IMPACT OF CULTURE ON THE APPLICATION OF QUALITY MANAGEMENT SYSTEM

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Abstract

The management of quality in companies has become more and more strategically important over recent years. The emphasis on quality is vital to managing projects and achieving excellence in today’s global economy. Modern petrochemical construction project management has incorporated quality management principles and initiatives in their activities.

The Quality Management System is used to ensure that the project will satisfy the requirements for which it was undertaken. Improving project quality in construction requires consideration of culture within the project environment that is often associated with miscommunication and fragmentation.

The focus of the thesis is to examine how quality culture can improve the quality in organisation and influence the implementation of Quality Management System in construction industry. The dissertation will comprise of extensive survey of the local academic literature and South African press reports concerning state of construction industry. A questionnaire conducted amongst professionals working in petrochemical industry is aimed to determine the impact of organisational culture on the successful implementation of quality management systems. The objective of this dissertation is to identify inefficiencies and possible improvements that can be achieved in current quality management systems.

The dissertation concluded that an improvement in the quality management and quality of construction can only be achieved if quality is embedded in the entire operational and managerial processes of its organizations. The thesis recommends that the South African construction industry would benefit from the development of quality culture that fosters deeper human relationships to improve quality management.
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List of Acronyms

**AACE** - Transactions of the American Association of Cost Engineers

**CIIs** - Cidb Construction industry indicators *are indicators and measures of the performance of the South African industry* [1]

**PMBOK® Guide** - Project Management Body of Knowledge Guide *is an ANSI standard for the project management profession. It describes project management best practices and established norms that are common to the majority of projects, most of the time.* [2]

**PMI** – Project Management Institute *practice standards are guides to the use of a tool, procedure or processes recognized in PMBoK® Guide.* [3]

**TQM** - Total Quality Management *is an integrative philosophy of management for continuously improving the quality of products and services at every level of the organisation to increase customers’ satisfaction.* [4]

**QA** Quality Assurance *activities ensure that the procedures and processes used to generate the deliverables are of high quality.* [5]

**QC** Quality control *activities ensure the deliverables created by the project achieve customer’s expectations.* [5]

**QMP** Quality Management Plan

**QMS** - Quality Management System *refers to a set of policies, processes and procedures needed to implement quality management to ensure that the services or product provided to client consistently conform to specific, predetermined measures.* [6]
ISO - International organisation for standardization (ISO) is a world standard-setting body to discuss, originate and establish uniformity, commonality and standards for products and services. [7]

ISO 9000:2000 - ISO developed the 9000 series as quality standards for the quality management practices and commitment to quality. [7] Key changes were made to ISO 9000 in late 2000.

ISO 9001 - ISO 9001 standard address the Quality Management Systems requirements for companies to demonstrate its capability to meet client needs. [8]
1 Introduction to Research Problem

1.1 Quality

The guide to Project Management Body of Knowledge (PMBOK Guide) defines quality as “the degree to which a set of inherent characteristics fulfill requirements.” [2] This definition is taken directly from ISO 9000:2000 guidelines which define standards that address for quality management systems. Quality is represented by how close the project and specified deliverables come to fulfilling the customer’s specifications and expectations. [5] Often quality is synonymous with the customer requirements. Quality is strategically important to the organisation in order to build long term relationship with clients through customer satisfaction, as quality is ultimately measured by the customer.

South African contractor’s often face problems characterized by rework, poor work quality and low productivity. [9] Lack of quality in the local construction industry is manifested in inadequate work practice, and unsafe activities, schedule delays, budget over-runs and disputes in construction contracts. [10] A common problem identified in most cases is the failure of many contractors to completely acknowledge the significance of quality management process.

The dissertation was motivated by this need to better understand the quality management process in South African construction industry. Even if procedures and standards are in place to manage quality, the impact of the employee on quality is often overlooked. There is a need to continuously improve activities to make sure that quality is embedded in the way employees do things.

Quality management is the process of identifying and managing the activities needed to meet the quality objectives of organisation is called Quality Management. [12] Initially when a project is specified, project team needs to understand the customer’s expectations in terms of quality and must plan their activities to achieve those expectations in a Quality Management System (QMS). [5] QMSs is used to mitigate non-conformances and rework during construction, which in turn have a positive
impact on quality, enhance customer satisfaction and provide the catalyst for the synergy relative to the project parameters such as productivity and schedule. \[13\]

Quality Management System generally uses two processes to achieve reliable quality, which is quality control and quality assurance. \[5\] Quality control activities ensure the deliverables created by the project achieve customer’s expectations. \[5\] While the quality assurance activities ensure that the procedures and processes used to generate the deliverables are of high quality. \[5\] However quality is result of much more than just QMS and procedures, but can benefit from quality culture within the organisation.

**Total Quality Management**
- Management approach
- Customer Satisfaction
- Continuous Improvement
- All employee involvement & commitment
- Process management
- Involvement of suppliers and customers
- Quality culture

**Quality assurance**
- Provide confidence to deliver client requirement of high quality
- Planned and systematic activities
- Establishing procedures, standards, training and systems to produce quality
- Develop Quality Management Systems
- Prevent quality problems through early warning

**Quality control**
- Reduce defects, changes & omissions
- Satisfy requirements for quality
- Self-inspection and testing
- Basic quality planning

**Inspection**
- Find problems/defect that have occurred
- Corrective actions
- Identify sources of non-conformance

Figure 1: The four stages of quality management \[12\]
The four stages of quality management are shown in the above figure 1. Quality inspection and quality control aims to detect quality problems that have already occurred. Quality assurance aims to reduce and ultimately prevent quality problems from occurring. [12] Total Quality Management (TQM) is an approach that an organizations uses to meet the customer expectations by benefiting from quality culture and the commitment and the involvement of management, employees, suppliers and even customers. [4]

Quality must be incorporated into the strategic management process in order to be effective. [7] A commitment to quality in the organisation’s objectives is translated into, for example in its projects to reduce total costs of quality, engineer products to increase reliability, improve processes to reduce variability, empower project team to address problems with the systems and develop more reliable services. [7] Responsibilities for quality in these projects do not exclusively depend on the quality department but rather will all parts of the organisation involved. [7]

The primary challenge faced by management is to achieve the project goals and objectives while maintaining the project constraints which are prescribed scope, budget and schedule. [12] The project manager must try to balance the three elements of equal importance in order to meet the business objectives and satisfy the client. Though quality is an integral part of scope, cost and schedule, its significance can easily be neglected due to continuous varying scope from customers and stretched budget and unrealistic schedule because of the extremely competitive construction industry. [12]

Quality starts with the understanding of scope because scope is based on client’s requirement or market’s needs and quality of the deliverables is closely associated with client’s satisfaction and requirements. [14]

It is important to define what quality is and understand its relationship to quality management systems. The interrelationships between the quality and other functions in the organisation needs to assessed and how to use this information to significantly improve the quality and impact the performance of the organisation. [7]
1.2 State of construction quality in South Africa

Construction plays a fundamental role in South Africa’s economic and social development. It is the physical infrastructure and backbone for economic activity. [15] Business confidence in South African’s construction industry is at its lowest in 11 years, however it’s expected to improve by the end of 2011, despite the slow pace of economic recovery to date. [16] According to a report from Fin Week in July 2011, the First National Bank/Bureau for Economic Research civil construction index up from 21 points to 23 points in the second-quarter 2011. [17] Slight improvement, but a reading of 23 indicates around just one out of five civil contractors rated current business conditions as satisfactory.

