G5- Level of impact of challenges experienced (Granger Bay)

Challenges	1	2	3	4	5	Total	Mean	SD	Rank
	%	%	%	%	%				
Lack of human and financial resources	0	0	3.7	1.9	9.3	8	4.37	0.91	1
Lack of focus on school stakeholders	0	1.9	1.9	5.6	5.6	8	4.00	1.06	2
Non-involvement of maintenance workers in decision-making	0	0	3.7	11.1	0	8	3.75	0.46	3
Maintenance workers are not involved the formulation of policies	0	0	5.6	7.4	1.9	8	3.75	0.70	4
Lack of clear objectives from top management	0	1.9	1.9	9.3	1.9	8	3.75	0.88	5
Lack of sufficient training and education on quality	0	0	9.3	5.6	0	8	3.37	0.51	6
Lack of support from top management towards quality improvement	1.9	1.9	1.9	7.4	1.9	8	3.37	1.30	7
Lack of understanding amongst workers	0	5.6	1.9	5.6	5.6	8	3.25	1.16	8
Lack of vision within the maintenance department.	1.9	1.9	7.4	0	3.7	8	3.12	1.35	9
Insufficient communication network	0	0	14.8	0	0	8	3.00	0.00	10
Top management in the maintenance department does not have sufficient knowledge of maintenance activities.	0	0	14.8	0	0	8	3.00	0.00	11
Workers lack expertise in management of quality	0	3.7	7.4	3.7	0	8	3.00	0.75	12
Resistance from supervisors to implement approved ideas	13.0	0	0	1.9	0	8	1.37	1.06	13
OVERALL						8	3.31	0.78	

APPENDIX H1- Level of practice of TQM success factors (Bellville)

TQM success factors	1	2	3	4	5	Total	Mean	SD	Rank
	%	%	%	%	%				
Training and education of maintenance workers	0	5.6	7.4	3.7	14.8	17	3.88	1.21	1
The use of statistical methods	1.9	5.6	3.7	11.1	9.3	17	3.64	1.27	2
Commitment from top maintenance management	3.7	1.9	9.3	5.6	11.1	17	3.58	1.37	3
Commitment and involvement of workers	3.7	1.9	5.6	16.7	3.7	17	3.47	1.17	4
Commitment to the satisfaction of the school stakeholders	3.7	0	11.1	11.1	5.6	17	3.47	1.17	4
Benchmarking of maintenance processes	3.7	1.9	9.3	9.3	7.4	17	3.47	1.28	6
Continuous improvement of maintenance processes	1.9	1.9	13.0	11.1	3.7	17	3.41	1.00	7
Empowerment of maintenance workers	3.7	1.9	7.4	14.8	3.7	17	3.41	1.17	8
Adequate communication network	1.9	1.9	11.1	16.7	0	17	3.35	0.86	9
Top management involvement	3.7	1.9	11.1	13.0	1.9	17	3.23	1.09	10
OVERALL						17	3.49	1.16	

APPENDIX H2- Level of practice of TQM success factors (Cape Town)

TQM success factors	1	2	3	4	5	Total	Mean	SD	Rank
	%	%	%	%	%				
Training and education of maintenance workers	0	7.4	3.7	1.9	18.5	17	4.00	1.32	1
The use of statistical methods	0	1.9	11.1	7.4	11.1	17	3.88	0.99	2
Commitment from top maintenance management	1.9	3.7	7.4	3.7	14.8	17	3.82	1.33	3
Benchmarking of maintenance processes	0	3.7	9.3	9.3	9.3	17	3.76	1.03	4
Top management involvement	0	3.7	11.1	7.4	9.3	17	3.70	1.04	5
Continuous improvement of maintenance processes	0	1.9	13.0	11.1	5.6	17	3.64	0.86	6
Commitment to the satisfaction of the school stakeholders	1.9	3.7	11.1	3.7	11.1	17	3.58	1.27	7
Adequate communication network	0	1.9	11.1	18.5	0	17	3.52	0.62	8
Empowerment of maintenance workers	0	1.9	16.7	7.4	5.6	17	3.52	0.87	9
Commitment and involvement of workers	0	5.6	5.6	20.4	0	17	3.47	0.79	10
OVERALL						17	3.69	1.01	

