PROJECT TITLE:
QUALITY MANAGEMENT: A CHALLENGE FOR THE KENYAN CONSTRUCTION INDUSTRY

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A Project paper in part-fulfilment of the requirements of the award of the degree of Master of Arts (Construction Management), University of Nairobi, Department of Building Economics and Management.
DECLARATION

The Project is my original work and has not been presented in any University

DINDE M A

This Project paper has been submitted for the examination with my approval as a University supervisor

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ABSTRACT

Increasing degree of competition on several fronts of business aspects has caused the management of organisations to think of ways of increasing their competitiveness in the market place. Of these adjustment techniques that have been applied in coping with these developments, the concept of quality has been used in the management of organisations with a view to maintaining customers on a long-term basis. Organisations have therefore turned their attention to managing for quality. Managing for quality has required the organisations to rely on the basic tenets and philosophy of Quality Management that have been postulated in the discipline of Total Quality management.

Total Quality Management techniques have been used extensively and beneficially in the areas of Manufacturing and Industrial engineering processes to control processes and prevent defects before they occur, ultimately saving millions of shillings. The purpose of this research paper is to find out how far concepts of Quality Management are applied in the Construction Industry in Kenya. The objective is to find out the extent of awareness of participants in the Construction Industry of Quality Management techniques. The study examines how the principles of customer satisfaction, defects prevention and continuous improvement are practised if at all in the Construction Industry in Kenya.

The literature reviews the term Quality and the development of Total Quality Management. It also covers some typical concepts of Total Quality Management as proposed by various schools of thought: Juran, Deming, and Crosby, which are later, used to develop the Theoretical Framework. The literature focuses as well, on how these theories apply in the Construction context.

The findings of the study from five typical case studies are that Quality Management concepts are not known let alone practised. The most used forms of Quality Control are supervisions and inspections.

The research concludes that Quality Management on sites does exist but in the very traditional form. Few people understand the concept of Quality Management as applied in Manufacturing and many believe Quality is unattainable without inspections and supervisions. The conclusion is that the human factor plays a significant role in achieving quality.
The recommends the starting point to achieving quality as the human element i.e. workers, supervisors, designers and even clients themselves. There is need of ingraining into people the fact that it is possible to do work right the first time even without supervision.

With that recommendation, the study ends with possible further areas of further research.
CHAPTER ONE

1.0.0 Introduction

The products of construction are expensive, complex, immovable and long-lived. They seldom offer scope for repetition, they have to be built where they are needed, and if not built or designed correctly, there's usually little that can be done to rectify things at a later stage.

In an article in the Nation Newspapers about ideas on building or renovating a home (Saturday magazine, March 29- April 4 2003 by Carol Mandi) the author points out that most people will only build or buy one home in their lifetime. If they don't get it right the first time, they will not have another opportunity to make it good. Quality must be assured in the first place. This is the best remedy and one that is readily and freely available within the industry.

Unlike other industries, the potential purchaser in the Construction Industry cannot examine the finished product before committing himself to buy. This means that should there be defects, the purchaser would be in no position to refuse the product since he has already committed himself to buy. To overcome these difficulties, procurement systems have evolved to facilitate the formal commitments, which are necessary, before work can proceed. The contract defines what is to be built, terms of engagement between the parties involved, their roles and provides the framework of quality assurance.

Many authors have defined quality in different ways.

- **Taylor (1989)** says that BS 4778: Part 1 defines 'quality' in clause 3.1 as: "The totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs".

- **Mitra (1998)** defines quality as the fitness of a product or service for meeting or exceeding its intended use as required by the customer.

- **Ashford (1989)** defines quality as the concepts of compliance with a defined requirement, of value for money, of fitness for purpose or customer satisfaction.

Thus, quality then can be said to be a summation of all those characteristics, which together make a product acceptable for its intended use or market.
A quality system on the other hand comprises the management processes and resources assembled and implemented to achieve the organisation's quality policy, (Ashford 1989). A quality system will have collective plans, activities, and events that are provided to ensure that a product, process or service will satisfy given needs.

One of the main purposes of a quality system is to ensure that the supplier satisfies a purchaser's requirements. To achieve this, a quality system for procurement will provide for the following:

1. Precise definitions of the client's requirements
2. Selection of potential suppliers who can demonstrate both the means and the will to meet the requirements
3. Surveillance of work in progress
4. Verification that the built products or services are in conformance with the specified requirements.

This is a conventional system for assuring customer satisfaction and compliance with specification and can only partially satisfy requirements for a quality system. Traditional quality control techniques like inspection and supervision seem to be unable to ensure construction firms a competitive position in the emerging international market with the fierce competition and demanding customers (Ashford 1989).

Ashford (1989) states: "the existing quality system is a system founded at a time when few skills were needed and (...) much of the work depended upon brawn and endurance rather than brainpower, and when empirical design methods used allowed ample margins for error". In other words, despite this system of quality control, there are serious problems regarding quality that still emerge.

We have inherited this system, yet today's circumstances are very different. It is not surprising then that the Construction Industry should have a reputation for low quality. Change is overdue.
1.1.0 Statement of the Problem

The introduction of quality management to a construction site is a uniquely formidable task, but it would not make sense to ignore it all together.

The Construction Industry in Kenya is frequently in the limelight for its poor quality of products. All too many buildings and roads fail to satisfy the legitimate requirements of their users. In the year 2000, Kenya emerged second last in trade competitiveness in the study conducted by the World Economic Forum. One of the reasons for this was the quality of roads, for which, Kenya ranked last. (Nation Newspapers, Business News July 20, 2000). In 1999, manufacturers in Nairobi's Industrial area were reported to be losing 50% of business because of the rundown infrastructure (Special report Nation Newspapers, October 17, 1999). These are just but a few reported cases. The record is not one of which any manager should feel proud. There are faults in concept, design, materials and workmanship, but especially workmanship. Just through observation one is able to discern how bad the roads are. In Nairobi for instance, whenever it rains, there is always a snarl-up of vehicles caused by the general panic of motorists since the roads become impassable due to poor drainage and potholes. As one writer puts it:

"Although Kenya has one of the most impressive road networks in East Africa, the deteriorating condition of this network because of poor maintenance is one of the serious constraints to overall country development... The roads are full of potholes of all sizes and are generally in poor state of repair both in Urban and Rural areas" (I alukhanhaa et al, 1998)

In 1986, a supermarket collapsed killing fourteen people. There was a major outcry in the country. Professionals came up with all possible causes of failure; Initial design, workmanship, rotting of timber members and so on and so forth. In a letter to 'Architecture' the Journal for the Architectural Association of Kenya (Vol. 19 No.3, 1996) one Engineer stated: “If you look at the way standards are adhered to in Europe and elsewhere, ours is one big joke. And yet, we pride ourselves at having qualified Architects, Engineers and Planners. ...

Although the blame for this problem lies with all participants in the industry, greater proportion of the blame is usually apportioned to the contractors for lack of proper workmanship. This is due to the fact that the contractor is responsible for the means, methods, techniques, sequences and procedures of construction.
In a construction project, the success of a project is determined by the relationship between the following three variables:

- Time
- Cost
- Quality

Many scholars have done research on the effects of time and cost overruns on projects; their causes and what can be done to reduce overruns. Mbatha (1986) states that the majority of building contracts in Kenya suffer cost and time overruns. Talukhaha (1999) points out that construction projects in Kenya experience time and cost overruns, falling quality standards and increased litigation.

While acknowledging that cost and time are important in ensuring the success of a project, quality of the project is just as important especially in this era of globalisation where competition is rife and the client is more aware about what to expect in a construction project. Quality in this case means the totality of features and characteristics of the product that bears on its ability to perform its intended function.

