

Total quality management:
***What is it and how can it be implemented in roads
construction?***

By: Roland Hendrik Dam

Submitted in fulfilment of part of the requirements for the Degree of
B.Sc (Hons) (Construction Management)
In the faculty of Engineering, Built Environment and Information Technology
University of Pretoria

Study Leader: JH Cruywagen

October 2010

Declaration by student

I, the undersigned, hereby confirm that the attached treatise is my own work and that any sources are adequately acknowledged in the text and listed in the bibliography.

Signature of acceptance and confirmation by student

ABSTRACT

Title of treatise : Total quality management: What is it and how can it be implemented in roads construction?
Name of author : Mr RH Dam
Name of study leader : Mr JH Cruywagen
Institution : Faculty of Engineering, Built Environment and Information Technology
Date : October 2010

The South African construction industry is becoming more competitive with more contractors joining the industry every year. Contractors are tendering for jobs with lower profit margins to remain competitive. The quality of workmanship is a very important aspect of the construction company's reputation and profit margin. It is very important that construction companies maintain a high standard of construction quality to remain competitive. This research report investigates Total Quality Management as management tool that can be employed by construction companies to increase the level of quality employed on construction projects.

Table of Contents

CHAPTER 1	1
<i>INTRODUCTION</i>	1
1.1 Background	1
1.2 Statement of the main problem:	2
1.3 Hypothesis of main problem	2
1.4 Statement and hypotheses of the sub problems.....	3
1.4.1 What are the benefits of Total Quality Management?	3
1.4.2 Difficulties and resistance to the implementation of Total Quality Management in construction companies, what are the causes?	3
1.4.3 Training and the people side of Total Quality Management.....	3
1.4.4 How can total quality management be implemented in a roads construction company?.....	3
1.5 Delimitations	4
1.6 Definition of terms	4
1.7 Assumptions.....	4
1.8 Importance of the study.....	4
1.9 Research methodology	5
CHAPTER 2	6
<i>WHAT ARE THE BENEFITS OF TOTAL QUALITY MANAGEMENT?</i>	6
2.1 Background	6
2.2 What is quality?.....	7
2.3 What is management?	8
2.4 What is total quality management?	9
2.5 Advantages and disadvantages of total quality management.....	10
2.5.1 Advantages	10
2.5.2 Disadvantages	13
2.6 Summary	13
2.7 Conclusion	14
2.8 Hypothesis.....	14
CHAPTER 3	15
<i>DIFFICULTIES AND RESISTANCE TO THE IMPLEMENTATION OF TOTAL QUALITY MANAGEMENT IN CONSTRUCTION COMPANIES – WHAT ARE THE CAUSES?</i>	15
3.1 Background	15
3.2 Difficulties with implementing TQM systems.....	16
3.3 Resistance to Total Quality Management in Construction	18
3.3.1 Product Diversity	18
3.3.2 Organizational Stability	19
3.3.3 Misconception of the Cost of Quality	19
3.3.4 Other factors.....	20
3.4 Summary	22
3.5 Conclusion	22

3.6 Hypothesis.....	23
CHAPTER 4	24
<i>TRAINING AND THE PEOPLE SIDE OF TOTAL QUALITY MANAGEMENT</i>	24
4.1 Background	24
4.2 Training and education in construction companies.....	25
4.3 Training for quality	25
4.4 Why training is important	26
4.5 Who should be trained?.....	27
4.5.1 Top management training	27
4.5.2 Middle management training	28
4.5.3 Training technical personnel.....	28
4.5.4 Operator and all other employee training	30
4.6 Summary	30
4.7 Conclusion	31
4.8 Hypothesis.....	31
CHAPTER 5	32
<i>HOW CAN TOTAL QUALITY MANAGEMENT BE IMPLEMENTED IN A ROADS CONSTRUCTION COMPANY?</i>	32
5.1 Background	32
5.2 Integrating total quality management into the strategy of the business	33
5.2.1 Step 1: Gain commitment to change through the organization of the top team.	33
5.2.2 Step 2: Develop a shared ‘mission’ or vision of the business or of what change is required.	33
5.2.3 Step 3: Define the measurable objectives, which must be agreed by the team, as being quantifiable indicators of success in terms of the mission.....	35
5.2.4 Step 4: Develop the mission into its critical success factors (CSFs) to coerce and move it forward.....	35
5.2.5 Step 5: Break down the critical success factors into the key or critical processes and gain process ownership.	37
5.2.6 Step 6: Break down the critical processes into sub-processes, activities and tasks and form improvement teams around these.	38
5.2.7 Step 7: Monitor and adjust the process alignment in response to difficulties in the change process.	38
5.3 Summary	39
5.4 Conclusion	39
5.5 Hypothesis.....	40
CHAPTER 6	41
<i>SUMMARY AND CONCLUSIONS</i>	41
6.1 Background	41
6.2 Summary	43
6.3 Conclusion	43
6.4 Suggestions for further research.....	45
BIBLIOGRAPHY	46

AHMED, S. M. (2000) Measurement of construction processes for continuous improvement. *Revised final report to the State of Florida*. Department of Community Affairs. 46

DYER, C. G. (1982) *Road Construction Technology in South Africa*, Cape Town, Juta & Co. 46

MENON, H. G. (c1992) *TQM in new product manufacturing*, New York, McGraw-Hill. 46

OAKLAND, J. S. (2000) *Total quality management: text with cases*, Oxford; Boston, Butterworth-Heinemann. 46

CHAPTER 1

INTRODUCTION

1.1 Background

The construction industry has been slow to implement Total Quality Management probably due to the age of the industry and the reluctance to change old management techniques. Projects are getting bigger and more complex while clients are demanding higher standards of quality of the end product. A lot of time, money and resources are wasted on construction projects as a result of poor quality management.

It is important for construction companies to provide consistent value and quality to the products that they construct to remain competitive in today's construction environment.

The cost of construction is ever increasing and it makes sense to try and save as much money as possible. A lot of money is lost not just during the construction period but also after the project is completed because of latent defects, which stem from poor construction practices. Latent defects are also bad for the company's image and it is very important to maintain a good company image.

It is time for construction companies to develop better and more direct relationships with employers, to initiate more teamwork at the jobsite, and to produce better quality work. Such goals demand that a continuous improvement process be established within the company in order to provide quality management. This continuous improvement process is referred to as Total Quality management.