APPENDIX H3- Level of practice of TQM success factors (Mowbray)

TQM success factors	1	2	3	4	5	Total	Mean	SD	Rank
	%	%	%	%	%				
Empowerment of maintenance workers	0	1.9	3.7	1.9	5.6	7	3.85	1.21	1
Top management involvement	0	0	7.4	1.9	3.7	7	3.71	0.95	2
Commitment to the satisfaction of the school stakeholders	0	3.7	1.9	1.9	5.6	7	3.71	1.38	3
The use of statistical methods	0	1.9	3.7	5.6	1.9	7	3.57	0.97	4
Benchmarking of maintenance processes	0	3.7	3.7	3.7	1.9	7	3.28	1.12	5
Commitment from top maintenance management	5.6	0	3.7	0	3.7	7	3.14	1.34	6
Continuous improvement of maintenance processes	0	3.7	7.4	1.9	0	7	2.85	0.69	7
Training and education of maintenance workers	0	7.4	1.9	1.9	1.9	7	2.85	1.21	8
Commitment and involvement of workers	5.6	0	3.7	3.7	0	7	2.42	1.39	9
Adequate communication network	5.6	0	5.6	1.9	0	7	2.28	1.25	10
OVERALL						7	3.16	1.15	

APPENDIX H4- Level of practice of TQM success factors (Wellington)

TQM success factors	1	2	3	4	5	Total	Mean	SD	Rank
	%	%	%	%	%				
Training and education of maintenance workers	0	1.9	0	3.7	3.7	5	4.00	1.22	1
Empowerment of maintenance workers	0	0	1.9	9.3	0	5	3.80	0.44	2
The use of statistical methods	0	1.9	1.9	1.9	3.7	5	3.80	1.30	3
Top management involvement	0	0	3.7	5.6	0	5	3.60	0.54	4
Benchmarking of maintenance processes	0	1.9	1.9	3.7	1.9	5	3.60	1.14	5
Commitment and involvement of workers	1.9	0	0	7.4	0	5	3.40	1.34	6
Commitment from top maintenance management	1.9	0	3.7	3.7	0	5	3.40	1.67	7
Commitment to the satisfaction of the school stakeholders	0	0	1.9	3.7	3.7	5	4.20	0.83	8
Continuous improvement of maintenance processes	1.9	0	3.7	1.9	1.9	5	3.20	1.48	9
Adequate communication network	1.9	0	3.7	3.7	0	5	3.00	1.22	10
OVERALL						5	3.60	1.18	

APPENDIX H5- Level of practice of TQM success factors (Granger Bay)

TQM success factors	1	2	3	4	5	Total	Mean	SD	Rank
	%	%	%	%	%				
Training and education of maintenance workers	0	0	0	3.7	11.1	8	4.75	0.46	1
The use of statistical methods	0	0	0	3.7	11.1	8	4.75	0.46	1
Commitment to the satisfaction of the school stakeholders	0	0	0	3.7	11.1	8	4.75	0.46	1
Commitment from top maintenance management	0	0	0	5.6	9.3	8	4.62	0.51	4
Benchmarking of maintenance processes	0	0	0	7.4	7.4	8	4.50	0.53	5
Top management involvement	0	0	1.9	3.7	9.3	8	4.50	0.75	6
Continuous improvement of maintenance processes	0	0	0	11.1	3.7	8	4.25	0.46	7
Commitment and involvement of workers	0	0	0	13.0	1.9	8	4.12	0.35	8
Adequate communication network	0	0	0	13.0	1.9	8	4.12	0.35	8
Empowerment of maintenance workers	0	0	3.7	7.4	3.7	8	4.00	0.75	10
OVERALL						8	4.43	0.50	

APPENDIX I1- Statement on TQM success factors (Bellville)