According to a research done by Omufira, A (2001) there is poor implementation of Quality in Construction due to:

- Unclear and poor communication between the different parties
- Non involvement of workers in setting goals related to their work
- Lack of motivation among workers due to non involvement in decision making
- A lack of understanding among the parties of what quality really implies

The main problem is that in spite of Quality Control measures in-built in the process of Construction, there are still cases of poor product quality in the Construction Industry in Kenya.

The concept of Quality Control and Assurance as a management tool in construction is relatively new and hence there is little research on the subject in Kenya. For many years, the Construction Industry has been criticised for its perceived inability to innovate and its slow adaptation of new technology and modern management methods (Palmer, 1997). If the industry has to progress issues such as Quality Management have to be addressed.
Time, cost and quality are always related and are the three criteria on which the success of a project is judged. Thus, research in the area of Quality Management will be very helpful to the industry as a whole. The study addresses Quality during construction process and not in design and seeks to establish the reasons why quality of performance fails despite adherence to the standards. The study will also find out the factors that influence Quality Management in Construction, the level of awareness of participants in the Construction Industry of the importance of Quality Management practice and its level of development in Construction.

1.2.0 Objectives of the Study

The main purpose of this study is to find out how the variables of Customer satisfaction, Communication, Defects prevention and Continuous improvement are used as indicators of quality in Construction in Kenya, if at all. The specific objectives are:

1. To develop a theoretical framework for Quality Management within which the Construction Industry in Kenya can operate and that can be a basis for future investigation of the topic.
2. To identify factors which pose a challenge to Management of Quality currently in use in the Construction Projects in Kenya.
3. To evaluate the level of participants' awareness to the importance of concepts of Quality Management in the Construction in Kenya.

1.3.0 Research Question

What are the factors that affect quality management in construction projects and how can they be resolved?
### 1.4.0 Operational definition of terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td><strong>Purchaser</strong></td>
<td>The developer of construction products. The purchaser is also known as the client, customer or user.</td>
</tr>
<tr>
<td><strong>Supplier</strong></td>
<td>The one who provides construction products/services to the client.</td>
</tr>
<tr>
<td><strong>Customer</strong></td>
<td>All those who are affected by the organization's work.</td>
</tr>
<tr>
<td><strong>Customer satisfaction</strong></td>
<td>The level to which a product meets customer's expectation.</td>
</tr>
<tr>
<td><strong>Quality Management</strong></td>
<td>A management approach that places emphasis on continuous process, system improvement and customer satisfaction to achieve quality.</td>
</tr>
<tr>
<td><strong>Total Quality Management</strong></td>
<td>It is a way of managing to improve the effectiveness, flexibility and the competitiveness of the business as a whole.</td>
</tr>
<tr>
<td><strong>Specification</strong></td>
<td>A set of conditions or requirements, of specific and limited application, that provides a detailed description of the procedure, process, material, product or service for use in construction.</td>
</tr>
<tr>
<td><strong>Standard</strong></td>
<td>A prescribed set of conditions and requirements, of general or broad application, established by authority, to be satisfied by a material or product. For instance British Standards (BS), Kenya Bureau of Standards (KBS).</td>
</tr>
<tr>
<td><strong>Defects</strong></td>
<td>A quality characteristic that does not meet certain standards or that does not satisfy the client.</td>
</tr>
<tr>
<td><strong>Quality Management System</strong></td>
<td>A management approach incorporating Quality standards, Quality Control, Quality Assurance.</td>
</tr>
<tr>
<td><strong>Quality Control</strong></td>
<td>It refers to the use of specifications and inspections of completed products to improve quality.</td>
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1.5.0 Assumptions

The study does not dwell too much on quality of design and conformance this is because the case studies selected include parties of repute and good standing thus it is assumed that quality of design and conformance is achieved.

1.6.0 Scope of the Study

Quality Management in Construction can be practiced at two levels (as stated in section 2.7.5.2) namely: the Organisation level and the Project Level. Quality at the organisation level sets organisation-wide quality policy procedures in construction firms, while at the project level it is to each different project. Because of time constraints, this study limits itself to the project level and is based on case studies. A case study was preferred to other forms of research design due to the ability to do an in-depth study of the particular case, which would prove difficult if a sample population was used.

The main concepts used in this research relate to Total Quality Management. Since TQM is managing the effectiveness, flexibility and competitiveness of a business as a whole, this study adopts the usage of Quality Management without the word 'total' since it will only focus on quality management of the process in order to produce a final product and not on the business as a whole.

The study is also limited to Building and Construction Projects only and not Civil engineering projects mainly due time and the fact that the researcher has working experience in Building and not Civil Engineering projects.

Theoretically the study focuses on Quality Management models as practiced in Manufacturing Industry and their application in Construction including the level of awareness of various participants of these issues.
Chapter one includes the statement of the problem, the study objectives, research question and scope of study.

Chapter two is the theoretical framework and literature review. It dwells on the term Quality, its evolution and some schools of thought on Quality Management. It also reviews Quality Management as applied to the Construction Industry.

Chapter three is the research methodology and research design.

Chapter four includes data collection and analysis. The data has been analysed to reveal if the existing quality system is appropriate for the construction industry. Chapter five contains the conclusions and recommendations.

1.7.0 Significance of the study

The practice Quality Management is important in ensuring a product is acceptable to the market. Thus products/services, which are lacking in quality, will in the long term prove unmarketable and so the need to promote and control quality is of fundamental importance to any enterprise but more so, the construction industry.

It is hoped that this research in Quality Management will develop awareness to the importance of this concept in improving quality of Construction Projects amongst stakeholders in the Construction Industry, to appreciate its usefulness and thus adopt modern methods in Quality Management.

The practice of Quality Management in construction will contribute in eliminating costs, delays, waste, aggravation and disruption brought about by failure to do things right the first time. The results achieved in this research can be used to give recommendation to professional bodies on how to include quality systems as part of a contract with the client.
The research will also contribute to the increase of knowledge in this area. This will be good not only to the University for teaching and for practice but also to the Industry as a whole and will be a lee way for many other researches to be carried out in this area.

References:


    new Delhi.

CHAPTER TWO: LITERATURE REVIEW AND THE THEORETICAL FRAMEWORK

2.0.0 Introduction

The concept of Quality is one that poses many difficulties in defining. There are many authors who view quality in different terms. One may even go further and say that Quality is subjective because what one party may consider satisfactory may not be so with regards to another. We must therefore attempt to define Quality and have a common understanding on what the term means.

The concepts dealt with in this chapter are derived from Quality Management theory. The theory emphasizes those tenets of Quality Management used in the Manufacturing Industry that are relevant to construction projects. The main concepts reviewed are:

Quality, which will assist in understanding the meaning of quality. Unless an organization is aware of the importance of Quality, they cannot know that it is lacking.

Total Quality Management (TQM) will help in the understanding of the concept of continuous improvement of Quality at all stages. The factors affecting TQM implementation are important in looking for attributes in organizations that can make Quality Management work. The literature will also relate to what has been done so far in this field in connection with the construction industry, which will help the researcher to develop a suitable conceptual model that can be applied in construction.

2.0.1 QUALITY

Quality can be defined as the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs. The push for higher quality appears to be customer driven. Customers are now demanding higher performance requirements, faster product development, higher technology levels, materials and processes pushed to the limit, lower contractor profit margins, fewer defects and so on.
Quality can take many forms, quality of design, quality of conformance, and quality of performance. **Quality of design** means that the product has been designed to successfully fill a consumer need, real or perceived. Mitra (1998) explains that quality of design deals with the stringent conditions that the product or service must minimally possess to satisfy the requirements of the customer. He implies that the product or service must be designed to meet at least minimally the needs of the consumer. For instance, a house that provides shelter, as long as it provides shelter it meets the quality of design, however, a house has many other functions apart from providing shelter and it has to fulfill these functions as well.

**Quality of conformance** refers to the manufacture of the product or the provision of the service that meets the specific requirements by the consumer. It is concerned with the degree to which quality is controlled from the procurement of raw material to shipment of finished goods. It consists of the three broad areas of defect prevention, defect finding and defect analysis and rectification. In construction the Architect and Structural Engineers do this through inspections during the normal course of construction.