A number of factors were identified which is hampering the South African industry’s growth, including inadequate planning, clear government decisions, business confidence, capacity or skills shortage and variable quality in construction. [16]

When delivering construction projects, many South African contractors face problems characterized by rework, poor work quality and low productivity. [9] Studies identified problems to be the result of cost over-runs, delayed schedules, inadequate work practice and poor management of design and quality activities. [10] [11] A common problem identified in most cases is the failure of many contractors to completely acknowledge the significance of quality management process.

Research conducted in South Africa indicates that the majority of construction contractors does not implement documented QMSs and often depend on informal procedures to achieve quality. [18] Further studies concluded that upper management don’t demonstrate commitment and support for quality management system and often don’t communicate the quality objectives to employees. [19]

The Cidb Construction industry indicators (CIIs) are indicators and measures of the performance of the South African industry, focusing on customer satisfaction. [1] Surveys have shown that customers were satisfied with the quality of completed
work at handover on 86% of the projects, and were neutral or dissatisfied on 14% of the projects surveyed in 2010. [1]

Customers were satisfied with the resolution of defective work during the construction period on 83% of the projects surveyed in 2010, and were neutral or dissatisfied on 17% of the projects surveyed. [1] As with most aspects of customer’s satisfaction with the performance of contractors, customer satisfaction with the resolution of defects tended to decrease with increasing project size. [1] As larger project are usually more complex, often requiring multi-disciplinary contributions and hence the likelihood of non-compliance with quality requirements.

While 82% of projects surveyed in 2010 were “apparently defect free” or had “few defects” at practical completion, 10% of facilities had “some defects”, and 2% had “major defects” or were “totally defective”. [1] However the level of defects in 2010 suggests a sustained improvement over the years.

Poor quality often erodes the organisation’s ability to compete in international marketplace. [13] However poor quality of construction trends is not unique to South Africa, its worldwide problem and is evident in both developed and developing countries.

Surveys indicate there is an increasing demand for QMS in order to improve the construction quality in South Africa and customer satisfaction. [20] [21]

1.3 Statement of the Problem

Research Questions:
What is Quality?
Why is there a need for Quality Management System?
What are the deficiencies with current Quality Management System?
What is the link between Quality management and Project management?
How to get people involved and create a quality culture within project team?
1.4 Research Objectives

The objectives of this dissertation are to identify the fundamentals of quality and the perception of quality which usually varies depending on the type of industry and economy. It will examine a number of techniques and management approaches that promotes the achievement of quality. The thesis begins by defining quality and understanding the cost of quality.

The thesis will identify the inefficiencies and possible improvements that can be achieved in current Quality Management System used by instrumentation services providers in a petrochemical project. It also elaborated on philosophy of creating a quality culture and understanding the process which enables you to meet the customer needs.

1.5 Significance of the study

The focus of the thesis is to define the process followed by project management to develop a Quality Management System. Quality Management System is used by the project manager to ensure that the project will satisfy the requirements for which it was undertaken. This process covers quality planning, quality assurance and quality control in respect to deliverables, procurement, construction, handover and commissioning from project concept to the end of the project’s life cycle. The findings of the dissertation will give opportunities to work on areas of deficiencies. The application of quality management can be used as a basis for improving business performance and quality management techniques can help businesses to focus their resources and activities on meeting customer needs and improving performance.
1.6  **Scope and limitations**

The dissertation comprise of extensive survey of the literature concerning the quality management. The scope of this thesis is limited to quality management systems in the instrumentation services providers in a petrochemical industry. Expert opinions from industry professionals like project managers, engineering managers will be obtained. However the selection criteria of the industry professionals will be limited to Sasol and their related engineering contractors. This can be justified due to time and cost constraints of the researcher.
2 Literature review

2.1 Defining Quality

Quality is defined in various literatures, each describing the unique attributes to the environment within which it exists. [22]

It’s often difficult to define quality, as the perception of quality varies with customers. The interpretation of quality often depends on the responsibility of the people defining it. [4] Hence David Garvin proposed a conceptual framework to classify different approaches to define quality: transcendent, product based, user based, manufacturing based, and value based. [23]

The transcendent perspective of quality defines it in terms of some abstract philosophical, perceptual, moral or religious entity and is often used in advertisements when promoting services or products. [23]

A product-based perspective of quality implicitly supports the definition that quality is viewed as quantifiable and measurable attribute. [24] It is based on the concept of “fitness for use” which evaluates how well the product performs its intended purpose or use. ISO 9000:2000 guidelines are based on this product-based approach, where quality is defined as fitness for use, performance, safety and reliability. [23] However this approach of measuring quality objectively has its limitation as well. When quality is based on individual customer preference, this approach for quality measurement may be deceptive. [24]

A user-based definition of quality suggests that quality is the ability of a product to satisfy individual preferences. The problem with this approach is that the customers’ preference varies extensively and is difficult to combine these preferences into product or services with broad appeal. [24]
Manufacturing-based definitions describe quality as conformance to specifications and customer requirements and any deviation implies a decline in quality. [24] This approach is common in the engineering and manufacturing industries. Its major weakness is that customer’s perception of quality is equated with conformance set by the organization and hence the process is only internally focused. [24] The importance on conformance to design and manufacturing tends to address cost reduction as the objective, instead of customer satisfaction.

Value-based perspective of quality is defined in terms of costs and prices as well as other characteristics. This is the only definition that combines economics with the consumer’s purchase criteria based on quality at the acceptable price. [24]

A key aspect of creating a competitive advantage through quality is by creating an environment within the organisation that encourages creativity and innovation.

2.2 Cost of Quality

Quality has gained such prominence in many companies as management has started to understand the high cost implications of poor quality and as its affects all aspects of the organisation. [4] Most organizations are vulnerable to poor quality issues, as the recent crisis surrounding accelerator pedals on Toyota vehicles demonstrated. [25] Toyota a company with a remarkable reputation for high quality standards suffered billions of dollars in market value and considerable damages to its brand value as results of poor quality.

Traditionally, quality has been about managing risks in production processes. The cost of quality refers to the entire cost of all efforts associated to quality throughout the product life cycle. [2] The most obvious consequence occurs when poor quality creates dissatisfied clients and eventually leads to loss of revenue. Prevention costs are incurred by a company in the process of preventing poor quality from occurring. [4] Prevention costs include the cost of training personnel, data analysis and cost involved in developing and implementing quality systems. As more comprehensive
quality programs and systems are put in place, prevention cost will increase and the failure costs should decrease as the quality improves. [26]

Appraisal cost are associated with process of uncovering defects and if it meets the customer’s requirements. Appraisal costs should not differ drastically with quality achieved as costs of inspections remains the same whether 90% or 1% defect is uncovered. [26] However appraisal costs in theory can keep increasing without a drop in failure costs.

Quality failure costs are the cost consequence of poor quality and can be categories into internal and external failure costs. [4] Internal costs are associated with cost of correcting poor quality before the product is transported to the client site and often includes the cost of rework and scrapping. [4] External quality cost are the associated with quality failure at client site which can often damage customer relationships. These include cost of investigating complaints, warranty claims and even replacing defective products. [27]

By monitoring and controlling the cost of quality, an organisation can make a correlation between the cost of a particular activity and its effect on quality. [26] Organisations that invest heavily in prevention and appraisal costs in order to prevent failure costs, often reach a point of diminishing returns. [4]

![Figure 2: Cost of defects](image)
The contemporary approach of continuous improvement in design phase makes it possible to achieve conformance without excessive prevention and failure costs. The earlier quality defects are found, the less costly they are to correct. This is shown in below Figure 2.