Total Quality Management can briefly be described, as a management style that tries to incorporate all of organizations functions to meet the client's needs as well as the organizations objectives and to deliver a quality end product to the client. Total Quality Management empowers employees in an organization with the responsibility of ensuring quality in their tasks and duties. Employees that are empowered range from the labourers on site to the director. Total quality management is dependent on people, so it is not a system that a company can purchase, but rather implement.

1.2 Statement of the main problem:

Total quality management: what is it and how can it be implemented in roads construction?

This research report will try to answer this question by defining total quality management and identifying areas in roads construction where it can be implemented. It also aims to identify how total quality management can be used to save on time, money and resources that are wasted on road construction projects due to poor quality control during and after construction. The concepts of quality and management will be explored in detail.

1.3 Hypothesis of main problem

Total Quality Management is a management tool that can be used by the management team of a construction company to increase the standard of quality of construction projects. It has to be implemented throughout the entire company and monitored on a continuous basis to remain effective and to be beneficial to the company.

1.4 Statement and hypotheses of the sub problems

1.4.1 What are the benefits of Total Quality Management?

Total Quality Management has advantages and disadvantages. The advantages must outweigh the disadvantages for Total Quality Management to be effective. Many companies outside the construction industry use Total Quality Management as a management tool. There must be a reason as to why it is used and there must be some benefits linked to Total Quality Management.

1.4.2 Difficulties and resistance to the implementation of Total Quality Management in construction companies, what are the causes?

There must be difficulties with the implementation and resistances offered by people to the implementation of Total Quality Management in construction companies. There could be many causes of this problem and not one specific cause.

1.4.3 Training and the people side of Total Quality Management

People will need to be trained in the principles of Total Quality Management because without people Total Quality Management cannot exist. It is people based and training will form a very important part of the effective implementation of Total Quality Management.

1.4.4 How can total quality management be implemented in a roads construction company?

There must be different ways to implement Total Quality Management and there must be steps that can be used to implement Total Quality Management because it is not a system that can be implemented overnight. It will take time to implement the system.

1.5 Delimitations

Only contractors that operate in South Africa will be used for this research report. Some contractors specialize in the construction of roads, and other contractors specialize in buildings, roads and other types of construction. This research report will focus primarily on contractors which build roads.

1.6 Definition of terms

TQM: Total Quality Management

CSFs: Critical Success Factors

1.7 Assumptions

Assume that no South African construction companies employ Total Quality Management as a management tool.

1.8 Importance of the study

The importance of this research report is significant because Total Quality Management is not used by many South African construction companies. Total Quality Management can be a very useful management tool if it is properly implemented.

1.9 Research methodology

Information will be collected from books in the University of Pretoria library. Books containing information about Total Quality Management as well as road construction and quality will be used for the purpose of this research report.

Information will also be collected from articles published on Total Quality Management and related topics, as well as websites dealing with Total Quality Management.

CHAPTER 2

WHAT ARE THE BENEFITS OF TOTAL QUALITY MANAGEMENT?

2.1 Background

The aim of this chapter is to establish what the advantages and disadvantages of Total Quality Management are and whether the advantages outweigh the disadvantages. The aim is also to find out if the advantages of total quality management can be applied in a construction company. It is important to find out if this is in fact true before continuing with the rest of the research report.

In this chapter the terms quality, management and total quality management will be defined before the advantages and disadvantages of Total Quality Management will be defined. It is important to understand the above mentioned terms to understand Total Quality Management.

The importance of quality in road construction is very important due to the high cost of construction. A mistake or poor quality of construction early in a construction project could have very costly implications at the end of the project when the mistake or defect has to be repaired.

It is also very important for a construction company to have a good reputation regarding quality due to the relatively small size of the industry. If a construction company has a bad reputation the news will spread quickly through the industry and clients or employers will doubt the construction company before it has a chance to prove itself. This will have the biggest effect at the tender stage.

There is a certain Pretoria based road construction company with such a reputation. Its name is synonymous with poor quality and bad workmanship and its reputation has spread throughout the industry.

It is therefore very important for a construction company to have a system of quality management in place to ensure that the required standards are met.

Quality is also very important because it is one of the biggest factors, which determines the success of a contractor. In the construction part of the construction process quality is very important in every aspect of the work. In the construction industry, clients also have a big influence on quality because it includes everything that the client expects and it can change continuously throughout a construction project. The client will have a great influence on the standard of quality because the client is the one financing the project and the one who ultimately has to be satisfied at the end of a project.

2.2 What is quality?

Ahmed (2000) quotes ISO 8402 in defining quality as “the degree of excellence in a competitive sense, such as reliability, serviceability, maintainability or even individual characteristics”

According to *Wikipedia* (Quality (business), 2010), quality can be defined as: The common element of the business definitions is that the quality of a product or service refers to the perception of the degree to which the product or service meets the customer's expectations. Quality has no specific meaning unless related to a specific function and/or object. Quality is a perceptual, conditional and somewhat subjective attribute.

In this definition it is stated that quality has no specific meaning unless related to a specific function or object. In the construction industry quality is linked to materials and workmanship. The specifications of the materials and workmanship are specified in the design drawings and general specifications.

2.3 What is management?

Drucker (1993) defined management as “Supplying knowledge to find out how existing knowledge can best be applied to produce results is, in effect, what we mean by management. But knowledge is now also being applied systematically and purposefully to determine what new knowledge is needed, whether it is feasible, and what has to be done to make knowledge effective. It is being applied, in other words, to systematic innovation.”

From the above definition, it can be said that knowledge has to be applied systematically to produce results. This is important in the construction industry because each employee has different knowledge and that knowledge has to be channelled in the right direction to produce the required end result.

Other definitions of management, which are applicable to the construction industry, include:

The organizational process that includes strategic planning, setting; objectives, managing resources, deploying the human and financial assets needed to achieve objectives, and measuring results. Management also includes recording and storing facts and information for later use or for others within the organization. Management functions are not limited to managers and supervisors. Every member of the organization has some management and reporting functions as part of their job.

The process of getting activities completed efficiently with and through other people; 2. The process of setting and achieving goals through the execution of five basic management functions: planning, organizing, staffing, directing, and controlling; that utilize human, financial, and material resources (Shed, 2010).

Effective utilization and coordination of resources such as capital, plant, materials, and labour to achieve defined objectives with maximum efficiency (Fryer, 1990).

From the above definitions, management can be broken down into four main functions namely planning, leading, organising and control. In the construction industry these functions are not only carried out by the company management but also by the people that work on construction sites.