**Quality of performance** means that the product or service performs its intended function as identified by the consumer. It measures the degree to which the product or service satisfies the customer. Now this is where most construction projects go wrong. Sometimes the project may satisfy quality of design and conformance but somehow the client may not be satisfied with the finished product. This shows that there exists a loophole somewhere. If the quality of design and quality of conformance are satisfactory, what makes the quality of performance unsatisfactory?

Design incorporates the wishes of the client converting them into drawings, while construction converts the designer's concepts into the actual product. It is thus expected that the final product should be what the client had in mind but this is not always the case. This is the reason for examining factors that are necessary for quality management.

### 2.0.2 Principles of good quality

1. Clients come first
2. Quality design, quality control and quality improvement form the three sides of the quality triangle and are equally important. Quality design sets objectives, allocates
resources and establishes guidelines to ensure effectiveness. Quality control monitors program activities and staff performance, while Quality improvement seeks to keep raising the level of performance.

3. Strengthen systems and processes. Thinking of an organization as a network of interdependent systems and processes can help improve quality.

4. Everyone contributes. Good quality happens when every staff member at every level believes that quality is important and takes responsibility for it. Quality is not just for top management alone or for workers to ‘put’ into products and in Construction it is not the problem of the contractor alone, all participants should be in charge.

5. Every program can improve quality. No matter what its scale, budget or cultural setting, every program can take steps towards better quality. Improvements can be simple and inexpensive.

Making quality a top priority can require changes in goals, guidelines, attitudes and activities that are difficult to make. Commitment and persistence are crucial.

2.0.3 Benefits of good quality

1) Safety and effectiveness both for the client and the workers.
2) Client satisfaction. In construction, it is important that the client be satisfied, since the product is long-lived.
3) Job satisfaction, the supplier is happy because the customer is. The contractor should be happy if the client is happy with the way the project has turned out.
4) Better reputation and competitiveness. This will earn the firm a good name and even more projects in the future.

Where resources are limited, good quality may seem to be an affordable luxury. Quality is determined not only by the resources available, but by how resources are used. Quality attracts revenue; improving quality can attract more clients. Clients will be willing to pay more for good quality services. The researcher had an opportunity to visit a few construction sites in Germany on a study visit. One of the most impressive things observed was that the cost of construction was not as important as the time and quality in which the products would be delivered. The contractor is chosen on the basis of expertise and not on the basis of price.
Having thus looked at what quality is and its principles and benefits, it would be helpful to look at the evolution of quality and how the principle of quality management came into being.

2.1.0 EVOLUTION OF QUALITY MANAGEMENT

Up until the advent of mass production, artisans completed individual products and inspected the quality of their own work or that of an apprentice before providing the product to the customer. In a mass production setting the steps necessary to create a finished product are divided among many individuals who each perform a single repetitive operation. For mass production to work, the different interchangeable parts must be; one, identical and two, have to be produced with minimal variation and within specification. Quality principles evolved to meet those two needs. However as will be seen later in the chapter, Quality principles have evolved through many phases, from inspection to Total Quality Management.

2.1.1 Inspection

As the variety of items being mass-produced grew, so did the need for monitoring the quality of the parts produced by those processes. At first inspection was the primary method of ensuring that a quality product or service was provided.

Inspection refers to those activities designed to detect or find non-conformances existing in already completed products and services. Inspection is mainly a detection of defects, which is a regulatory process.

Inspection occurring only after the part or assembly has been completed can be costly. If a large number of defective products have been produced and the problem has gone unnoticed, then the scrap or rework costs will be high.

2.1.2 Quality control

It refers to the use of specifications and inspections of completed parts, sub-assemblies and products to design, produce, sustain and improve the quality of a product or service. The
construction Industry mostly uses this method. However, quality control goes beyond inspection by:

- Establishing standards for the product or service based on the customer needs, requirements and expectations.
- Ensuring conformance to these standards.
- Taking action if there is a lack of conformance to the standards.
- Implementing plans to prevent future non-conformance.

Quality control efforts can be enhanced by the use of statistics to help with decision-making. The primary concern of people involved in quality is the monitoring and control of variation in the product being produced or service being provided.

2.1.3 Statistical Process Control

This is the use of statistical methods of production monitoring and parts inspection. As the area of quality evolved, it became obvious that there was a need to become more proactive when dealing with quality problems.

Thus the emphasis shifted from utilizing statistical quality control methods for the inspection or detection of poor quality to their use in the prevention of poor quality.

Prevention of defects by application of statistical methods to control the process is known as Statistical Process Control. It emphasizes prevention of defects. By using key indicators of product performance and statistical methods, those monitoring the process are able to identify changes that affect the quality of the product and adjust the process accordingly. To do this, information gained about the process is fed back to those involved in the process. This information is then used to prevent defects from occurring. Thus, emphasis shifts away from inspecting quality into a completed product or service to - making process improvements to design and, manufacture quality into the product or service.

Statistical process control also seeks to limit the variation present in the item being produced or the service being provided. In the study conducted by Arditi (1998), he found that the Statistical Control Process does not have a lot of impact in the Construction Industry. This is because a
building project is not a prototype. It is a single product run. It has unique product location, even housing estates for instance with similar houses will have different positions for drainage connections. These are all factors that will have influences on detail if not on basic design. These factors will produce variety and eliminate the potential for any kind of statistical process control.

2.1.4 Total Quality Management

As the use of statistical process control grew in the 1980's, industry saw the need to monitor and improve the entire system of providing a quality product or service.

"Sensing that meeting customer needs, requirements, and expectations involved more than providing a product or service, industry began to integrate quality into all areas of operation from the receptionist to the sales and billing departments" (Summers & Donna CS, 2000). The philosophy of TQM revolves around building in quality.

TQM is a management approach that places emphasis on continuous process and system improvement as a means of achieving customer satisfaction to ensure long-term company success. It utilizes the strengths and expertise of all employees of a company as well as the statistical problem solving methods. It relies on the participation of all employees of an organization/company to continuously improve the processes, products and services their company provides as well as the culture they work in.

Quality management encourages a long term; never ending commitment to the improvement of the process not a temporary program to be began at one point in time and ended at another. As the Quality theory evolved, many people came up with theories of quality management that could work. Some of them are discussed below.
2.2.0 QUALITY ADVOCATES

There are many quality advocates who have come to light but the main ones who made a lot of impact in the area of Quality Management and are known as the gurus of Quality Management are the following:

2.2.1 Dr Edward Deming

He made it his mission to spread the theory of Quality Management (Oakland 2000). He encouraged top management to get involved in the process of creating an environment that supports continuous improvement.

Dr Deming who described his work as "Management for Quality" felt that the customer is the most critical aspect in the production of a product or the provision of a service. Listening to the voice of the customer and utilizing the information learned to improve products and services is an integral part of his teachings.

His message is aimed primarily at management. Using 14 points as guidelines, Deming's philosophy encourages company leaders to dedicate themselves and their companies to the long-term improvement of the quality of their products or services.

1. Create a constancy of purpose toward improvement of product and service, with the aim to become competitive and to stay in business and to provide jobs.
2. Adopt the new philosophy that rejects "acceptable" quality levels and poor service as a way of life.
3. Cease dependence on inspection to achieve quality.
4. End the practice of awarding business on the basis of price tag alone. Instead minimize total cost.
5. Constantly and forever improve the system of production and service.
6. Institute training on the job.
7. Institute leadership.
8. Drive out fear.
10. Eliminate slogans.
11. Eliminate arbitrary work standards and numerical quotas. Substitute leadership.
12. Remove barriers that rob people of their right to pride of workmanship.
13. Institute a vigorous program of education and self-improvement.
14. Put everybody in the company to work to accomplish the transformation.