TQM success factors	1	2	3	4	5	Total	Mean	SD	Rank
	%	%	%	%	%				
Top management involvement promotes growth within the maintenance department	0	0	3.7	5.6	22.2	17	4.58	0.71	1
Benchmarking of maintenance processes helps to drive specific performance improvements within the maintenance department	0	0	1.9	14.8	14.8	17	4.41	0.61	2
Continuous improvement of maintenance processes promotes the progress and development of maintenance department	0	0	3.7	11.1	16.7	17	4.41	0.71	3
Empowerment of maintenance workers encourages the use of their expertise and knowledge to improve the maintenance activities	0	0	7.4	5.6	18.5	17	4.35	0.86	4
The use of statistical methods enhances easier monitoring and control of maintenance processes	0	0	3.7	16.7	11.1	17	4.23	0.66	5
Adequate communication network facilitates exchange of information within the maintenance department	1.9	0	3.7	9.3	16.7	17	4.23	1.09	6
Commitment from top maintenance management facilitates the success of maintenance activities by ensuring all decisions are made adequately	0	0	5.6	14.8	11.1	17	4.17	0.72	7
Commitment and involvement of workers enhances the level of decision-making in the maintenance department	1.9	0	1.9	14.8	13.0	17	4.17	1.01	8
Commitment to the satisfaction of the school stakeholders is the most important requirement for the sustainability of the maintenance department	0	0	5.6	16.7	9.3	17	4.11	0.69	9
Training and education of maintenance workers assists in the achievement and improvement of maintenance activities.	1.9	0	3.7	13.0	13.0	17	4.11	1.05	10
OVERALL						17	4.27	0.81	

APPENDIX I2- Statement on TQM success factors (Cape Town)

TQM success factors	1	2	3	4	5	Total	Mean	SD	Rank
	%	%	%	%	%				
Top management involvement promotes growth within the maintenance department	0	0	3.7	5.6	22.2	17	4.58	0.71	1
The use of statistical methods enhances easier monitoring and control of maintenance processes	0	0	5.6	3.7	22.2	17	4.52	0.79	2
Benchmarking of maintenance processes helps to drive specific performance improvements within the maintenance department	0	1.9	1.9	11.1	16.7	17	4.35	0.86	3
Commitment to the satisfaction of the school stakeholders is the most important requirement for the sustainability of the maintenance department	0	0	5.6	11.1	14.8	17	4.29	0.77	4
Continuous improvement of maintenance processes promotes the progress and development of maintenance department	0	0	7.4	7.4	16.7	17	4.29	0.84	5
Training and education of maintenance workers assists in the achievement and improvement of maintenance activities	0	0	5.6	13.0	13.0	17	4.23	0.75	6
Commitment and involvement of workers enhances the level of decision-making in the department	0	0	5.6	13.0	13.0	17	4.23	0.75	6
Empowerment of maintenance workers encourages the use of their expertise and knowledge to improve the maintenance activities	0	0	5.6	13.0	13.0	17	4.23	0.75	6
Adequate communication network facilitates exchange of information within the maintenance department	0	0	5.6	14.8	11.1	17	4.17	0.72	9
Commitment from top maintenance management facilitates the success of maintenance activities by ensuring all decisions are made adequately and timely	0	0	13.0	5.6	13.0	17	4.00	0.93	10
OVERALL						17	4.29	0.79	

APPENDIX I3- Statement on TQM success factors (Mowbray)