2.4 What is total quality management?

Total quality management is a set of management practices throughout the organization, geared to ensure the organization consistently meets or exceeds customer requirements. Total quality management places strong focus on process measurement and controls as means of continuous improvement.

According to searchio.com (Jan 2002) total quality management can be defined as: Total Quality Management is a comprehensive and structured approach to organizational management that seeks to improve the quality of products and services through ongoing refinements in response to continuous feedback. Total Quality Management requirements may be defined separately for a particular organization or may be in adherence to established standards, such as the International Organization for Standardization's ISO 9000 series. Total quality management can be applied to any type of organization; it originated in the manufacturing sector and has since been adapted for use in almost every type of

organization imaginable, including schools, highway maintenance, hotel management, and churches.

Total quality management processes are divided into four sequential categories: plan, do, check, and act (the PDCA cycle). In the planning phase, people define the problem to be addressed, collect relevant data, and ascertain the problem's root cause; in the doing phase, people develop and implement a solution, and decide upon a measurement to gauge its effectiveness; in the checking phase, people confirm the results through before-and-after data comparison; in the acting phase, people document their results, inform others about process changes, and make recommendations for the problem to be addressed in the next PDCA cycle.

Total quality management requires commitment from and involvement of all employees in a construction company to be effective.

2.5 Advantages and disadvantages of total quality management

2.5.1 Advantages

2.5.1.1 Improves reputation- faults and problems are spotted and sorted quicker (zero defects)

Improved reputation is very important for construction companies due to the competitive nature of the industry. A construction company with a good reputation has a distinct advantage over a construction company with a bad reputation and it makes a big difference when it comes to the tendering process. If faults and problems are spotted and reported quicker the faults and problems can be rectified quicker and therefore there will be less latent defects and the client will have more confidence or trust in the contractor.

2.5.1.2 Higher employee morale– workers motivated by extra responsibility, team work and involvement in decisions of TQM

It is very important to have high employee morale in the construction industry because employees don't hesitate to move to companies, which offer them higher pay. This is a common phenomenon in the construction industry. If an employee feels part of the team the employee will have more commitment and be more productive and show loyalty to the company. Employees will take pride in their work and it will improve quality standards.

2.5.1.3 Lower costs – Decrease waste and fewer defective products

Waste contributes to a lot of the money that is wasted on construction sites. Defective workmanship is also a cause of latent defects and a lot of money is wasted to rectify latent defects. If employees understand how they can reduce waste and minimise defective workmanship construction companies will be able to save money.

2.5.1.4 Quality Control inspectors

Total quality management allows in theory for each employee to become a quality control inspector because each employee is responsible for his own work and employees will criticise the work of their fellow employees if their work is not up to standard or they are performing poorly.

2.5.1.5 Provides an invaluable problem-solving tool for managers and supervisors to use.

Because of the size of big construction sites it is very difficult for managers and supervisors to check on all of the work in a short space of time. Total quality

management makes each employee responsible for the quality of their own work and this assists managers and supervisors a great deal.

2.5.1.6 Develops management skills that were never taught, or are long forgotten due to lack of application.

Most employees in the construction industry do not have formal education or training and trained management skills are often not used. Total quality management allows for the development of these management skills.

2.5.1.7 Management becomes more aware of problems that affect the individuals work environment.

Total quality management gives employees the opportunity to report problems to management as soon as they recognise a problem. This enables management to make decision to rectify problems sooner and to put systems in place to help employees deal with problems more effectively.

2.5.1.8 Provides opportunity for personal growth and development (as a result of team training activities) and the opportunity to develop and present recommendations for improvement.

Total quality management gives employees the opportunity to improve their skills and knowledge through training and skills development. It is important for employees to feel that they are developing their skills and this also reduces employee turnover.

2.5.2 Disadvantages

2.5.2.1 Initial introduction costs- training workers and disrupting current production whilst being implemented

The initial introduction costs of implementing total quality management will be high because employees will have to be trained in the importance of quality and methods to improve quality. This will disrupt production not only during the training process but also after because employees will take longer to complete work if the quality of work is to be improved.

2.5.2.2 Benefits may not be seen for several years

The effects of total quality management will not be seen until employees get used to doing better quality work. People take time to break old habits. Companies have to change the culture of the company to adapt to total quality management, as total quality management will create a new culture over time.

2.5.2.3 Workers may be resistant to change – may feel less secure in jobs

The saying “*you can't teach an old dog new tricks*” might be applicable especially to older employees who have been in the construction industry for a number of years. They don't like to be told how to do their work and to change their methods. These older employees might feel intimidated by the implementation of total quality management.

2.6 Summary

In this chapter the terms quality, management and total quality management were defined. The terms quality and management were defined to give a better meaning to the term total quality management.

Eight advantages and three disadvantages of total quality management were also listed and discussed.

2.7 Conclusion

The information included in this chapter shows that total quality management is a continuous process and that it has more advantages than disadvantages.

Implementing total quality management in managing everyday construction activities is relevant to all those who participate in and contribute to the construction process.

This chapter shows that the advantages of total quality management outweigh the disadvantages of total quality management and that the advantages are applicable to construction companies in South Africa.

2.8 Hypothesis

Total Quality Management has advantages and disadvantages. The advantages must outweigh the disadvantages for Total Quality Management to be effective. Many companies outside the construction industry use Total Quality Management as a management tool. There must be a reason as to why it is used and there must be some benefits linked to Total Quality Management.

This chapter showed that there are advantages and disadvantages of a TQM system. It also showed that the advantages outweigh the disadvantages and that the advantages are applicable to construction companies in South Africa. The original hypothesis is therefore proved correct.

CHAPTER 3

DIFFICULTIES AND RESISTANCE TO THE IMPLEMENTATION OF TOTAL QUALITY MANAGEMENT IN CONSTRUCTION COMPANIES – WHAT ARE THE CAUSES?

3.1 Background

There are a number of difficulties and resistance to the implementation of TQM systems. This chapter identifies and discusses some of difficulties and resistances to the implementation of TQM systems by construction companies.

Firstly, the difficulties related to TQM systems in construction companies are discussed and secondly the resistance to TQM systems in construction companies are discussed.

The difficulties with the successful implementation of a TQM system are predominantly people based, while the resistance encountered are industry and organisation based.

The biggest barrier to the implementation of total quality management is people. According to Menon, (1992 pg247), the biggest difficulty encountered with the use of total quality systems is not having top management with a vision to see the benefits of a total quality management system. Top management with a vision for a Total Quality Management system is the greatest prerequisite to creating such a system, and without their support it cannot succeed.