Dr Deming encouraged management to create systems that enable people to find joy in their work.

2.2.2 Dr Joseph Juran

Dr Juran’s approach to Quality Management involves:
   i) Creating awareness of the need to improve
   ii) Making quality improvement an integral part of each job
   iii) Providing training methods
   iv) Establishing team problem solving and recognizing results

He emphasizes, the need to improve the entire system.

He developed a trilogy, which makes use of three managerial processes: Quality planning, Quality control, and Quality improvement. By following Dr Juran’s approach, companies can reduce the costs associated with poor quality and remove chronic waste from their organizations.

Quality planning encourages the development of methods to stay in tune with customers’ needs and expectations. Quality control involves comparing products produced with goals and specifications. Quality improvement involves the ongoing process of improvement necessary for the company’s continued success (Summers & Donna C.S 2000).

2.2.3 Philip Crosby

Philip Crosby emphasizes four absolutes to Management. These absolutes set expectations for a continuous improvement process to meet.
The first absolute defines quality as conformance to requirements. Determining customer requirements, defining them as clearly as possible and then producing products or providing services that conform to the requirements as established by the customer.

Prevention of defects, the second absolute, is the key to the system that needs to be in place in order to ensure that the products or services provided by a company meet the requirements of the customer.

The third absolute: zero defects. This is the performance standard against which any system must be judged. It refers to making products correctly the first time with no imperfections.

The fourth absolute, costs of quality are the costs associated with providing customers with a product or service that conforms to their expectations.

In order to quantify the benefits of quality, QM must be measurable. One way of doing this is through Quality costs. Quality costs consist of the cost of prevention, cost of appraisal, and the cost of failure. Prevention costs are those resulting from quality activities used to avoid deviations or errors, while appraisal costs consist of costs incurred from quality activities used to determine whether a product, process or service conforms to established requirements.

Failure costs are those resulting from not meeting the requirements, and can be divided into two aspects: internal and external failure costs. Internal failure costs are those costs incurred on the project site due to scrap, rework, failure analysis, re-inspection, supplier error or price reduction due to non-conformance.

External failure costs are those that are incurred once the project is in the hands of client. They include costs for adjustment of complaints, repairs, handling and replacement of rejected material, workmanship, rectification of defects and so forth.

Crosby identified some erroneous assumptions about Quality and they are:

1) Quality means goodness or luxury or weight. This makes quality a relative term. Only when quality is defined in terms of customer requirements can quality be manageable.
(2) Quality is intangible and therefore cannot be measured. Quality is measured by the cost of doing things wrong. Quality costs involve the cost of failures, rework, scrap, inspection, prevention and loss of customer good will.

(3) There exists 'an economics of quality'. Here one errs in thinking that quality means building luxuries into a product. Rather quality means that it is more economical to do things right the first time.

(4) Cause of quality problems is often blamed on workers. Without the proper tools, equipment, and raw material, workers cannot produce quality products or services.

(5) Quality originates in the quality department. The quality department's responsibility revolved around educating and assisting other departments in monitoring and improving quality.

2.3.0 TOTAL QUALITY MANAGEMENT THEORY

Total Quality Management is a comprehensive approach to improving competitiveness, effectiveness and flexibility through planning, organizing and understanding each activity, and involving each individual at each level.

Total Quality Management ensures that management adopts a strategic overview of quality and focuses on prevention not detection of problems. The impact of TQM on an organization is firstly to ensure that the management adopts a strategic overview of quality. The approach must focus on developing a problem prevention mentality, but it is easy to underestimate the effort required to change attitudes and approaches. "Many people will need to undergo a complete change of mindset to unscramble their intuition, which rushes into the detection/inspection mode to solve quality problems" (Oakland, 2000).

The correct mindset may be achieved by looking at the sort of barriers that exist in key areas. Staff may need to be trained.

The managements of many firms may think that their scale of operation is not sufficiently large, that their resources are too slim or that the need for action is not important enough to justify
implementing TQM. Before arriving at such a conclusion, however, they should examine their existing performance by asking the following questions:

- Is any attempt made to assess the costs arising from errors, defects, waste, customer complaints, lost sale. If so, are these costs minimal or significant?
- Is the standard of management adequate and is an attempt being made to ensure that quality is given proper consideration at design stage?
- Are the organization’s quality systems, documentation, procedures, operations etc in good order?
- Have personnel been trained in how to prevent errors?
- Do job instructions contain the necessary quality elements?
- What is being done to motivate and train employees to do work right first time?
- How many errors and defects and how much wastage, occurred last year? Is this more or less than the previous year?

If satisfactory answers can be given to most of these questions, an organization can be re-assured that it is already well on the way to using adequately quality procedures and management.

2.3.1 Concepts Of Total Quality Management

TQM is mostly a process of creating an environment in which management and workers strive to create constantly improving quality. TQM must not be thought to mean that an organization must seek perfection in all its products and services. Rather it means achieving the highest quality of service and products possible, under circumstances of that organization.

TQM means that the organization’s culture is defined by and supports the constant attainment of customer satisfaction through an integrated system of tools, techniques and training. This involves the continuous improvement of organizational processes, resulting in high quality products and services. TQM is management focused on customer satisfaction. In short, there are three important aspects in TQM:

1. The goal of TQM is customer satisfaction.
2. It must be a total approach to quality.
3. It is ongoing, a continuous process. However good a system is it can always improve further. (Palmer, 1997)

### 2.3.1.1 Customer focus

The idea of customer focus is important because it gives managers a means of providing products and services that meet customer needs. From the point of view of TQM, there are two types of customers: the end user and the internal customer. The idea of the internal customer relates strongly to the idea of business process. As such, the internal customer is the customer of the process or the next person down the chain of production.

The voice of the customer serves as a significant source of information for making improvements to a company's products or services.

### 2.3.1.2 Integration

An organization that is integrated has a single objective and a common culture. Communications are improved and there is respect for the individual and not the department they work in.

### 2.3.1.3 Continuous improvement

It means that even where an organization is profitable, with a high percentage of market shares, it should still look for ways of improving.

Continuous improvement focuses on improving processes to enable companies to give the customer what they want the first time, every time. This customer-focused, process-oriented approach to doing business results in increased satisfaction and delight for both customers and employees. For continuous improvement to successfully take place, the following factors have to be taken into consideration:
Management commitment and involvement

The foundation of continuous improvement is a management philosophy that supports making customer requirements right the first time every time. The strongest continuous improvement processes are the ones that begin with and have genuine involvement of top-level management. Substitutions from lower levels of management will send employees the message that this new effort is not important enough to require the time and commitment of top management.

Motivation and change

Change is a difficult thing to accomplish. It is only when commitment takes form of providing resources and active participation that change begins to occur. Management must visibly support change by doing it themselves.

Deming suggests that motivations for change come from a variety of sources: fear, financial incentive, desire. Continuous Improvement practitioners prefer that it is the latter reason that serves as motivation for change. One powerful source involves listening to employees and their needs and then acting on their concerns. Management needs to create the feeling that each employee’s job is and has an impact on the company’s bottom line. In a continuous improvement process, management must meet the obligations of educating the workforce; supporting innovation and research; and encouraging the improvement of product design, processes and service.

Responsibility and Authority

Assigning responsibility and granting authority is an important aspect of creating a continuous improvement environment. Assigning responsibility removes the “not my job” syndrome. Granting authority enables those with responsibilities to meet them. When employees receive an assignment, they are responsible for getting it done. Responsibility must be given authority as well.
Training and Education

Training refers to being taught to perform a function in order to be qualified to perform that function. Training must be transmitted correctly if customers are to receive what they ordered. Education is focused on developing a person’s level of understanding about a job, task or topic (Summers, 2000 pp 47). Both education and training are important to providing a quality product.

Communication

Without communication, ideas are lost, improvements are not implemented, and the continuous process is stalled. Communication between departments is key to providing the customer with the desired product or service.