It’s important to include the loss of brand equity from negative media exposure when quantifying cost of poor quality. [28] Organizations needs re-conceptualize quality functions to proactively engage with clients with a strategic cross-enterprise focus and a rejuvenated quality culture in order to achieve far-reaching benefits in terms of cost of quality. [29]

Ultimately quality is not inherent in a product or service; it’s a client’s perception about that service or product which does not always correlate with designers’ calculation of quality inputs and processes. [29] But often quality functions focus on those product characteristics rather than the customer. In other words it’s vital to manage quality as a customer experience. [29]

2.3 Evolution of Quality

The concept of quality has existed throughout the ages, although the definition of quality has changed and evolved over the years. [4] Quality management is not derived from a single concept or a person. [30] A collection of philosophies from notable individuals like Shewhart, Deming, Juran, Feigenbaum, Crosby and Ishikawa have contributed to understanding quality and shaped the evolution of Total Quality Management (TQM). [4]

Shewhart during 1920s and 1930s developed concept of statistical sampling techniques and quality control charts used to identify the variability in the process to improve quality. [4]

Edward Deming often referred as “father of quality control” outlined his philosophy on quality in “14 points” to guide companies in achieving quality improvement. Deming
in the early 1950s suggested the need for transformation within an organisation in order to achieve quality and identified top management's responsibility for quality. [4] Historically employees were held responsible for poor quality. However Deming believed that management should be accountable for the poor quality caused by inadequate quality management system. Management needs to foster an environment that supports quality to ensure employees to achieve their full potential. [4]

Joseph M Juran is considered to have had the greatest impact on quality management and known for originating the idea of quality trilogy i.e quality planning, quality control and quality improvement. [4] Juran in the late 1950s is credited with developing the concept of cost of quality and defining quality as fitness for use taking into account client requirement rather than simply conformance to specifications. [4]

Armand Feigenbaum introduced the concept of total quality control and must be integrated throughout the entire organisation. [4] Philip B Crosby in the late 1970s developed the phrase “Do it right the first time”, “zero defects” and “quality is free”. Crosby claimed the quality costs are hard to quantify. [4] Crosby defined quality as “conformance to specifications” which is probably most relevant to construction industry. [22]

Kaoru Ishikawa developed quality problem solving tools like cause and effect diagram and emphasized the importance of the “internal customer”. [4] Ishikawa suggested that employees need to be united with a shared vision and a common goal. [4]

Genichi Taguchi, a Japanese quality expert philosophy is based on the idea quality efforts during the design phase, as changes during the design phase are easier to implement and cheaper than during production process. [4] Taguchi loss function pointed out that the traditional views of conformance costs to specifications are incorrect and cost of quality increases as a quadratic function as conformance values move away from the target. [4]
The philosophy of quality improvement which is usually referred to as Total Quality Management (TQM) has developed from ‘traditional’ approaches to quality, such as quality control, and was subject of teachings by the Deming and other quality gurus. [31] In essence, Deming, Juran, Crosby and the other quality gurus, said that total quality management involved positive participation of everyone in the organisation and proactive approach to achieve better quality. [31] 

Total Quality Management is an integrative philosophy of management for continuously improving the quality of products and services at every level of the organisation to increase customers’ satisfaction. [4] TQM address quality as a strategic issue in an organisation. [32] TQM focuses on identifying the root cause of quality problems and correcting them at the source, instead of scrutinizing the final product. [4] 

The principle feature of TQM is the organisation’s objective to identify and meet customer requirements. [4] TQM recognized that a perfect product of high quality was of little value if it’s not what the customer needs. Hence the phrase “quality is customer driven”. [4] Another concept of TQM is the focus on the philosophy of never-ending continuous improvement. [4] Continuous improvement, also known as Kaizen by the Japanese, requires the organisation continually attempts to improve through learning and problem solving. [4] 

What was different and significant about TQM was that it changed people’s perception about the nature of quality issues and the responsibility for quality. [31] One of the key principles of TQM is the establishment of quality systems and procedures. [31] Good quality needs to be underpinned by quality systems with clearly defined objectives and procedures. [31] 

The Project Management Body of Knowledge (PMBOK® Guide) describes project management practices that are common to the majority of projects, most of the time. [2] It provides guidance on the quality and defines the concepts of quality planning, quality assurance and quality control for the implementation of quality management processes in project management arena. [2] Project Managers benefits from several tools and techniques identified as part of the implementation process.
Quality systems involve internal and external aspects. Quality Management System (QMS) is an internal quality system which describes activities aimed at providing confidence to the management of an organisation that the intended quality is being achieved. [33] QMS refers to a set of policies, processes and procedures needed to implement quality management to ensure that the services or product provided to client consistently conform to specific, predetermined measures. [6] The purpose of the Quality Management System is to first understand the expectations of the client in terms of quality and then put a plan and process in place to meet those expectations. Construction contractors seldom attempt to find out what their customers’ expectations are, and this may hinder the improvement when their quality management systems are implemented and hence affect customers’ satisfaction. [34]

Quality Assurance System is an external quality system describes activities aimed at inspiring confidence in the customer that the contractor’s quality system will provide a product or service that will satisfy the customer’s quality requirements. [33] The quality system can work effectively only when the management responsible for engineering or design takes full responsibility for interpretation and implementation of the quality assurance program. [33] A contractor’s quality assurance system is very significant to ensure customers gain confidence that “getting it right the first time” will be the contractor’s norm. [33]

A contractor’s quality assurance system is necessary to avoid any inefficiency that could result in poor quality and the reoccurrence of quality issues in the construction projects. [33] This system ensures consistent quality for the contractor’s clients. Systematic quality work reduces the costs of failure in contractor services and final product itself. [33] One such quality systems standard is the ISO 9000 Quality Standards.

Due to economic globalization, construction companies are actively working to achieve internationally accepted quality standards to ensure their leading position in the emerging global market. [35]
2.4  ISO 9000 Quality Standards in Construction

As international trade increased in the 1980s, it created a need for development of universal standards of quality. [4] The standards can ensure quality work more efficient by creating uniformity. [33] The international organisation for standardization (ISO) is a world standard-setting body to discuss, originate and establish uniformity, commonality and standards for products and services. ISO developed the 9000 series as quality standards for the quality management practices and commitment to quality. [7]

Key changes were made to ISO 9000 in late 2000, introducing the following three new standards.

  It provides the terminology and definitions described in the system of standards. [4]
- ISO 9001:2000 – Quality Management System – Requirements; it’s used for the accreditation of organization’s QMS and demonstrates the compliance of QMS to meet the client’s requirements. [4]
  This provides guidelines for establishing a QMS and focuses not only on meeting client’s requirement but also on improving performance. [4]

The five clauses of ISO which describe the requirements for QMS implementation are quality management system, management responsibility, resource management, product realization, and measurement, analysis, and improvement. [32]

The ISO 9001 standard address the Quality Management Systems requirements for companies to demonstrate its capability to meet client needs. [8] By receiving ISO 9000 certification, organizations can demonstrate the standard specified by the ISO has been met and standards can be used as set of audit tools to evaluate the quality system of organisation. [4] It provides organizations with a framework and set of
principles to ensure a common approach to quality management of activities in order to consistently achieve client satisfaction. [36] The certificate often serves as a business reference between the organization and potential customers. [37]

However ISO 9001 certification does not automatically guarantee quality. [38] It ensures that quality processes and procedures are in place, but does not guarantee that quality is happening on construction site. [38] Quality should be a more holistic process that is an integral part of daily activities for quality system to positively affect product quality. [39] Responsibility for quality should be at front end loading of project, where it can be acted on proactively, and not just with the QA/QC department, which acts retroactively. [38]

Customer satisfaction is the primary objective of the ISO 9001:2000 quality management system. [40] Organizations must determine client’s expectations and ensure all the employees throughout organization are aware of clients’ requirements and consider them in establishing objectives for improvement. [40] Hence a significant emphasis is placed on client communication to ensure focus is on the client.