The success or failure of TQM systems depends on the people working within the organisation. The traditional concepts of managing people using discipline as the basic tool has to give way to motivating them to contribute to the process. The

employees have to feel respected and valued to make a meaningful contribution to the process. Once attitude is ingrained among the employees, the contributions and cost savings resulting from the TQM systems will amaze you. (Menon, 1992, pg47)

According to Oakland, (1993 pg 22), to be successful in promoting business efficiency and effectiveness, TQM must be truly organization wide, and it must start at the top with the chief executive officer or equivalent. The most senior directors and management must all demonstrate that they are serious about quality. The middle management has a particularly important role to play, since they must not only grasp the principles of TQM, they must go on to explain them to the people for whom they are responsible, and ensure that their own commitment is communicated. Only then will TQM spread effectively throughout the organisation. This level of management must also ensure that the efforts and achievements of their subordinates obtain the recognition, attention and reward that they deserve.

3.2 Difficulties with implementing TQM systems

Menon, (1992, pg 247), identified a number of problems with the implementation of TQM systems. The first issue for successful implementation of TQM systems is the failure to inform everyone in the organization regarding the direction in which the TQM system is heading. Any successes due to the TQM system must be publicized, since this encourages individual elements within the company to build on these successes.

Another reason for the failure of TQM systems is lack of adequate training systems. Many organizations tend to cut out training programs due to financial problems created by external constraints. In fact, external training programs conducted by consultants are often the first to be dropped when a company's budget starts to tighten. Training systems also pose a problem since the systems require sending an

internal trainer for a two day training program and then expecting him or her to train all the firm's employees in methods of TQM.

A third reason for failure of TQM systems is lack of follow through on certain systems which are often not up to date. Continuously monitoring all existing systems is critical to successful implementation of TQM systems. To this end each of the systems created should be regularly monitored at the appropriate level.

Another problem faced with TQM systems is the inability to control suppliers. This is particularly true for small manufacturers (or small construction companies), who may have difficulty controlling the suppliers due to the small volume of business they generate.

Mismanagement of the suppliers by large customers, who do not offer appropriate support to their suppliers, is another problem.

Finally, the failure of TQM systems can be due to poor planning and lack of adequate tools for quality planning. Even if management has the vision to see TQM for what it can do for the company, lack of proper planning for creating and using these systems will lead to failure. Once a problem area is identified, then immediate corrective action steps must be taken. Failure to take corrective action steps at the appropriate time or inadequate systems to find causes and eliminate those results in failed TQM systems. The steps described in the problem solving process or in any suitably modified sequence of steps must be implemented to ensure that problems are corrected.

3.3 Resistance to Total Quality Management in Construction

Pheng and Teo (2003) identified factors which may cause resistance in the implementation of TQM in construction which are discussed below.

3.3.1 Product Diversity

All buildings constructed are unique. Quality is seen as consisting of those product features which meet the personalized needs of the customers and thereby provide product satisfaction, supplemented with a provision of freedom from deficiencies.

In the construction industry, anything which is constructed is unique, not just buildings, so the above paragraph can apply to all construction projects. Each customer or employer is different and has different personalized needs, but the end product still has to remain free from defects. Each employer will have different standards of quality and a successful TQM system will have to accommodate for that. The standard of quality employed by the TQM system will have to be high to cater for all employer quality standards so that the employer will know what standard to expect.

Benchmarking is a good way of catering for this problem and setting a good standard. Menon, (1992, pg 180), states that benchmarking is a powerful tool in managing for quality and setting in place the continuous improvement process. Benchmarking attempts to compare similar products manufactured by competitors to gain a competitive advantage. The method used is to measure the process, service and product to assess current activities compared to competitors and determine where competitive advantage might be gained.

3.3.2 Organizational Stability

The construction industry has a high number of organizational collapses, especially during a downturn in the economy. Thus, commitment toward TQM strategies and policies that may take several years to provide pay-offs may be perceived as futile or a misdirection of resources. As compared to the head office, the building site is transitory. Teams specially formed for a project may cease to exist after contractual obligations end.

This is very true in the South African construction industry at present because of the economic recession experienced at the moment. There are also large fluctuations in the construction industry over time. Many workers are employed only for the duration of a specific contract and few are employed for longer periods, so it makes it very difficult to see the benefits of TQM in the long run.

Each time a new employee is employed, he or she has to be trained in the quality standards of that specific company which can become expensive in terms of TQM goals in the long run. The TQM system will have to cater for this event to remain successful. A good training program will be beneficial.

3.3.3 Misconception of the Cost of Quality

The cost of quality as costs associated with conformance to requirements and costs associated with non-conformance to requirements. Costs in the construction industry are being compounded by prevention and appraisal costs coupled with non-conformance costs. Contractors often perceive TQM as an extra cost, but they do not realize that it is not the quality, but rather the non-conformance to quality that is expensive. The sources of costs associated with the non-achievement of quality include the costs of rework, correcting errors, reacting to customer complaints,

having deficient project budgets due to poor planning, and missing deadlines. Biggar (1990) argues that the costs associated with implementing a TQM system could be substantial, depending on the size and nature of the company. However, Biggar (1990) pointed out that the costs incurred from not achieving quality can cost owners up to 12% of the total project cost.

Oakland, (1993, pg 186), states that the costs of quality are no different from any other costs. Like the costs of maintenance, design, sales production/operations and other activities, they can be budgeted, measured and analyzed.

The cost of redoing an item of work far outweighs the cost of doing it right the first time.

3.3.4 Other factors

According to Luna (Business First of Louisville - July 27, 1998) there are eight factors which, individually or collectively, have caused unsuccessful results. While most businesses do not possess all of these factors, they do possess at least some of them. Some of these factors are elaborated on below.

3.3.4.1 Lack of measurement

Probably the most important, yet least understood, component of TQM is measurement. After all, TQM's chief innovators including Deming, Juran, Ishikawa, and Shewhart were all statisticians. The basic premise behind TQM is that all processes are not perfect and vary to some degree. This variation is due to either random variation (beyond the control of the organization) or assignable causes (those which can be controlled by the organization). Measurement is used to identify those assignable causes and to monitor the improvement of a process. Without measurement, there is no TQM.

3.3.4.2 Not supported by upper management

TQM's success depends upon upper management. They should be the ones who are first sold on its usefulness, will commit the time and resources for implementation, and will allow for organizational growth based on the new knowledge gained from TQM.