Quality in all aspects

It extends to how the receptionist answers a phone, how the product/service is, how courteous sales and repair people are and how managers treat subordinates.

2.3.2 Ingredients for success in implementing TQM

Deming states that TQM cannot be “installed” in an organization the way a carpet is installed in a new house (Williams, 1994). The methods to implement TQM are as varied as the organizations themselves and hinge on experience of the persons involved. There is no standard process for implementing TQM but Williams suggests the following five-step process that has been successful for many organizations.

2.3.2.1 Corporate Culture

Companies seeking to remain competitive in today’s global markets must integrate quality into all aspects of their organization. Successful companies focus on customers, and their needs, requirements and expectations.
A culture in an organization will either accept or reject TQM. The cultural dimension measures eight elements important in support and sustaining a quality movement:

- Measurement for improvement
- Authority equal to responsibility
- Rewards for results
- Team work and cooperation
- Secure jobs
- Fairness
- Pay equity
- Ownership

2.3.2.1 Training

Training is one of the three distinctly separate learning processes used in organizations. The other two are education and development. Training is the process of bringing employees to the desired standard of work performance by instruction and practice. Training can bring great benefits. The actual value of these benefits must depend on how well the training is planned and conducted.

Since TQM has to start at the top, a training process should be conducted for top leadership. Participants can then absorb the potential impact of TQM implementation.

Williams then suggests six elements that training for TQM should include:

- A basic summary of what TQM is, what it will do, what it will not do.
- The purpose and intent of TQM in a service or manufacturing organization.
- Why TQM is important in today’s market place.
- An overview of TQM principles.
- A description of the commitment required from the entire organization to make it work effectively.
- A written statement of the executive group’s vision of what quality should be.
2.3.2.3 Quality Council

The council would consist of participants from all levels of management i.e. top, middle, low level management to hourly employees from all departments.

The council's purpose is to identify any potential barriers that could hamper adoption of TQM and then devise methods of getting rid of the barriers.

The council must be empowered to make changes, sometimes, significant ones to the organization.

2.3.2.4 Information dissemination

The quality council establishes a communications process to disseminate its information. One member of the council is assigned responsibility for ensuring that communications are effective and information reaches all levels of the organization.

Methods of communication that can be used include small employee meetings, memoranda and articles.

2.3.2.5 Integration

The final step is an integration of TQM tools, techniques and training in the organization. Tools are used by management and workers, while techniques are primarily for management, while still training is often intended for workers, it can be beneficial for management as well.

Awareness

Resterfield (1999) argues that an organization will not begin the transformation to TQM until it is aware that the quality of the product or service must be improved. Awareness comes about when an organization loses market share or realizes that quality and productivity go hand in hand. It also occurs if TQM is a better way to run a business and compete in domestic and world markets.
All the foregoing discussions have been based on TQM in the manufacturing Industry. We now turn our attention to the construction Industry to see how these principles can be implemented.

2.4.0 TOTAL QUALITY MANAGEMENT IN CONSTRUCTION

Palmer (1997) tries to compare a house to a car using a case in point where a house owner after purchasing a house and living in it for a short time found 112 faults in spite of having engaged a contractor to finish it. The author poses the question that suppose for a moment the house in question was a car. If it turned out that the car had 112 defects, what would one do? Would one allow the manufacturer to come to the house three or four times in a week for five months to fix it?

Palmer concludes that the problem that faces the construction industry as a whole is one of poor quality culture. The industry may have improved in other aspects such as technology, site management and many other things but in terms of satisfying the customer, the industry has still a lot to do.

Literature shows that many people have attempted to present alternative methods of how the Construction Industry can be better organized but at least one thing they all agree on is that the resources used by the construction industry can be made to perform more effectively. One of the ways in which this can be done is through substantial improvements in quality and efficiency. But by ‘what means?’ Dr Deming was often reputed frequently to present this question to those who wanted to achieve change.

The Construction Industry can learn from the experiences of other industries, particularly the service and manufacturing industries. If the Construction Industry is to achieve the sort of radical improvement that has been produced in these industries, it must be prepared to be committed to five fundamentals to the process (McCabe, 2001).
Committed leadership

There has to be wide spread evidence of burning commitment by leaders to raise quality and efficiency.

- A focus on the customer

There is little systematic research on what the end-user actually wants and little education to users to be more discerning.

- Integrate process and team around the product

There is need to overcome the notion that the industry only deals with a series of sequential and largely separate operations. Changing this culture is fundamental to increasing efficiency and quality in construction.

- A quality driven agenda

Construction must understand what clients may mean by quality.

- Commitment to people

Commitment to people requires that people be recognised as the best assets and to treat them as such. The concepts that underpin TQM and continuous improvement are very similar to the above fundamentals. To demonstrate improvement it is important to use some measures. McCabe (2001) lists the assessment of 'minimum scope for improvement in the performance of the UK construction' as indicated by the Construction Industry Task force.
**Targets for improvement**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Percentage improvement per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital costs (i.e. all costs excluding land and finance)</td>
<td>Reduce by 10%</td>
</tr>
<tr>
<td>Construction time (i.e. time from Client approval to practical completion)</td>
<td>Reduce by 10%</td>
</tr>
<tr>
<td>Predictability (number of projects completed on time and to budget)</td>
<td>Increase by 20%</td>
</tr>
<tr>
<td>Defects (i.e. reduction in number on Handover to client)</td>
<td>Reduce by 20%</td>
</tr>
<tr>
<td>Accidents</td>
<td>Reduce by 20%</td>
</tr>
<tr>
<td>Productivity (i.e. increase in 'value added' Per employee)</td>
<td>Increase by 10%</td>
</tr>
<tr>
<td>Turnover and Profits (i.e. of the construction companies employed to carry out work)</td>
<td>Increase by 10%</td>
</tr>
</tbody>
</table>

2.4.1 Quality in the life cycle of Building Projects

In recent years, considerable attention has been given to improving the quality of the construction process. Much of this attention is caused by the successful application of TQM in manufacturing industry.

The TQM philosophy concentrates on process improvement, customer and supplier involvement, teamwork and training to achieve customer satisfaction, cost-effectiveness, and defect-free
The concept of TQM is considered important in the construction industry especially in developed nations. For example, the National Society of Professional Engineers (NSPE) in USA suggested the adoption of TQM by all construction parties throughout the construction process (Arditi et al. 1998). Also, a taskforce was set up by the American Construction Industry Institute (CII) to conduct a research in the construction industry to identify attributes of quality management organization and techniques that have been considered effective in the construction industry. The task force concluded that an integrated approach of TQM and quality assurance is required to improve the quality of the products and services provided by the construction industry. Before looking at the factors that affect Quality in the Construction Process, let us first look at the Construction Process and the activities that make it up.

2.4.2 The Construction Process

The development of a construction product be it a building or a road follows a course which shows common traits. The building process covers the period from the initiation of the building project until the finished structure is ready for use.

During the process, there occurs a progressive defining of the structure. This follows a well-known course of:

1. Inception
2. Design
3. Tendering
4. Construction

Inception

This is the stage when the client establishes his needs in principle but not in detail and appoints the consultants. During this stage and before appointment of the design team, the client should establish his basic needs in terms of functionality and the quality of his project and the cost as well as time parameters he wishes to set.
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Having set these fundamental requirements, he should determine the strategies he will use to successfully implement the project and on the basis of this appoint an appropriate design team. The decisions taken at this time set the whole tone and pattern for the remainder of the building process.

Design Stage

This stage has various steps namely; briefing, feasibility, outline, scheme and detailed design. In the briefing stage the client considers the necessity to build. He contacts the Architect and presents ideas. He should define preliminary details of project including deadlines and cost.

The architect on the other hand informs other consultants of their job responsibilities, fees, contracts and professional practice. He then obtains general information about possible conditioning parameters and prepares a reunion with the client with every relevant aspect.