Various studies have concluded the main difference between ISO 9000 and TQM as the following: [20] [41] [42]

- The main objective of TQM is to continuously improve quality and customer satisfaction through the involvement of both the organization and the individual employee. [41] ISO 9000 standards aims to provide and maintain an effective quality management system that will to eliminate rework and defects in order to meet their customer’s requirement. [20]
- The certification of ISO 9000 is achieved by quality managers without the involvement of upper management and other employees. [41] The implementation of TQM requires the involvement of everyone in the organisation. [20]
- ISO 9000 certification should not be viewed as a substitute for TQM, [42] instead it should be the stepping stone to bridge the gap to Total Quality Management. [41]
Top management must be committed to understand and support the quality management process and actively participate in its implementation rather than delegate it. [43] Management need not involved in the daily operation of the quality management system, but these leaders have to establish the quality strategies and objectives, perform management reviews, ensure availability of resources, and communicate the significance of meeting client’s requirements and any applicable regulatory mandates. [40] Management involvement and commitment is considered to be the most significant factor for success of a quality management system. [44]

2.5 Communicating Quality inside the Organisation

Communication strategy is least understood and most inefficiently managed characteristic of quality management implementation. [45] An organisational commitment to quality and the significance of communicating it together with the appropriate organisational culture is vital for the effectiveness of a Quality Management System. [46] Quality management plan should be an integral part of the organisation’s culture. Companies that have achieved the benefits of quality management plans have created a quality culture by developed processes in their daily activities for identifying customer-defined quality. [4]

It is essential the organization understand the difference between quality of communication and communication of quality inside the organisation. Both are equally importance in the implementation of an effective QMS.

Quality of communication within the organisation often determines the success or failure of quality management system. [45] The key to embedding high quality performance as part of an organisation’s DNA requires inspirational and capable leadership. [28] The leadership must communicate its values and priorities, inspirational visions and must lead by example to enhance client-contractor relationships. [47] Management needs to foster an environment that encourages and communicates the philosophy that quality needs to be given higher priority over
budget and schedule, and in the long run, consistent and better quality will always improve customer satisfaction, profitability and schedule performance. [48]

Leadership has the ability to inspire confidence and support amongst employees, in order to achieve organisational quality goals. Management needs to consistently communicate to the employees the significance of meeting customer requirements and how a QMS will help employees in achieving this. [32]

In order to implement an effective quality management system, the organization needs to encourage open, unambiguous communication and mutual support that is derived from trust-based relationship among employees. Studies indicate that the most difficult activities in implementing QMS, is to get employees to understand the new system and accept the changes, followed by lack of management commitment and lack of effective communication. [32] Employees need to be kept well informed about any changes in the organization’s quality policy and reasons behind such changes. [49] The employee’s willingness to accept the necessary changes will be based on the effectiveness of the communication about the QMS.

Management needs to communicate total quality through usual existing channels to ensure commitment and involvement of all personnel and reinforce that the concept of quality management plan is not a foreign concept, but the foundation on which the organisation operates. [45] An essential medium to motivate the workforce and gain their commitment to TQM is through direct communication and visible top management commitment. [50]
3 Organisational culture

Much of the literature on quality management discusses the need to establish a “quality culture” in order to achieve an organisation’s quality objectives [51] [52]. It is therefore, necessary to define organisational culture and investigate its influences.

3.1 Defining Organisational Culture and its significance

Organisational Culture is a “specific set of shared beliefs, values and behavioural norms that guide interpretation and control the way employees interact with each other by defining appropriate behaviour for particular situations and with stakeholders outside the organisation.” [53] The shared values and norms that make up an organisation's culture are fostered and cultivated by communications and interactions among people inside and outside the organisation. These perceptions and beliefs effect and influence employee behaviour in the manner which binds its employees together and becomes the strategies through which organisation achieves its objectives. [54]

The significance of an organisational culture can be identified as early in 1980s, when business week released an article entitled "Corporate Culture: The Hard-to-Change Values That Spell Success or Failure". Over the years a number of researchers have investigated culture from a strategic perspective and have presented organisational culture as a source of competitive advantage [55] and effectiveness. [56] Furthermore, Organisational culture can help to understand not just what happens in an organisation, but why it happens. [57] Companies view culture as something to be influenced to achieve organisational objectives of efficiency and profitability. [57]

The significance of a quality culture is also acknowledged by most of the quality guru like Deming, Juran and Crosby. [48] Their research specifies many cultural elements that must endure change in order to sustain an effective quality management system. They emphasized the significance of developing a quality culture by shifting collective values, beliefs and mind-set of employees towards quality. [58] [12]
Therefore, changing the organisational culture is to some extent because of TQM itself, but also due to the fact that it’s a pre-requisite to implement quality management system. [59]

People are a fundamental component in the relationship between the organisational culture and efficiency of organization. However if the people are removed, the organization is nothing. Remove the employee’s motivation, commitment and ability to work together in teams, and again, the organization is nothing. [46] Conversely, motivate the employee to work well, innovatively, efficiently, and the organization can successfully develop. Logically therefore, the development and correct utilization of employees are essential to the success of all quality management initiatives. [46]

Organisational culture manifests in a number of ways from the invisible and sometimes unconscious to very visible and real manifestations. The invisible aspects comprise shared values, beliefs and underlying assumptions [60]. The visible tangible aspects comprise of symbols, creations, heroes and behaviour norms collectively referred to as ‘practices’. [61]

Culture therefore has the ability to shape the behaviour of, not just individuals, but groups of people as in organisations and industries. This inherent ability of culture to shape behaviour has particular significance for the construction industry because of the industry’s nature of contracting and product delivery, requiring the cooperation of a numerous employees who sometimes have different and conflicting objectives. [62]

Quality culture within an organisation is defined as the pattern of positive human habits, collective beliefs, and behaviour concerning quality, which often manifests themselves in the actions of its managements and employees. [12] In other words quality culture can be defined as one having comprehensible defined values and shared beliefs that foster total quality behaviour. [63] Therefore developing a quality culture that nurtures the quality management is important in the implementation and continuance improvement of QMS.

Largely due to the complexity of petrochemical projects, the development of a quality culture in the construction environment depends on certain inherent characteristics in
The sub-contracting model has become common within project organisation and has led to fragmentation of the process. Subcontractors usually perform their activities as fast as possible using the least labor required, often in segregation from the main contractor. [20] The employees of subcontractors are contracted on a project-to-project basis with little training and often uncertain of their employment period. [20] It also hinders an important aspect of Total Quality Management namely that of employee empowerment to make quality decisions at their level of operation. [64] The high mobilization of sub contractor’s workforce results in shortsightedness and a lack of commitment towards quality in general. [12] These conditions don’t foster good quality.