3.3.4.3 Hidden agendas

Anytime TQM is used in the same sentence with cost containment, consolidation, cutback or attrition, the system talked about is not TQM. While TQM is attributed to decreased costs and increased quality, studies show that costs may actually increase when TQM is first implemented. The purpose of TQM is to achieve higher quality, nothing else.

3.3.4.4 Organizations not concentrating on the vital few problems

Well-intentioned organizations sometimes jump into the TQM philosophy and immerse the entire operation into the program without first identifying those few problems that are vital to the success of the business. The result is that the company usually bites off much more than it can chew. Staff soon become overwhelmed, managers see a decrease in work and efficiency, and TQM is soon forgotten.

3.3.4.5 Businesses hostile toward innovation

Many businesses do not want to change. While most live with the saying "*If it ain't broke, don't fix it,*" TQM philosophy says, "*If it ain't broke, there must be a better way of doing it.*"

3.3.4.6 Failure of the business to identify customers

While a customer is usually defined as someone who purchases goods or services, the definition of a customer in TQM language is broader. Suppliers, purchasers, and other departments within the business should all be considered customers. By understanding your various customers, you can better design your improvement strategies.

3.3.4.7 Trainers and teams that have limited knowledge

When TQM was introduced to South Africa, TQM "experts" were everywhere, and many were unqualified in either, TQM, business or both.

3.3.4.8 Expecting too much too soon

Because TQM is not a fad, positive results take time.

3.4 Summary

In this chapter, difficulties and barriers to the implementation of TQM systems were described and discussed. The biggest difficulty with the implementation of TQM systems is people. The most important aspect of a successful TQM system after implementation is the continuous monitoring and control of the system. The barriers to the implementation of TQM systems discussed in this chapter are product diversity, organisational stability, and the misconception of the cost of quality.

3.5 Conclusion

There are a number of issues that affect the implementation of a successful TQM system. If a TQM system is selected by to be used as a management tool then it should be thoroughly thought through before it is implemented. The TQM system should also be continuously monitored to remain effective.

3.6 Hypothesis

There must be difficulties with the implementation and resistances offered by people to the implementation of Total Quality Management in construction companies.

There could be many causes of this problem and not one specific cause.

This chapter identified the difficulties and resistances encountered with the implementation of successful TQM systems by construction companies. It shows that there are many and that they are mostly caused by people. The original hypothesis is therefore proved correct.

CHAPTER 4

TRAINING AND THE PEOPLE SIDE OF TOTAL QUALITY MANAGEMENT

4.1 Background

To implement successful TQM system employees will have to be trained. Training therefore becomes a very important part of TQM.

Menon, (1992, pg 8), states that the use of TQM systems requires a basic change in the operating philosophy of managing people. Everyone in the organisation has to understand that quality goes far beyond the issues of meeting the specifications of the customer. People have to be offered more than just a pay check in terms of job satisfaction.

For increased job satisfaction, it is necessary to create a culture in which employees can make a contribution to the whole process. Improved job satisfaction can manifest itself in the form of training for the employees, leading them to assume increased responsibilities.

Training ensures that all the tools available in the TQM system are correctly used, and that a team spirit is fostered in the company, with everyone working for continuous improvement of the process.

Like in manufacturing, every employee in a construction company contributes to the quality of the finished product because each employee has some sort of control over the project that they are working on. It is therefore very important that each employee fully understands his or her role within the project and that each employee has a positive attitude.

4.2 Training and education in construction companies

Fryer, (1985, pg 186), states that education is person centred, whereas training is job centred. This difference is very apparent when one compares the training requirements of a crane operator with the objectives of a degree course in building or civil engineering. Many training objectives are short term. Indeed, some can be achieved in a few days or even hours. Educational objectives, on the other hand, are long term and may take months or even years to achieve.

Training is essentially practical and job related. Most of the learning is about work methods and established procedures within a firm, trade or profession. Educational activities are broad based and the content more conceptual, aimed at developing the individuals analytical and critical faculties.

However, these differences should not mask the fact that both education and training are concerned with human development. They are complementary and they overlap. Almost every training activity has some educational impact on the learner to do a job better. The educational element in the training of an engineer or quantity surveyor will, however, normally be greater than the training of a scaffolder or joiner.

4.3 Training for quality

Menon, (1992, pg 49) states that one of the most important facets of the TQM system is the participation of every level of personnel within the company to the quality process and getting appropriate inputs from them.

This process can be accelerated and improved by providing appropriate tools to all levels of personnel.

Oakland, (1993, pg 390), states that training for quality should have, as its first objective, an appreciation for the personal responsibility for meeting the customer/employer requirements by everyone from the most senior executive to the newest and most junior employee. Responsibility for the training of employees in quality rests with management at all levels and, in particular, the person nominated for the co-ordination of the organisations quality effort. Quality training will not be fully effective, however, unless responsibility for the quality policy rests clearly with the CEO.

4.4 Why training is important

Menon, (1992, pg 49) also states that before training programmes are started, it is necessary to ask the question, what is the purpose of your training? The answer could be one of the following:

- foster an attitude of change.
- make all employees view the business from the customer's point of view.
- demonstrate management commitment to continuous improvement.
- develop skills in workers, leading to solutions to problems.
- encourage employee decision making.
- encourage group problem-solving skills.
- provide the tools necessary to provide quality service to customers.
- build a team spirit among the workers.

According to Metri (2005), Education and training forces employees to not only possess the adequate knowledge and skills to perform their jobs, but also to possess specific values, knowledge, and skills associated with TQM issues and activities. Reasons cited for the failure of TQM initiative include the lack of appropriate training and inadequate knowledge. Thus employees will be motivated to engage in

quality-oriented behaviour when their roles and the relevance of their training to overall quality goals are clarified.

4.5 Who should be trained?

Menon, (1992, pg 49) also states that this one factor will be the critical variable in determining how successful the TQM system will be. Training should not be short term, but should be a continuous reinforcement of the learning process. Depending on the level of the personnel in the organisation, different levels of quality education and training are required. Basically, organisations can be divided into four levels:

- Top management, including owners, presidents, and vice presidents.
- Middle managers, including department chiefs and plant managers
- Engineering, design, and research and development personnel.
- Supervisory personnel and operators.