At the feasibility stage, the client provides all information required by the architect. This stage also includes analysis of the feasibility report and decision on the evaluation of project. The Architect reviews all data and studies, gathered by other team members and, ensures every relevant information is issued to concerned members.

At the outline proposal the client continues to provide information required by the Architect as well as assist in studies by any team member. He makes decisions on all matters submitted. He then receives the Architect's report and checks consistency with project objectives and makes final decisions to enable carrying of next design phase.

At this stage too, the Architect defines timetables to enable co-ordination between team members. There is a lot of information exchange at this stage concerning space arrangements, building image, circulations and so on.

At the scheme and detailed design, it is important that the client be well informed and makes quick decisions concerning various aspects since it would be hard and costly to implement them later. The Architect on the other hand coordinates all team members making sure that all pending
issues are resolved. He tries to foresee any adjustment of detailing to the proposed project and how it can be adjusted.

**Procurement phase**

Procurement of the contractor presents the owner with a variety of opinions related to both the contract systems employed and methods of procurement. Each variable method has associated predictable risks upon the systems selected and knowledge of the potential related to each system. In the conventional system, for procurement to operate successfully it is imperative that the design is fully developed before tenders are prepared.

Masterman (1992) states that whilst selection of the contractor by limited competitive tendering should offer the assurance of achieving the lowest price for the project, in reality the designer’s drawings are rarely sufficient in detail to enable a Bill of Quantities to be prepared with any accuracy. Where documentation is suspect in this way bids obtained through tendering can only be considered as indicative of the final cost to the client.

**Construction Phase**

When using the conventional system of procurement, an adequate period should be allowed for the contractor to plan the project thoroughly and organize required resources.

The management and supervision of the work on site, to ensure that it conforms to client’s brief as reflected in the design, specification and contract conditions is the responsibility of the design team, although it should be remembered that under normal terms of engagement they are not required to carry out full-time supervision of the works which is usually an additional service provided by a resident architect, engineer and/or clerk of works whose services are provided at an extra cost.

Quality management in construction involves the establishment of management information systems, which identify the item source, quantify the cost potential, and provide clear lines of authority and accountable responsibility. The management systems should include the following features necessary to analyse risk liability potential and manage quality during construction:

- Recognition of what exposure is involved
- Quantification of what is at stake
- Identification of who has the power to control outcome
- Determination of who should assume responsibility

2.4.3 Factors that affect Quality in the Construction Process

The generally accepted factors that affect quality are well defined and thoroughly described in literature. They are top involvement enhanced by top management support, teamwork, communication, training, and quality improvement teams.

Establishing project requirements for quality begins at project inception. A careful balance is essential; between the owner’s requirements of the project’s costs and schedule, desired operating characteristics, materials of construction and the design professional’s need for adequate time and budget to meet these requirements against economic considerations and in some cases, against chance of failure.

The design professional strives to satisfy the owner’s needs but also is obliged to protect the public health and safety in the context of the final completed project. The contractor is responsible for the means, methods, techniques, sequences, and procedures of construction, as well as safety precautions and programs during the construction process.

In the study research conducted by Arditi and Murat (1998) the following factors were studied and ranked according to their importance in design and construction:

2.4.3.1 Design Phase

Project specifications were found to be very important. Definitions should be clear and consistent with the requirements and perceived same by all parties. In case of change, the specifications should be updated thoroughly and promptly for all parties.

Each project is unique, and therefore the selection of an appropriate design firm for a project may contribute to the quality. Here, factors like the design firm’s experience; capabilities, workload, expertise and financial stability may play a significant role.
Designer's experience may become the most effective problem-solving tool for constructability and prevention tool against reworks and errors.

Communication with the owner in the design phase has to be handled carefully. The main purpose of communication with the owner is not for the owner to only define the project requirements but also to transmit those requirements effectively to other parties involved in the process. It also involves the other parties briefing the owner and extracting from the owner relevant information that is necessary for high quality design and construction (Arditi et al., 1998).

Constructability is one major factor that affects the quality of design. The design professional must consider the requirements of the constructor. The project must be constructible by those retained to build the project. Designs have to be reviewed for effectiveness and compatibility with local requirements, including both the initial construction and the post construction operations.

### 2.4.3.2 Construction Phase

From the subcontractor's point of view, lack of information and overlapping activities, which are common on the site, may result in reworks, high costs, and low quality performance (Arditi et al.).

Selection of the contractor was found to be very important in achieving high quality performance. The contractor’s expertise, technical staff, financial situation, equipment ownership, workload and reputation may directly affect quality of the project. Selection of an inadequate contractor to execute the work will only multiply the problems encountered on the project.

Findings of the study indicated that the quality of drawings and specifications received from the designer affect the quality in the design and construction phases and consequently the quality of the constructed facility.

### 2.4.3.3 Operation phase

The operation of the building should be addressed early in the design phase and be planned according to the owner's requirements.
2.4.4 Generic factors affecting quality in Construction

Several factors may affect the quality of the building process. Management commitment and leadership, training, teamwork, statistical methods, and supplier involvement/customer service are the generally accepted factors that are effective in achieving high process quality. However, in the building project, the process is complex and specific factors may contribute more or less than others to the level of the quality in each phase.

Management participation in promoting quality issues is very important in every phase of the building process. Management committed to continuous quality improvement and management leadership in promoting high process quality are of the utmost importance. Higher management must actively participate in the implementation of quality-enhancing measures and be committed fully to improving quality on a continuous basis.

The TQM theory should be expanded on in detail to make quality an integral part of the construction industry. Quality in training should be taught to students who will become future professionals.

At corporate level, efficient teamwork to improve quality appears to be of importance. Costly reworks, design changes, constructability problems and frequent change orders during construction phase can be minimised by the efficient cooperation and effective coordination of the design professionals in the design phase.

According to a research carried out by Abdel-Ra'ezek, (1998) various factors of quality improvement were identified. The factors were then grouped into four major categories that are important to the construction industry. They are:

1. Improvement of employee satisfaction

One of the most important aspects of TQM as a philosophy of business management is to focus more on employee's improvement and participation. It encourages the delegation of responsibility and authority to the lowest levels possible through employee involvement, participation and empowerment to make decisions.
2. Improvement of training and learning

The need to be properly trained, to improve current training to learn and gain modern experience was well recognised in the project.

3. Improvement of company processes and regulations

In the research, several factors fall under this. For instance, lack of liquidity was cited as a cause of poor quality.

4. Improvement of Quality systems

Making improvements in the high priority factors taking steps to eliminate the sources of problems in each identified area and taking steps to fulfil the project manager’s needs and overcome weakness should make it possible to achieve progressively better quality.

2.5.0 CONSTRUCTION CONTRACTS AS QUALITY SYSTEMS

A quality system incorporates both quality assurance and quality control. According to the International Standard Quality Vocabulary (ISO 8402), Quality assurance is defined as the collective term for planned, formalized activities intended to provide confidence that the output will meet required quality levels.

Quality Control on the other hand is the collective term for in-process activities and techniques intended to create specific quality characteristics. They include monitoring, reduction of variation, elimination of known causes and efforts to increase economic effectiveness.

The aim of a quality system is to ensure that the facility’s product or service generically referred to as output meets the customer’s requirements. As mentioned in chapter one section 1.0, to achieve this a quality system in procurement, the process may provide for:
1. Precise definition of purchaser's requirements
2. Selection of potential supplier's who can demonstrate both the means and the will to meet the requirements
3. Mechanism for surveillance of work in progress
4. Verification at source or after receipt that the purchased products or services are in conformance with the specified requirements

How then does the traditional arrangements for procuring construction work satisfy these criteria? In the following four steps, the author shows how various activities are planned and formalized in order to provide confidence that the output will meet required quality levels. In other words, the four stages show construction contracts as quality models.