Relationships in project team are often tense as a result of the profit driven competitive sub-contracts which they are based on. [65] New sets of relationships have to be created among the project team every time a new project starts. The demand for social management skills within the project team has increased, but this requirement often remains unfulfilled. [65]

Studies indicate that the values and beliefs underlying an organisation’s culture are able to shape its quality management philosophy and policies of business management, which in turn influence the development of the organisation’s quality management practices. [66] In order for an organisation to realize the full benefits of implementing quality practices, it must have a culture that is capable of fully supporting their implementation. [67]

Cultural and behavioral change within the organisation is required in order to implement the Total Quality Management successfully. [68] In order to bring about this cultural shift, the organisation needs to identify the characteristics that contribute to the development of quality culture in construction industry. [48] It’s important to provide a framework, systematic strategy and methodology to help management guide the change initiative at the most basic level. [69]
3.2 **Framework of Organisational Culture**

Competing Values Framework developed by Quinn and Rohrbaugh (1981) is extensively used to study the values and beliefs underlying an organisation’s culture in the literature. [70] [69] [71]

Competing Values Framework establishes two key dimensions which forms four quadrants as shown in Figure 3. [72] The first dimension distinguishes between organizational focus (internal versus external), while the second one specifies the preference about structure (flexibility and discretion versus stability and control). [72] Each quadrant denotes a specific set of organizational culture orientations namely (1) clan - a group culture, (2) adhocracy - a developmental culture, (3) market - a rational culture, and (4) a hierarchical culture. [72] Each of the four cultural characteristics represents separate values about management, motivation and strategic values in organisations. [71]

Competing Values Framework is used in this thesis to examine how an organisation emphasizes each of the four cultural orientations to influence the quality management practices. However culture in organizations is often a combination of the four cultural orientations. [73]

![Figure 3: The Competing Values Framework](image-url)
Organisations emphasizing a clan/group culture tend to value loyalty, trust and employee involvement. [72] The strategies used in these organisations focuses on the development of human relationships and personnel commitment. [71] The corporate management generally encourage teamwork and forms of participative management where staff shares management responsibilities such as decision making. [71]

Organisations with emphasis on adhocracy/developmental cultural values tend to foster growth, flexibility, creativity, and adaptability to the external environment. [72] The strategies used to manage organisations include novelty, resource acquisition, and the growth of new market. [71] Management styles in such organisations are entrepreneur and innovator type. [71]

Organisations with emphasis on a market/rational culture focused on the external environment with suppliers and customers. [72] Market culture promotes competition and the successful accomplishment of well-defined objectives. [71] The core values are focused on efficient planning and control of production to achieve competitive advantages and high productivity. [72] The management styles tend to be directive, goal-oriented, and practical. [72]

The hierarchical culture is characterised by stability, predictability and internal integration. [71] Organisations are characterised by a formalized and structured workplace with leaders who are traditional and cautious. [72] The strategy within hierarchical culture usually focuses on clear regulations and close control. [71]

Researchers from studies have concluded that the clan culture and adhocracy culture are the ideal cultural characteristics which can foster an efficient quality management implementation. [71] [74] [75] These cultural values emphasize people in their core values and flexibility within the organization. [71]
4 Guidelines for quality management in projects

There are many approaches to quality management. The Project Management Body of Knowledge (PMBOK® Guide) is a generally recognized standard and describes the sum of knowledge generally accepted as best practices within the project management profession. [76] This approach to quality management specifically in the context of project management is intended to be compatible with that of the Total Quality Management (TQM) and ISO standards. [2]

As shown in Figure 4, PMBOK® Guide describes three basic elements of project quality management processes which are quality planning, quality assurance and quality control. [2] However this differs slightly from what the quality guru Juran describes as the elements: quality planning, quality control and quality improvement. [77] Juran’s quality view includes assurance and control activities within quality control. [77] It also adds the critical element of quality improvement which the PMBOK® Guide does not include as a separate process. [77]

![Figure 4: Outline of Project Quality Management Processes](image-url)
PMBOK® Guide cites that project quality management includes the procedures and activities that will establish quality policies, objectives, and responsibilities in order to ensure that the project will satisfy the requirements for which it was selected. [2] Quality management system is implemented by means of policies and procedures with continuous process improvement activities. [2] Project Quality Management addresses the management of the project, despite the nature of their product or service. [2]

4.1 Plan Quality

Quality Planning is defined by the PMBOK® Guide as the process which identifies quality requirements or standards which are relevant to the project and documents how the project will satisfy compliance. [78] This activity is the basis for quality being designed or planned into the product, not inspected or corrected. [77]

During the framing meeting it is important to establish the basis for quality objectives and quality policy needs to be approved by top management and project stakeholders in order to set the proposed direction of project with regard to quality. [2]

The correct tools and training are required to ensure the appropriate level of quality for the project deliverables is achieved. [79] Quality planning tools like cost-benefit analysis, cost of quality, control charts, statistical sampling, are often used to define the quality requirements for the project deliverables and effectively plan quality management activities. [2] Inputs to quality planning include scope of work and project management plan. [79]

Quality Management Plan (QMP) describes how the project team plans to implement the quality policy and how quality assurance will be assessed within the project. QMP includes quality control, quality assurance, and continuous process improvement approaches for the project. [2] QMP needs to be reviewed early in the project in order to reduce cost and schedule overruns caused by rework. [2]
With all the emphasis on quality functions and activities, there is a tendency to overlook that in project management it is the scheduled work that actually determines what gets done. [80] Hence the quality activities need to be built into the work breakdown structure and made part of the baseline schedule. [80] It is necessary that the project manager understands the significance of scheduling as practical quality tool and ensure the quality management plan is translated into project schedules. [80]

4.2 **Perform Quality Assurance**

The PMBOK® Guide defines quality assurance as “the application of planned, systematic quality activities to ensure that the project will employ all processes needed to meet requirements.” [78] QA is the processes of auditing the quality requirements and results identified during the quality control process to ensure quality standards are used. [2]

A quality audit is a planned, independent review to establish whether project activities fulfil the project strategies, processes, and procedures. [2] Comprehensive quality assurance provides an efficient method to manage project risks and ensure the project requirements are met. It’s vital that the project management team implements and supports the quality assurance system to increase its ability to detect engineering mistakes and construction defects early in the project. However errors are often only detected during the construction phase of project and are more difficult and expensive to correct them. [79]

Quality Assurance offers an umbrella for continuous process improvement, which is an iterative method to enhance the quality of all processes and improve productivity. [2] The reasons for the unacceptable quality outcomes needs to be identified with the help of customers and appropriate measures needs to be suggested to the relevant stakeholder to ensure continuous improvement in quality results. [81] QMS needs to be maintained to enable successful documentation and communication of quality issues and outcomes to a higher project management and stakeholders. [81]
4.3 Implement Quality Control

The PMBOK® Guide defines quality control as the process of monitoring and documenting project results to measure if they fulfill the relevant quality standards. [82] Quality control detects poor quality problems through inspection and proposes action to reduce or eliminate them. [2] The objective of quality control is to determine the correctness of deliverables specified in quality planning in order to validate project scope.

The project management team needs to have a good understanding of statistical quality control, especially sampling and probability, to assist estimate quality control outputs. [2] Prevention is the process of ensuring quality errors are kept out of the process, while inspection is keeping errors after it has occurred out of the hands of the customer. [2]

Quality inspection is the assessment of the works to validate if it conforms to documented specifications and if quality assurance activities are having the desired result. Quality inspection activities include measuring, examining and testing of the product. Processes need to be reviewed throughout the project life cycle and the approved changes need to be implemented repetitively to ensure continuous improvement to quality.