4.5.1 Top management training

The first step in the process of implementing a TQM system is the orientation of the top management in the dynamics of TQM with an in depth analysis of reasons for failure of such systems: (this relates to chapter 3)

- Failure to bridge the gap between training and implementation.
- Partial training, where only some members of the organisation are trained in process control.

Top management must also be trained in the executive managements roles and responsibilities, required long term investment and strategic and operation planning, and the difference between management commitment and endorsement of TQM.

The leadership or the top management is critical to the success of the TQM process for the following critical reasons:

- They are required to provide the vision to unify all the quality improvement projects.
- They are the chief motivators during the massive changes in philosophy as a result of applying TQM.
- They have the power to change manufacturing systems before crisis stage is reached.
- They have the ability to allocate resources necessary for solving the problems and effecting continuous improvement.
- Priority for continuous quality improvement at the levels offered to manufacturing can be attained only if the top management wishes for it.
- Only the leadership can allocate adequate training time for every level of the organisation.

4.5.2 Middle management training

The next level in the organisation that must be trained is middle management. Middle management should be trained similarly to top management, with less emphasis on strategy and more on the overall management of quality. Considerably more emphasis is placed on tools and techniques of TQM. The actual implementation of the methods is dependent on this level of management having a clear understanding of the techniques available for use.

4.5.3 Training technical personnel

Once middle managers are trained in the tools of TQM, the next step in the process is training the technical personnel, who, depending on the organisational responsibility, should be trained in every aspect of TQM. The various courses in training will depend on the responsibilities.

Oakland, (1993, pg 396), states that there is a layer of personnel in many organisations which plays a vital role in their inadequate performance – foremen and supervisors – the forgotten men and women of the industry. Frequently promoted from the ‘shop floor’ (or recruited as graduate in a flush of conscience and wealth), these people occupy one of the most crucial managerial roles, often with no idea of what they are supposed to be doing, without an identity, and without training. If this behaviour pattern is familiar and is continued, then TQM is doomed.

The first level of supervision is where the implementation of TQM is actually ‘managed’. Supervisors training should include an explanation of the principals of TQM, a convincing exposition on the commitment to quality of the senior management, and an explanation of what the quality system means for them. The remainder of their training should then be devoted to explaining their role in the operation of the quality system, teamwork, etc., and to gaining their commitment to the concepts and techniques of TQM.

It is often desirable to involve the middle manager in the training of first line supervision in order to:

- ensure that the message they wish to convey through their tactical manoeuvres is not distorted, and
- indicate to the foremen level that the organisations whole management structure is serious about quality, and intends that everyone is suitably trained and concerned about it too. One display of arrogance towards the training of supervisors and the workforce can destroy such careful planning, and will certainly undermine the educational effort.

4.5.4 Operator and all other employee training

Finally, training the operators is a critical aspect of the successful implementation of the TQM system. Operators should be trained in the actual operation of the machinery.

Oakland, (193, pg 396), states that awareness and commitment at the point of production, or operation, is just as vital as at the very senior level. If it is absent from the latter the TQM programme will not begin; if it is absent from the 'shop floor', TQM will not be implemented. The training here must include the basics of quality, and particular care should be given to using easy reference points for the explanation of the terms and concepts. Most people can relate to quality and how it should be managed, if they can think about the applications in their own lives and at home. Quality is really such common sense that, with sensitivity and regard to various levels of intellect and experience, little resistance should be experienced.

All employees should receive detailed training in the quality procedures relevant to their own work. Obviously they must have appropriate technical or job training, but they must also understand the requirements of the employer. This is frequently a difficult concept to induce, particularly in the non-manufacturing areas, and time and follow up assistance must be given if TQM is to take hold. It is always bad management to ask people to follow instructions without understanding why and where they fit into their own scheme of things.

4.6 Summary

This chapter deals with training for TQM. The importance of training as well as the differences between training and education is discussed. The chapter also deals with who should be trained and how they should be trained and it covers all employees from top management to the general worker.

4.7 Conclusion

Training forms a very important, if not the most important part of a TQM system. Everyone in a construction company has to be trained. The lower the level of education a person has will determine the amount of training that the person will require. The general labourers, foremen and supervisors will be the most difficult to train in most cases. They will offer the most resistance to change.

4.8 Hypothesis

People will need to be trained in the principles of Total Quality Management because without people Total Quality Management cannot exist. It is people based and training will form a very important part of the effective implementation of Total Quality Management.

This chapter showed that TQM can be used to empower employees in the construction industry as the more training they receive in TQM, the better they will become at their work even if they move from one company to the next. Employees will be able to do work more efficiently and they will better understand their roles within the organization. The original hypothesis is therefore proved correct.

CHAPTER 5

HOW CAN TOTAL QUALITY MANAGEMENT BE IMPLEMENTED IN A ROADS CONSTRUCTION COMPANY?

5.1 Background

The area where a TQM system will benefit a roads construction company the most is on site. There are many activities involved in the construction process. A successful TQM system will have to monitor all of these activities.

According to Dyer (1982), the activities involved in constructing a road include the following:

- Earthworks
- Material handling
- Material processing
- Stabilizing
- Drainage
- Embankments
- Pavement construction
- Surfacing
- Kerbing
- Guardrails

There are many more activities involved than what is listed above. Some of the activities are carried out by the construction company involved and other activities are carried out by subcontractors. A successful TQM system will have to be integrated into the strategy of the business in such a way that it takes all of the construction activities as well as the resources required to carry out the work into account.

5.2 Integrating total quality management into the strategy of the business

Organizations will avoid the problems of ‘change programs’ by concentrating on ‘process alignment’ – recognizing that people’s roles and responsibilities must be related to the process in which they work (Oakland, 1995, pg321). Senior managers may begin the task of process alignment by a series of seven distinct but clearly overlapping steps (Oakland, 1995, pg321). These seven steps include:

5.2.1 Step 1: Gain commitment to change through the organization of the top team.

Process alignment requires the starting point to be a broad review of the organization and the changes required by top management team. By gaining this shared diagnoses of what changes are required, what the ‘business’ problems are, and what must be improved, the most senior executive mobilizes the initial commitment that is vital to begin the change process. An important element here is to get the top team working as a team.