2.5.1 Definition of Purchaser's requirements

The specifications and drawings incorporated in construction contracts have details that are subject to practical limitations. The designer must sometimes rely on the contractor to interpret what is needed. From the client's point of view, this may not lead to ultimate satisfaction.

Traditionally various strategies have been used to ensure Quality at the definition stage and they include:

- Choice of the design team which most of the time depends on previous work relationship or recommendation from someone who has worked with the particular design team and is convinced they can deliver
- Constant communication between the designers and the client to ensure that all requirements are incorporated.
- Approval of every stage of drawings

The formal approval provides some satisfactory outcome. If a client were to realise that the designer failed to provide for his requirements there are very few practical remedies to the situation. This is indicative of a defective quality system.
2.5.2 Supplier selection

The trend nowadays is towards an extension of the principle of competition in the selection of all participants in the construction process, moderated by a more intensive examination of the quality systems of potential contenders before commitment to contract.

Competition is meant to ensure that the Client gets value for money. Traditionally the client did not have to ask for tenders from Consultants. This was because it was assumed that all Consultants having received the same training are likely to provide the same quality of service. However what we see today is that even professional services are being tendered for and this competition gives the consumer of these services some confidence that the products will be of quality as they choose the best there is.

Competition also ensures that the Consultant or contractor is not complacent with merely performing but performing well because this may earn them their next project.

2.5.3 Surveillance and verification

Surveillance and verification in construction mainly includes inspection and tests. Inspection involves mainly activities by either the Architect or Engineer, to check whether the products produced are to conformance or if they are defective. After inspection is done a list is made of defective items that need to be rectified or work that needs to be re-done.

Inspection therefore gives the contractors a feeling that it is a detection of defects more than control of quality and this has many at times given rise to cases of cheating.

The surveillance and verification done on site is not very effective and is far from failure proof. In practice, neither professional designers nor contractors provide much documentary or other evidence of compliance with specification.

The conventional system can thus only partially satisfy requirements for a quality system and this calls for action. How the contractor, subcontractor, or department gets the job done is their own business and is irrelevant as long as they meet their "contractual" commitments.
Summary

The foregoing literature has attempted to capture the concepts of Quality and Quality Management and their application in construction. In the chapter, we have looked at what quality is, its benefits and principles and how it has evolved through the years.

The literature has also dealt with Quality advocates and their schools of thought, which have a significant bearing on the study. Having looked at the theories as applied in manufacturing, the literature has also pointed out their relevance to construction.

From all of the above therefore, what can be concluded is that there is need for continuous improvement. That in order to remain competitive, companies need to seek out wasteful processes and improve them, with the aim of preventing defects and making products right the first time.

At this stage therefore, there is need to develop a conceptual model framework, which would be suitable for the Construction Industry taking into consideration, its characteristics and organization.
2.6.0 THEORETICAL FRAMEWORK

Introduction

The concept of Quality Management has its origin in the manufacturing industries. The literature reviewed has touched on three models, that of Deming, Juran and Crosby.

The works by the three authors refer mainly to Quality Management in the Manufacturing Industry. These findings may not be of direct application to Construction and there may be need to adapt them to Construction.

2.6.1 Characteristics of the Construction Industry

The Construction Industry is characterised by a number of elements, which differentiate it from other industries like manufacturing.

Zantanidis (1998) groups these characteristics into 5: Products, technology and organization, product market and competition structures, capital market, labour market and environmental effects. A short discussion on the characteristics follows:

2.6.1.1 Products

- The products are unique, custom made and not easily substitutable goods, built to specifications provided from the customer. Thus even if standard designs are used, details have to be frequently modified to satisfy site, regulatory or client requirements.
- They are provided on location of consumption, which means they are immobile/fixed thus even when quality assured components are used, once brought on the building site they are likely to be handled, stored, assembled and installed under adverse weather and other conditions.
- They have a long life span, which means that defects may not even be detected early enough until they have been used.
- Even as they decay, they can still be used. Buildings/roads are fortunately not 'life threatening' when they have defects as for instance a car. Thus, even with defects, they
can still be used and immediate need of rectification of defects may not be seen. This gives users a lax attitude towards defects since the defects can always be rectified later unlike a manufactured good that may not be used in the first place if it is defective.

These characteristics therefore render Quality Management implementation difficult in Construction as opposed to Manufacturing.

2.6.1.2 Technological/organizational characteristics

- Machine and equipment are moved regularly from one site to another.
- Labour intensity is high while capital intensity is low and consequently labour productivity is low.
- The industry itself is one of the most territorially dispersed.

The technological characteristics therefore make Quality management somewhat different from manufacturing where there's constancy.

2.6.1.3 Product market

- The relationship between a construction firm and its customer is one of executor and instructor so the contractor may hardly take initiative to implement quality in a project before checking with the client.
- There is separation of product design and construction. Design work is split between different practitioners and will more or less be completed before the producer of the product in this case the builder is chosen. This breaks the continuous improvement.
- A construction firm has to sell something, which has yet to come into existence, often under conditions that are partly beyond its control. The client on the other hand buys something, which he is not sure, will turn out the way he wants.
- Competition is based more on price and less on quality and time-span of delivery.
- Quality control is necessary but difficult. Fierce competition has forced contractors to occasionally use cheaper and lower quality building materials. When defects are discovered, remedial work is unlikely to be easy for several reasons; it may be difficult to determine the cause of failure, and a wrong diagnosis could well aggravate the problem.
2.6.1.4 Capital Market

- Construction products tend to be very expensive goods and therefore it is rare that they are paid for in cash. They have to be financed.
- Interest rates and more general developments on capital markets are major factors influencing demand for construction products.

2.6.1.5 Labour Market

- There's high mobility of labour due to on-site production
- There's wide use of subcontractors so the responsibility for quality is split between the many contractors.

Construction workers move from site to site and many change employers from one job to the next. Type of work also changes as well as the size of workforce and skills required from it. Employer relations change as do the quality of inspection, supervision and expertise, thus the level of work quality required from an individual operative is unlikely to be defined clearly.

2.6.1.6 Environmental effect

- Products are directly connected with the location where they are produced. Buildings are mostly one-off products erected on a piece of ground, which has unique features and may vary every few metres.

All of the above characteristics render Quality Management hard to implement and complex whereas it is very straightforward in Manufacturing. In Manufacturing, one chooses a product off the shelf whereas in construction this is not possible.

2.6.2 Quality Management Models in relation to Construction

Quality Management has been used extensively and beneficially in the areas of manufacturing to prevent defects before they happen thus saving millions of shillings. The Construction Industry can use the same concepts but due to the dissimilarities that exist between the two industries, it cannot apply them as they have been used in the manufacturing. They have to be adapted to suit
the unique characteristics of the construction industry. The following is a brief discussion of the approaches by Juran, Deming and Crosby as relates to construction.

2.6.2.1 Deming

Listening to the voice of the customer and utilizing the information learnt to improve products and services is an integral part of his teachings. He developed 14-point guidelines of which only four will be discussed.

Cease dependence on inspection to achieve quality. Supervision and inspection on construction sites are not usually systematic. Site testing of work in progress is rarely undertaken except when substandard work is discovered and when it is, rectification is likely to be costly and building completion delayed.

For Quality to be assured without Inspection in construction, it would require that owners, designers, engineers and builders must effectively communicate and work together to achieve high level of project quality.

Another way that ceasing dependence on inspection may achieve quality in construction is by instilling work ethics into contracts. Like Deming states “create a system where people find joy in their work”

End the practice of awarding business on basis of price tag alone. The Construction Industry still has a long way to go as regards award of tenders to the lowest bidder. Until the stakeholders realise that quality in the long run will save more costs than just going for the cheapest, this principle will take some time to make any impact on the industry.