Lessons learned throughout the project life cycle and recommended improvements must be identified, documented and passed on to a relevant management for use in future projects.
5 Research Methodology

It's important to decide on which methodology and research instruments should be used for dissertation. [83] Quantitative and Qualitative techniques focus on different research methods and questions to ensure accuracy by these techniques. These dissertation methodologies provide the researcher with different challenges and different methods to generate and analyse data. Qualitative techniques are preferred as thesis is more subjective and involves the examination and reflection on assessment in order to gain understanding of human behaviour.

5.1 Target Population of Relevance

The target population of relevance for this thesis consisted of all individuals involved in project management, engineering and quality management within the petrochemical construction industry in South Africa. The survey was conducted amongst professionals working in project environment in Sasol and Instrumentation contracting companies in petrochemical industry. Individuals in the positions of quality managers, engineering managers, project managers and project engineers were typically considered. The sample that was finally realized was 36.

5.2 Sampling Method and Size

It's important to ensure the sample accurately represents the population and the process of achieving this is called sampling. [84] The primary objective of this qualitative research is to gather an in-depth understanding of behaviour related to quality management and the reasons that govern such behaviour. [85] Hence, smaller but more subjectively selected samples are often required than large random samples.

Non-probability sampling was used for this research as the sample was subjectively selected based and there was no sampling frame for the population of relevance. In general, researchers prefer probabilistic or random sampling methods over non-probability sampling, and consider them to be more accurate and rigorous. However,
in this applied social research it was not feasible, practical or theoretically sensible to do random sampling. Hence consider a wide range of non-probability sampling alternatives was used.

5.3 Data Collection

To achieve objectives of thesis one has to identify the research methodology, tools and techniques which will be used. Engineering research methodology is very flexible approach and usually combines several methods of collecting and analyzing data. To clarify the approach it is necessary to name and describe the stages of research process that will help to achieve the objectives of the dissertation.

The dissertation will comprise of extensive survey of the local academic literature and South African press reports concerning state of construction industry. International academic literature concerning the quality management system covering quality planning, quality assurance and quality control will be reviewed. Awareness of these concepts and principles mentioned in literature review represents the basic knowledge which is needed to begin working on the thesis. This will provide a good theoretical base, in addition to basic practical knowledge attained from my working environment.

The necessary information will be collected from the following areas:

- Websites
- International research journals associated to Construction Engineering & Management.
- International transactions & conference proceedings from AACE.

Forms of data collection methods used for qualitative researchers can include personal interviews, telephonic unstructured interviews, participant observation and surveys. [85] Primary data collection for this dissertation will be done using surveys and unstructured interviews. The concept of survey is defined as collection of a large quantity of verified data usually numeric or data that will be converted into numbers normally by means of a questionnaire. [86] The questionnaire is a list of carefully
structured “closed” questions, chosen after extensive testing with an outlook to extract reliable response from a chosen sample. The objective of the questionnaire is to establish what a selected population do or think and validate the practicality of the concepts and principles mentioned in literature review. A phenomenological approach to survey proposes the use of unstructured “open ended” questions while positive approach to survey proposes structured “closed” questions. In this research a positivistic approach will be used and the data collected could suggest ways in which the organizations could improve the impact of culture in the project environment in terms of quality.

5.3.1 Questionnaire Design

The design and selection of statements in questionnaire was based on comprehensive literature review conducted. The questionnaire was divided into three sections and contained 20 questions. The questionnaire was designed to gather information on the following:

- Section 1: Background to dissertation and objective of questionnaire
- Section 2: Demographic of the respondents and their organisation
- Section 3: A general assessment aimed at identifying:
  - Adequacy of current quality management processes used by EC
  - Why is there a need for Quality Management System?
  - What are the deficiencies with current Quality Management System?
  - What is the link between Quality management and Project management?
  - How to get people involved and create a quality culture within project team?

Most of the questionnaires were distributed by email, while some were personally distributed to respondents during the interviews. The questionnaires consist of 20 statements representing quality management practice. The respondents are required to rank the frequency when answering the statements on a four-point summated
scale (4 for very often, 3 for often, 2 for rarely and 1 for never). The data obtained were analyzed using descriptive statistics and relative index technique.

5.4 **Limitations**

The dissertation has the following limitations:

- The population of relevance was fairly small and subjectively selected. Selection criteria of the industry professionals were limited to Sasol and their related engineering contractors. In a qualitative research, often non-probability sampling techniques are rely on subjective judgement of the researcher. Hence it can be questioned whether the sample is representative of construction industry and to what extend can the findings be generalised. [87]

- In a qualitative research, often the researcher becomes the primary research instrument, it requires exceptional discipline to remain objective and critically scrutinize any new insights. [87]

- Expert opinions from industry professionals like project managers, engineering managers was obtained. However these opinions remain subjective and open to scrutinize and criticism [87]

- The willingness of respondents from contracting firms to reveal flaws and weakness in their respective organization can be questioned.

- Certain respondents were not completely engaged in the interview due to unforeseen work commitment.
6 Results, Data Analysis and Interpretation

This chapter will outline the results from responses to the questionnaire conducted amongst the management in Sasol regarding the influence of culture on the success of a QMS implementation, the data analysis and the interpretation.

6.1 Demographic Breakdown

The demographical data collected include the average years for which companies have been practising, the total number of employees and scale of operations. Of the 36 respondents 29 (80.5%) were male and 7 (19.5%) were female. This indicates that the majority of respondents who were working in the Petrochemical industries are male.

![Graph showing the experience of respondents](image)

**Figure 5: The demographic profile of the respondent according to experience**

![Graph showing respondents according to occupation](image)

**Figure 6: The demographic profile of the respondent according to occupation**
6.2 **Analysis Method**

6.2.1 **Validation of Survey Results**

A descriptive analysis of the survey results returned by the respondents of questionnaire is illustrated below. The responses to the questions obtained through the questionnaires are indicated in bar chart below for ease of reference. This questionnaire is aimed to determine the impact of organisational culture on the successful implementation of quality management systems.

The first 5 questions in questionnaire as listed in Table 1 was designed to gather information on adequacy of current quality management processes used by EC.

**Table 1: Survey questions aimed at identifying adequacy of current quality management processes**

<table>
<thead>
<tr>
<th>Question (Q)</th>
<th>Adequacy of current quality management processes used by EC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>Each project has a quality management plan</td>
</tr>
<tr>
<td>Q2</td>
<td>Client/Customer are satisfied with quality of work in project</td>
</tr>
<tr>
<td>Q3</td>
<td>Organizations incorporate quality best practices in all their processes &amp; activities.</td>
</tr>
<tr>
<td>Q4</td>
<td>Inadequate training of employees effects quality negatively</td>
</tr>
<tr>
<td>Q5</td>
<td>Construction quality could be attributed to design related issues or the appointment of incapable contractors</td>
</tr>
</tbody>
</table>

The respondents are required to rank the frequency when answering the statements on a four-point summated scale (4 for very often, 3 for often, 2 for rarely and 1 for never).
61% of the respondents indicated that customers/clients are often satisfied with quality of work conducted by contractors in projects, and only 30% indicated that they were always satisfied. Disturbingly 14% of respondents were unsure whether a project has a quality management plan. The failure of many respondents to completely acknowledge the significance of quality management process is a common problem also identified in the literature review.

Nearly 36% respondents cited either “never” or “rarely” that organizations incorporate quality best practices in all their processes & activities.

86% of the respondents indicated that construction quality “often” attributed to design related issues or the appointment of incapable contractors, 14% cited the following reasons always affected construction quality negatively.