TQM success factors	1	2	3	4	5	Total	Mean	SD	Rank
	%	%	%	%	%				
Top management involvement promotes growth within the maintenance department	0	0	0	5.6	7.4	7	4.57	0.53	1
Benchmarking of maintenance processes helps to drive specific performance improvements within the department	0	0	1.9	3.7	7.4	7	4.42	0.78	2
Empowerment of maintenance workers encourages the use of their expertise and knowledge to improve the maintenance activities	0	0	1.9	3.7	7.4	7	4.42	0.78	2
The use of statistical methods enhances easier monitoring and control of maintenance processes	0	0	1.9	3.7	7.4	7	4.42	0.78	2
Commitment to the satisfaction of the school stakeholders is the most important requirement for the sustainability of the maintenance department	0	0	1.9	5.6	5.6	7	4.28	0.75	5
Commitment from top maintenance management	0	0	5.6	1.9	5.6	7	4.00	1.00	6
Continuous improvement of maintenance processes promotes the progress and development of maintenance department	0	0	7.4	3.7	1.9	7	3.57	0.78	7
Adequate communication network facilitates exchange of information within the maintenance department	1.9	1.9	0	3.7	5.6	7	3.71	1.60	8
Training and education of maintenance workers assists in the achievement and improvement of maintenance activities	1.9	1.9	1.9	1.9	5.6	7	3.57	1.61	9
Commitment and involvement of workers enhances the level of decision-making in the maintenance department	1.9	3.7	0	5.6	1.9	7	3.14	1.46	10
OVERALL						7	4.01	1.01	

APPENDIX I4- Statement on TQM success factors (Wellington)

TQM success factors	1	2	3	4	5	Total	Mean	SD	Rank
	%	%	%	%	%				
Training and education of maintenance workers assists in the achievement and improvement of maintenance activities	0	0	0	0	9.3	5	5.00	0.00	1
The use of statistical methods enhances easier monitoring and control of maintenance processes	0	0	0	1.9	7.4	5	4.80	0.44	2
Top management involvement promotes growth within the maintenance department	0	0	0	3.7	5.6	5	4.60	0.54	3
Benchmarking of maintenance processes helps to drive specific performance improvements within the maintenance department	0	0	0	3.7	5.6	5	4.60	0.54	3
Commitment and involvement of workers enhances the level of decision-making in the maintenance department	0	0	1.9	3.7	3.7	5	4.20	0.83	5
Adequate communication network facilitates exchange of information within the maintenance department	0	0	1.9	3.7	3.7	5	4.20	0.83	5
Continuous improvement of maintenance processes promotes the progress and development of maintenance department	0	0	1.9	3.7	3.7	5	4.20	0.83	5
Commitment to the satisfaction of the school stakeholders is the most important requirement for the sustainability of the maintenance department	0	0	1.9	3.7	3.7	5	4.20	0.83	5
Empowerment of maintenance workers encourages the use of their expertise and knowledge to improve activities	0	0	1.9	3.7	3.7	5	4.20	0.83	5
Commitment from top maintenance management	0	0	3.7	3.7	1.9	5	3.80	0.83	10
OVERALL						5	4.38	0.65	

APPENDIX I5- Statement on TQM success factors (Granger Bay)

TQM success factors	1	2	3	4	5	Total	Mean	SD	Rank
	%	%	%	%	%				
Top management involvement promotes growth within the maintenance department	0	0	0	0	14.8	8	5.00	0.00	1
Benchmarking of maintenance processes helps to drive specific performance improvements within the maintenance department	0	0	0	0	14.8	8	5.00	0.00	1
The use of statistical methods enhances easier monitoring and control of maintenance processes	0	0	0	0	14.8	8	5.00	0.00	1
Commitment and involvement of workers enhances the level of decision-making in the maintenance department	0	0	0	0	14.8	8	5.00	0.00	1
Training and education of maintenance workers assists in the achievement and improvement of maintenance activities	0	0	0	1.9	13.0	8	4.87	0.35	5
Continuous improvement of maintenance processes promotes the progress and development of maintenance department	0	0	0	1.9	13.0	8	4.87	0.35	5
Commitment from top maintenance management	0	0	0	1.9	13.0	8	4.87	0.35	5
Commitment to the satisfaction of the school stakeholders is the most important requirement for the sustainability of the maintenance department	0	0	0	1.9	13.0	8	4.87	0.35	5
Empowerment of maintenance workers encourages the use of their expertise and knowledge to improve the maintenance activities	0	0	0	1.9	13.0	8	4.87	0.35	5
Adequate communication network facilitates exchange of information within the maintenance department	0	0	0	3.7	11.1	8	4.75	0.46	10
OVERALL						8	4.91	0.22	