5.2.2 Step 2: Develop a shared ‘mission’ or vision of the business or of what change is required.

Once the top team is committed to the analysis of the changes required, it can develop a mission statement that will help define the new process alignment, roles and responsibilities. This will lead to a coordinated flow of analysis of process that crosses the traditional functional areas at all levels of the organization, without changing formal structures, titles, and systems which can create resistance. The mission statement gives purpose to the organization or unit. It should answer the questions ‘what are we here for?’ or ‘what is our basic purpose?’ and therefore must

define the boundaries of the business in which the organization operates. This will help focus on the 'distinctive competence' of the organization, and to orient everyone in the direction or what has to be done. The mission must be documented agreed by the top management team, sufficiently explicit to enable its eventual accomplishment to be verified, and ideally be no more than four sentences. The statement must be understandable, communicable, believable and usable.

Some questions that may be asked of a mission statement are:

- Does it contain the need that is to be fulfilled?
- Is the need worthwhile in terms of admiration and identification, both internally and externally?
- Does it take a long term view, leading to new service development, or training of personnel?
- Does it take into account all the stakeholders?
- Will the purpose remain constant despite changes to top management?

It is important to establish in some organizations whether or not the mission is survival. This does not preclude a longer term mission, but the short term survival mission must be expressed, if it is relevant. The management team can decide whether it wishes to continue long term strategic thinking. If survival is a real issue, it is not advised to concentrate on the long term planning initially.

There must be open and spontaneous discussion during generation of the mission, but there must in the end be convergence on one statement. If the mission statement is wrong, everything that follows will be wrong so a clear understanding is vital.

5.2.3 Step 3: Define the measurable objectives, which must be agreed by the team, as being quantifiable indicators of success in terms of the mission.

The mission provides the vision and guiding light and sets down core values, but it must be supported by measurable objectives that are tightly and inarguably linked to it. These will help to translate the directional and sometimes 'loose' statements of the mission into clear targets, and in turn to simplify managements thinking. They can later be used as evidence of success for the team, in every direction, internally and externally.

5.2.4 Step 4: Develop the mission into its critical success factors (CSFs) to coerce and move it forward.

The development of the mission is clearly not enough to ensure its implementation. This is the 'danger gap' into which many companies fall, because they do not foster the skills needed to translate the mission through CSFs into critical processes. Hence they have 'goals without methods' and TQM are not integrated properly into the business. At this stage of the process strong leadership from the top is crucial. Commitment to change, whatever it may be, is always imbalanced, some senior managers may be antagonistic, some neutral, other enthusiastic or worried about the proposed changes.

Once the top managers begin to list the CSFs, they will gain some understanding of what the mission or the change requires. The first step in going from mission to CSFs is to brainstorm all the possible impacts on the mission. In this way thirty to fifty items ranging from politics to costs, from national cultures to regional market trends may be derived.

The CSFs may now be defined – what the organization must accomplish to achieve the mission, by examination and categorization of the impacts. There should be no more than eight CSFs and no more than four if the mission is survival. They are the minimum key factors or sub goals that the organization must have or need, and which together will achieve the mission. They are not the how, and are not directly manageable – they may be in some cases statements of hope or fear – but they provide direction and the success criteria. In CSF determination a management team should follow the rule that each CSF is necessary, and that together they are sufficient for the mission to be achieved.

Some examples of CSFs may clarify understanding:

- We must have right-first-time suppliers.
- We must have motivated, skilled people.
- We need new products that satisfy market needs.
- We need new business opportunities.
- We must have best-in-the-field product quality.

The list of CSFs should be an agreed balance of strategic and tactical issues, each of which deals with a ‘pure’ factor, the use of and being forbidden. It will be important to know when the CSFs have been achieved through key performance indicators but the more important next step is to use the CSFs to enable the identification of the processes.

5.2.5 Step 5: Break down the critical success factors into the key or critical processes and gain process ownership.

This is the point at which the top management team has to consider how to institutionalize the mission or the change in the form of process that will continue to be in place, after any changes have been affected.

The key, critical, or business processes describe what actually is or needs to be done so that the organization meets its CSFs. As with the CSFs and the mission, each process necessary for a given CSF must be identified, and together the processes listed must be sufficient for the CSFs to be accomplished. To ensure that processes are listed, they should be in the form of verb plus object, such as ‘research the market’, ‘recruit competent staff’ or ‘measure supplier performance’.

Each business process should have an owner who is a member of the management team that agrees the CSFs. The business processes identified frequently run across ‘departments’ or functions, yet they must be measurable.

The first stage in understanding the critical process is to produce a set of processes of a common order of magnitude. Some processes identified by the quality council may break into two or three critical processes; others may be already at the appropriate level. This method will ensure that the change becomes entrenched, the critical processes are identified and that the right people are in place to own or take responsibility for them, and it will be the start of getting the process-team organization up and running.

5.2.6 Step 6: Break down the critical processes into sub-processes, activities and tasks and form improvement teams around these.

Once an organization has defined and mapped out the critical processes, people need to develop the skills to understand how the new process structure will be analyzed and made to work. The very existence of new processes quality teams with new goals and responsibilities will force the organization into a learning phase. The changes should foster new attitudes and behaviours.

Clearly the senior and middle managers must provide the right support. Once employees, at all levels, identify what kinds of new skills are needed, they will ask for the formal training programs in order to develop those skills further. This is a key area, because the teamwork around the processes will ask more of employees, so they will need increasing support from their managers.

5.2.7 Step 7: Monitor and adjust the process alignment in response to difficulties in the change process.

Change must create something that did not exist before, namely a 'learning organization' capable of adapting to a changing competitive environment. One must also learn how to monitor and modify the new behaviour to maintain the change sensitive environment.

Some people will, of course, find great difficulty in accepting the changes, and perhaps will be incapable of doing so, in spite of all the direction, support, and peer pressure brought about by the process alignment. There will come a time to replace those managers and staff who cannot function in the new organization, after they have had a good opportunity to make changes. These decisions are of course never

easy, especially where valuable technical skills are owned by the people who have difficulty working in the new participatory, process-driven organization.

When people begin to understand what kind of manager and employee the new organization needs, and this often develops slowly and from experience of seeing individuals succeed and fail, they should begin to accept the need to replace or move people to other parts of the organization.

5.3 Summary

Senior management may begin the task of process alignment through seven steps to a self-reinforcing cycle of commitment, communication and culture change. The first three steps are gain commitment to change, develop a shared mission or vision of the business or desired change, and define the measurable objectives. The remaining four steps comprise developing the mission into CSFs; understanding the key or critical processes and gaining ownership; breaking down the critical processes into sub-processes, activities and tasks; monitoring and adjusting the process into sub-processes, activities and tasks, and monitoring and adjusting the process alignment in response to difficulties in the change process.