72% of respondents strongly agreed that inadequate training of employees always effects quality negatively.
The questions as listed in Table 2, undertaken as part of survey for this dissertation highlighted the importance of quality management system.

**Table 2: Survey questions aimed at identifying need for QMS**

<table>
<thead>
<tr>
<th>Q</th>
<th>Need for Quality Management System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q6</td>
<td>Quality culture that fosters deeper human relationships can improve quality management</td>
</tr>
<tr>
<td>Q7</td>
<td>Construction contractors implement documented QMSs</td>
</tr>
<tr>
<td>Q8</td>
<td>Management needs to foster an environment that encourages and communicates the philosophy that quality needs to be given higher priority over budget &amp; schedule</td>
</tr>
</tbody>
</table>

![Figure 8: Need for Quality Management System](chart.png)

72.2% of the respondents indicated that contractors always implemented a documented QMS as it’s a requirement to do work, and 13.2% indicated that they were unsure.

As shown in Figure 8, nearly 31% of the respondents cited either “never” or “rarely” that management priorities quality over budget and schedule. 69% of the respondents indicated that often or always management priorities quality over budget and schedule. 61.1% of respondents strongly agreed that deeper human relationships can improve quality management, while 36.1% respondents suggested that human relationships is often makes a difference in quality management.
While the previous section of survey covered the need for Quality management systems, this part of survey investigates the deficiencies within the current QMS as given below in Table 3. Figure 9 indicates survey response on key factors such as top management commitment, contractor’s organizational culture, and employee participation as improvement areas in Quality management systems.

Table 3: Survey questions aimed at identifying deficiencies with current QMS

<table>
<thead>
<tr>
<th>Deficiencies with current Quality Management System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q9 Management demonstrate commitment and support for QMS</td>
</tr>
<tr>
<td>Q10 Quality is embodied within the values and belief system of the project team and contractor’s team</td>
</tr>
<tr>
<td>Q11 On a regular basis, quality procedures are reviewed</td>
</tr>
<tr>
<td>Q12 The employees’ goals are aligned with organisation quality objectives</td>
</tr>
</tbody>
</table>

Figure 9: Deficiencies with current QMS

Although 52.7% of respondent cited “always” and 33.3% “often” are aware of top management’s commitment and support for QMS, 13.8 % suggested that their organizations lack competent senior management and organisational structures to effectively implement and sustain the QMS.
Furthermore, 25% of respondents indicated that contractor or clients always reviewed quality procedures on a regular basis. While 27.8% stated they believed that quality procedures rarely or never reviewed and 11.1% indicated that they were unsure. Respondents cited that is vital to align the employees’ goals with organisation objectives.

Table 4: Survey questions aimed at identifying link between Quality management and Project management

| Q13 | Leadership among management can enhances quality culture and professionalism |
| Q14 | Project management has the responsibility to create an quality environment which encourages customer oriented culture and significance of quality in daily activities |
| Q15 | Management sets too aggressive cost or schedule targets which affects the quality of construction work |
| Q16 | Top management addresses employees concerns adequately and provides the relevant tools and training to do their work satisfactorily |

Figure 10: The link between Quality management and Project management
A notable finding is that 86.1% of respondents cited that management always sets too aggressive cost or schedule targets which affect the quality of construction work. 94.4% of respondents identified often or always that inspirational leadership among management can enhance quality culture and professionalism.

Table 5: Survey questions aimed to create a quality culture within project team?

<table>
<thead>
<tr>
<th>Question</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q17</td>
<td>All employees play a role in delivering good quality</td>
</tr>
<tr>
<td>Q18</td>
<td>Cultural and behavioral change within the organisation is required in order to improve QMS.</td>
</tr>
<tr>
<td>Q19</td>
<td>Quality culture amongst the project team will generate greater value and satisfaction</td>
</tr>
<tr>
<td>Q20</td>
<td>Recognition and communication of success improves the quality of the deliverables</td>
</tr>
</tbody>
</table>

Figure 11: How to create a quality culture within project team?
83.3% of respondent indicated that all employees are responsible for quality management. All respondent agreed that a cultural and behavioral change within the organisation is required in order to improve QMS.

While 88.9% of respondents indicated that quality culture amongst the project team will generate greater value and satisfaction. 58.3% of respondents cited recognition and communication of successfully work completed as tools to improves the quality of the deliverables. But 11.1% respondents cited that rarely recognition and communication of successfully work completed are enough to improve the quality.

6.2.2 **Sample**

The sample that was finally realized was 36.

**6.3 Analysis**

Typically, in most qualitative research conducted on groups of people, both descriptive and inferential statistics are used to analyse results and draw conclusions. Descriptive statistics aims to summarize raw data in a more meaningful way which allows simpler interpretation of sample such that patterns emerge using statistical measures, such as average, median, standard deviation. However descriptive statistics does not allow one to generalize conclusions beyond the sample analyzed or make conclusions regarding any hypotheses proposed. Inferential statistics aims to generalize findings and conclusions from the sample at hand to a broader population.

In total 36 respondents answered the questionnaire. The questions in the survey was tested for reliability
The following correlations can be drawn from this analysis of the survey respondents:

Respondents cited that an improvement in the quality management and quality of construction can only be achieved if quality is embodied within the values and belief system of the project team and contractor's team. This needs to be driven by the project manager who is the main role player in the quality managing process.

However respondents also stated that it is equally true that all employees of an organisation have a role to play in delivering good quality. Many employees believe that their job doesn't end with their primary task and their responsible include contributing to quality improvement. They believe that is important to work together with contractors to take ownership of quality.

Respondents recommend developing a quality culture amongst the project team will generate greater value and satisfaction. Creating a quality culture within a project environment is not as difficult as it may seem but it requires a shift in thinking of project team. One of the best ways to enhance quality and professionalism is through leadership with project managers serving as role model for the project members. It relates to how the behavior and actions of managers can motivate, support and encourage a culture of quality excellence.

The cultural awareness of quality, its significance to the organisation and its clients must be led and supported by management who has responsibility to create an environment which encourages customer oriented culture and significance of quality in daily activities. The project manager must encourage the project team with the belief that the right level of quality is more important than getting things done fast. If the intentions of the project manger are not good, then products and services will have limited quality.
Respondents cited that is vital to align the employees’ goals with organisation objectives. It is often organisational objectives and culture that guides and controls the project team’s behavior and actions. Everyone in the organisation must have a shared commitment to improve the quality of work. Efficient communication and alignment is vital to ensure the project objectives are met.

Most projects in today environment are schedule driven. Respondents cited specific concerns of management setting too aggressive cost or schedule targets which noticeably deceases the quality of work. If there is a choice to be made between quality and schedule it should be a matter for the higher management to decide. Improved management commitment and employee participation were identified by contractors and project managers as key areas that could improve quality of construction.

It was evident that customers were dissatisfied with quality of work completed on less than 5% projects. Majority of those projects in which customers were dissatisfied with construction quality could be attributed to design related issues or the appointment of incapable contractors. This highlights concerns about the construction industry facing major skills shortages, particular in certain specialist areas. These skills shortage are further aggravated by the aging profile of experienced professional in petrochemical construction industry.

Most respondents felt strongly that inadequate training of personnel effects quality negatively. However respondents were satisfied with on-the job training received and top management addresses their concerns adequately and provides the relevant tools to do their work satisfactorily. Project schedule and quality of processes is deeply related to the employee’s skills, competence and experience. Lack of quality in construction is evident in reduced or unsustainable workmanship, poor site management, escalating costs and schedule delays leading to disputes in contracts. Many contractors cited recognition and communication of success can help improve the quality of the deliverables.
Respondents suggested that regularly reviewing procedures improves the employees understanding of their jobs. Organizations need to incorporate quality best practices in all their processes and activities.