5.4 Conclusion

Managers must understand and pursue never-ending improvement. This should cover planning and operating processes, providing inputs, evaluating outputs, examining performance and modifying processes and their inputs. There are three basic principles of continuous improvement: focusing on the customer, understanding the process and seeing that all employees are committed to quality. In the model for TQM the customer-supplier chains form the core, which is surrounded by the hard management necessities of a good quality system, tools and teamwork.

5.5 Hypothesis

There must be different ways to implement Total Quality Management and there must be steps that can be used to implement Total Quality Management because it is not a system that can be implemented overnight. It will take time to implement the system.

This chapter shows that there are steps to be followed to implement a TQM system. The original hypothesis is therefore proved correct.

CHAPTER 6

SUMMARY AND CONCLUSIONS

6.1 Background

Total quality management: what is it and how can it be implemented in roads construction?

The construction industry has been slow to implement Total Quality Management probably due to the age of the industry and the reluctance to change old management techniques. Projects are getting bigger and more complex while clients are demanding higher standards of quality of the end product. A lot of time, money and resources are wasted on construction projects as a result of poor quality management.

It is important for construction companies to provide consistent value and quality to the products that they construct to remain competitive in today's construction environment.

The cost of construction is ever increasing and it makes sense to try and save as much money as possible. A lot of money is lost not just during the construction period but also after the project is completed because of latent defects, which stem from poor construction practices. Latent defects are also bad for the company's image and it is very important to maintain a good company image.

It is time for construction companies to develop better and more direct relationships with employers, to initiate more teamwork at the jobsite, and to produce better quality work. Such goals demand that a continuous improvement process be

established within the company in order to provide quality management. This continuous improvement process is referred to as Total Quality Management.

Total Quality Management can briefly be described, as a management style that tries to incorporate all of organizations functions to meet the client's needs as well as the organizations objectives and to deliver a quality end product to the client. Total Quality Management empowers employees in an organization with the responsibility of ensuring quality in their tasks and duties. Employees that are empowered range from the labourers on site to the directors. Total quality management is dependent on people, so it is not a system that a company can purchase.

Seven steps are identified that can be used to implement a TQM system. These steps are listed below.

- Step 1: Gain commitment to change through the organization of the top team.
- Step 2: Develop a shared 'mission' or vision of the business or of what change is required.
- Step 3: Define the measurable objectives, which must be agreed by the team, as being quantifiable indicators of success in terms of the mission.
- Step 4: Develop the mission into its critical success factors (CSFs) to coerce and move it forward.
- Step 5: Break down the critical success factors into the key or critical processes and gain process ownership.
- Step 6: Break down the critical processes into sub-processes, activities and tasks and form improvement teams around these.
- Step 7: Monitor and adjust the process alignment in response to difficulties in the change process.

6.2 Summary

This research report answers the question that the main problem poses by defining total quality management and identifying areas in roads construction where it can be implemented and how it can be implemented. It also identifies how total quality management can be used to save on time, money and resources that are wasted on road construction projects due to poor quality control during and after construction.

This research report consists of six chapters, where sections 2-5 deal with the sub problems. The chapters include:

1. Introduction
2. What are the benefits of total quality management?
3. Difficulties and Resistance to total quality management in construction companies, what are the causes?
4. Training and the people side of total quality management.
5. How can total quality management be implemented in a roads construction company?
6. Conclusion

6.3 Conclusion

There are a number of issues that affect the implementation of a successful TQM system. If a TQM system is selected by management to be used as a management tool then it should be thoroughly thought through before it is implemented. The TQM system should also be continuously monitored to remain effective.

Training forms a very important, if not the most important part of a TQM system. Everyone in a construction company has to be trained. The lower the level of

education a person has will determine the amount of training that the person will require. The general labourers, foremen and supervisors will be the most difficult to train in most cases. They will offer the most resistance to change.

Managers must understand and pursue never-ending improvement. This should cover planning and operating processes, providing inputs, evaluating outputs, examining performance and modifying processes and their inputs. There are three basic principles of continuous improvement: focusing on the customer, understanding the process and seeing that all employees are committed to quality. In the model for TQM the customer-supplier chains form the core, which is surrounded by the hard management necessities of a good quality system, tools and teamwork.

Total quality management philosophy extends beyond management systems related to the production process. It embraces the philosophy, principles, processes, practices and procedures necessary for providing customer satisfaction as well as achieving significant improvements in productivity and business performance. Commitment and perseverance from senior management and all employees is necessary when embarking on the quality journey. Contractors must realize that results will not happen overnight; it will take time for the organization to adapt, change and learn.

The original hypothesis of the main problem is: Total Quality Management is a management tool that can be used by the management team of a construction company to increase the standard of quality of construction projects. It has to be implemented throughout the entire company and monitored on a continuous basis to remain effective and to be beneficial to the company.

This research report proved the hypothesis correct.

6.4 Suggestions for further research

There are more frameworks that can be used to implement TQM that can be researched.

BIBLIOGRAPHY

AHMED, S. M. (2000) Measurement of construction processes for continuous improvement. *Revised final report to the State of Florida*. Department of Community Affairs.

BIGGAR, J. (1990) Total quality management in construction. *Transactions of the American Association of Cost Engineering*, 14, 1-4.

CHUNG, H. W. (1999) *Understanding quality assurance management in construction: a practical guide to ISO 9000 for contractors*, London, Spon.

DRUCKER, P. (1993) *Managing the Future: 1990s and beyond*, Plume.

DYER, C. G. (1982) *Road Construction Technology in South Africa*, Cape Town, Juta & Co.

FRYER, B. (1990) *The practice of construction management*, Oxford, BSP Professional Books.

LUNA, A. L. (1998) Problems with TQM are firm-based. *Business First*. Louisville.

MENON, H. G. (c1992) *TQM in new product manufacturing*, New York, McGraw-Hill.

METRI, B. A. (2005) TQM critical success factors for construction firms. *Management*, 10, 61-72.

OAKLAND, J. S. (2000) *Total quality management: text with cases*, Oxford; Boston, Butterworth-Heinemann.

PHENG, L. & TEO, J. (2004) Implementation of Total Quality Management in Construction Firms. *Journal of Management in Engineering*, 20.

Quality (business). (2010) *Wikipedia, The Free Encyclopedia*. Internet:
www.wikipedia.org Access: 15 April 2010

SHEAD, M. (2010) The Definition of Management. Internet:
<http://leadership501.com/definition-of-management/21/> Access: 21 April 2010