Corrected non-conformances to customer requirements can be prevented from recurring by incorporating it in lessons learns for future projects.

8 Suggestions for Further Research

Questionnaire must address a larger sample to enable quantitative analysis. Verification of data collected through interviews of respondents can be done through in-depth case studies involving observation of respondents in the workplace.

Considering the various features of the quality management practices, it is possible that cultural characteristics that support a specific quality practice may vary from those cultural characteristics that support other types of quality management practices. [71] Studies should examine the different effects of cultural characteristics on different quality management systems.
9 Conclusion

The role of quality management must not be an isolated activity, but must be embedded in the entire operational and managerial processes of organizations. All the employees in an organisation are responsible for translating the quality commitment from intention to action. Every project should have a quality management system that enables management to organize, plan and co-ordinate their projects. Quality in construction industry is thus not a matter of chance, it is achieved through proper quality management that begins with planning, and applying disciplined processes and tools.

Quality management is defined as the culture, procedures and organisational structures that are directed towards fulfilling potential quality opportunities to meet the customer requirements whilst managing adverse effects. To create and sustain a quality culture, it is important to assess quality risks within the organisation and test the extent to which the organisational culture empowers employees to work with quality at all times and in all situations.

It is very important to manage the quality process because it ensures that the deliverable ultimately fulfills the project requirements and the customer’s expectations. However it’s rather easy to keep track of procedures, policies, standards, and the infrastructure in place to manage quality. Thus project managers must concentrate their attention on the people factor and need to continuously improve efforts to make sure that quality is embedded in the way employees do things. The link in the quality chain that is often overlooked and which is most likely to failure is the human link.

The project manager must understand of quality practices and processes in order to motive and foster the development of a quality culture within the project team. Developing a quality culture amongst the project team will generate greater value and satisfaction. The project manager must encourage the project team with the belief that the right level of quality is more important than getting things done fast.
Successful project management will improve project quality while helping to maintain project budget, schedule and scope.

This thesis suggests that construction industry would benefit from the development of quality culture that fosters deeper human relationships to improve quality management.
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### Dissertation Questionnaire

**Student Researcher:** SJI ANTONY  
**Research Supervisor:** Prof. JAN-HARM C PRETORIUS (Pr Eng)  
**Institution:** UNIVERSITY OF JOHANNESBURG

#### Consent to Participate in the Dissertation Survey

You are invited to take part in this research project, aimed at establishing the impact of culture on application of Quality Management System. Your participation is entirely voluntary.

#### Confidentiality

No confidential information about the participants will be given to anyone. All responses of the participant will remain anonymously.

#### Objective of this Survey

The focus of the thesis is to examine how quality culture can improve the quality in organisation and influence the implementation of Quality Management System in construction industry. The Quality Management System is used to ensure that the project will satisfy the requirements for which it was undertaken. Improving project quality in construction requires consideration of culture within the project environment that is often associated with miscommunication and fragmentation.

Survey is for the dissertation submitted in partial fulfilment of the requirements for the researcher’s Masters degree in Engineering Management at University of Johannesburg.

#### Estimated time to complete the Survey

The estimated time to complete the questionnaire is about 10 – 15 minutes is required.

#### Results of the Survey

Please indicate if you are interested in the results of this survey and it will be e-mailed to you.
## SECTION A – DEMOGRAPHICS

The questions below provide the research with demographical information necessary to provide context. Please select your answer next to each question.

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Years of Work experience:</td>
<td>&lt; 1 year, 1-5 years, 6-10 years, 11-above years</td>
</tr>
<tr>
<td>2. Business Unit:</td>
<td></td>
</tr>
<tr>
<td>3. Location:</td>
<td>Johannesburg, Secunda, Sasolburg, Other (please state)</td>
</tr>
<tr>
<td>4. Time spent in Project work:</td>
<td>&lt;10%, 10 – 60%, &gt; 60%</td>
</tr>
<tr>
<td>5. Average size of projects you are involved in (CAPEX):</td>
<td>&lt;R 1m, R 1m-R50m, R50m-R1b, &gt;R1b</td>
</tr>
<tr>
<td>6. Are you part of management:</td>
<td>Yes, No</td>
</tr>
<tr>
<td>7. Have you had any formal training in Project Management?</td>
<td>Yes, No</td>
</tr>
<tr>
<td>8. Would you like to receive the results of this research?</td>
<td>Yes, No</td>
</tr>
</tbody>
</table>

If yes, please provide contact a name and email address so that these can be sent to you:

Name: 
E-mail address: 
### SECTION B – The impact of culture on application of Quality Management System Survey

Below are 20 questions about quality management. This questionnaire is aimed to determine the impact of organisational culture on the successful implementation of quality management systems in South African Construction Industry. Please respond to all the questions to the best of your knowledge.

<table>
<thead>
<tr>
<th>Question</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Each project has a quality management plan</td>
</tr>
<tr>
<td>2.</td>
<td>Client/Customers are satisfied with quality of work in project</td>
</tr>
<tr>
<td>3.</td>
<td>Organizations incorporate quality best practices in all their processes and activities.</td>
</tr>
<tr>
<td>4.</td>
<td>Inadequate training of employees effects quality negatively</td>
</tr>
<tr>
<td>5.</td>
<td>Construction quality could be attributed to design related issues or the appointment of incapable contractors</td>
</tr>
<tr>
<td>6.</td>
<td>Majority of construction contractors does not implement documented QMSs</td>
</tr>
<tr>
<td>7.</td>
<td>Management needs to foster an environment that encourages and communicates the philosophy that quality</td>
</tr>
<tr>
<td>8.</td>
<td>Management demonstrate commitment and support for quality management system</td>
</tr>
<tr>
<td>9.</td>
<td>Culture that fosters deeper human relationships can improve quality management</td>
</tr>
<tr>
<td>10.</td>
<td>Quality is embodied within the values and belief system of the project team and contractor’s team</td>
</tr>
<tr>
<td>11.</td>
<td>On a regular basis, quality procedures are reviewed</td>
</tr>
<tr>
<td>12.</td>
<td>The employees’ goals are aligned with organisation quality objectives</td>
</tr>
<tr>
<td>13.</td>
<td>Leadership among management can enhances quality culture and professionalism</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>14.</td>
<td>Project management has the responsibility to create an quality environment which encourages customer oriented culture and significance of quality in daily activities</td>
</tr>
<tr>
<td>15.</td>
<td>Management sets too aggressive cost or schedule targets which affects the quality of construction work</td>
</tr>
<tr>
<td>16.</td>
<td>Top management addresses employees concerns adequately and provides the relevant tools and training to do their work satisfactorily</td>
</tr>
<tr>
<td>17.</td>
<td>All employees play a role in delivering good quality</td>
</tr>
<tr>
<td>18.</td>
<td>Cultural and behavioral change within the organisation is required in order to improve QMS.</td>
</tr>
<tr>
<td>19.</td>
<td>Quality culture amongst the project team will generate greater value and satisfaction</td>
</tr>
<tr>
<td>20.</td>
<td>Recognition and communication of success improves the quality of the deliverables</td>
</tr>
</tbody>
</table>

Any additional comments on the impact of culture on application of Quality Management System:
_______________________________________________________________________________________________
_______________________________________________________________________________________________
_______________________________________________________________________________________________
___________________________________________________________________________________________

Thank you