It may help to compile data at the end of projects on cost of reworks, cost of rectification of defects and so on. A Professional body such as KABCEC then compiles this data so that on selection of contractors price and these costs form the basis for selection. These costs would be an indicator of how the firm is trying to maintain quality.
Institute training on the job. Training on the job is meant to contribute to cost savings in companies which have endorsed IQM. Training in construction need not just be on construction related activities only; Construction firms need to train their employees on the latest technology in the industry. In a survey conducted by Leslie Lehnert (1999), she found that there is a significant lag between technology being available and technology being taught in curriculum, and another lag between what is taught in curriculum to that knowledge prevailing in the industry. Therefore having better trained personnel is a legitimate need to applying this technology to the betterment of the industry.

Breakdown barriers between departments- The problem with the construction industry is that it has diverse parties taking part in a project. In traditional systems of procurement, each party is his own boss, therefore making it difficult for barriers not to exist.

2.6.2 Dr Juran

Juran’s approach involves

- Creating awareness of the need to improve
- Making quality improvement an integral part of each job
- Establish problem solving among others. He makes use of three managerial processes: Quality planning, Quality control and Quality improvement.

In a construction firm, there are two levels at which to consider development and implementation of QM: the organization level and project level (Zantanidis et al: 1998). The first level sets organization wide quality policy procedures while the second level focuses on implementing the applicable elements of the Quality system to each different project.

Dr Juran’s philosophy can work at the organization level in construction firms. Making quality improvement an integral part of each job, each job here is referring to different projects. At the project level, this could be achieved at each phase of construction. Quality control can include feedback from the client and using that information to improve the next phase. By constantly trying to improve quality, waste is reduced and thus costs. One advantage we could say, construction has over manufacturing is that products are not mass-produced and even where they
are, the client has a chance of choosing from a sample before it is fixed. This ensures that the client is satisfied at every step.

2.6.2.3 Crosby

Crosby emphasizes four absolutes to management:

a) Conformance to requirements. All parties in construction have to be responsible for quality. As much as a lot of emphasis lies on the contractor to achieve quality, the client must also realize that their clear instructions and definitions on what they want is important in achieving quality. There must therefore be a close link between the client and the rest of the team. Conformance to requirements can be achieved through sampling, consultative meetings and so on.

b) The second absolute: Prevention of defects. Even though this may be difficult due to the unique nature of construction products, it cannot be ignored altogether. What the stakeholders in the industry must try to do is minimize defects using targets for improvement as mentioned in section 2.4.0. For instance reduce the number of defects on handover to client by say 20%, increase number of projects completed on time and to budget by 20%, reduce quality costs by 10%. These are the measurable indicators of quality. It can be achieved both at the organizational level and project level.

c) The third absolute: zero defects. Is this possible in construction? One may ask. The construction industry has reached a stage where it needs to undergo a paradigm shift. Paradigms refer to the ways of thinking and acting that are characteristic of a body of knowledge, (Palmer, 1998). It is recognized that the existing paradigm is no longer adequate to meet the needs of a competitive and global construction industry and that it must change. For there to be zero defects the Construction Industry may have to abandon some ways of thinking and acting for instance, traditional methods of procurement. We may have to start using standardized products in a design-build-manage environment. This way defects even if not zero, will be greatly reduced.

d) The fourth absolute: costs of quality. Do construction firms in fact compile quality costs? Many firms may not adopt quality programs thinking that higher quality means higher cost, or cost of improving quality is less than the resulting savings. However, the quality
Management approach is that quality costs are viewed as those incurred in excess of those that would have been incurred if the product were built right the first time.

2.6.3 Summary of the three major approaches

Quality improvement was the focus of all the three models. In summary, certain aspects come out very clearly.

1. Customer satisfaction is very important and this comes about through conformance to specifications.
2. Communication between the different parties is equally important.
3. Defect prevention rather than rectification
4. Continuous improvement of product through training etc

Only Crosby comes up with zero defects as a principle of quality improvement.

2.6.4 AN INTEGRATED QUALITY MANAGEMENT MODEL FOR CONSTRUCTION

Quality management may seem a very straightforward concept. However, applying it in an industry that has always “excused” itself for having unique characteristics may be difficult. Therefore when applying these concepts those characteristics have been taken into consideration.

The Researcher proposes an integrated approach of quality management, which will give rise to a theoretical framework that integrates the salient features of the three schools of thought.

From the three advocates of Quality Management, we can make out a quality system comprising of three elements:

1. Quality Standards
2. Quality Control
3. Quality Assurance
Quality Standards

These are the expected levels of quality. Activities that would set quality standards include the following:

- Creating awareness and an environment of continuous improvement as proposed by Deming.
- Quality planning for instance encouraging methods to stay in tune with customer needs and expectations as proposed by Juran. This will include activities such as consultations at each stage, bringing suppliers in and workers early in the process, establishing cause of design errors, breaking down the project into lower level quality actions and so on.
- Top management involvement in setting expectations for continuous improved as stated by Crosby.

Quality Control

Quality control is comparing products with the goals and specification. This will include:

- Comparing time each activity has taken in the Work Breakdown Structures (WBS) with the work program
- Establishing cause of deviations and correcting them, for instance defective materials
- Making sure that products inspected conform to specifications and if not what were the causes of deviations, then working at eliminating them in the next phase
- Consulting with the relevant parties on what is expected.
- Zero defects of Crosby. Doing things right the first time.

Quality Assurance

These are planned or formalized activities that will provide confidence that product will meet required quality levels. These activities will include:

- Ceasing dependence on inspection to achieve quality
- On going process of improvement using target performance for instance reducing the number of defects by a certain percentage by the date of handing over, reducing costs of quality by certain percentage
- Training workers in up-to-date techniques
- Asking for information feedback from client on level of satisfaction and areas of improvement.
- Finding out how to curb root causes of problems
- Including quality as one of the criteria for selection of Contractors for instance, a letter of recommendation on quality satisfaction from former client.

In order for these activities to take place, there is need for constant communication between those three phases and information feedback such that all the three processes are always going on at any one time.
Legend:

- Communication
- Information Feedback

Figure 1: Integrated Quality Management Model for Construction

Source: Own Survey 2004. (Adopted from Juran, Crosby and Deming)
This is simply guidance at what may work for construction industry. However there is an urgent need for a cultural shift from the 'old ways' to new ways of managing projects. Quality management requires a paradigm shift in order to be successfully implemented and that needs a cultural shift. For instance the following:

1. Meeting specification to- continuous improvement. Meeting specification is building to the details that have been provided. Take for instance 5mm thick opaque glass in Metal putty. The contractor may conform to specification by providing opaque glass, but unless he provides the client with the available samples, the client will never be satisfied. Thus as part of continuous improvement the contractor needs to always provide samples, even for what the architect has specified. As one client put it: "You never know how it will turn out until it has been fixed."

2. Complete on time to- satisfy customer. Most contractors are always in a hurry to finish work mainly due to the penalty of liquidated damages that is attached to non-completion on time. This however needs to shift to taking time to satisfy customers. Even if the works takes time to complete but it is done well, the contractor is likely to save more money than if he hurries.

3. Focus on final product to- focus on process. Focusing on final product instead of the process may render the final product unacceptable. In an isolated case, the contractor was to make a concrete altar. To the contractor, the important thing was that the altar be concreted and cladded with marble. However, he did not pay attention to the process and as a result, the altar was indeed finished but its height was short by 50mm. This was not the only problem, the top of the altar had been cast before finishing the back and since the altar was 80mm from the wall, he could not finish the back with marble as there was no way to get behind the altar. These problems should have been foreseen had the contractor paid attention to this whole process. The result was of course obvious, he had to re-do the altar, as the client could not have it that way, especially when it was very clear in the drawings. This meant removing the top marble slab, recasting the altar and finding some way to finish the back. It cost both money and time.

4. Inspection based quality to- prevention based quality. This is where a cultural shift is needed and not only that but behavioural change as well. A system would have to be developed so that construction workers take it upon themselves to work well without supervision or being coerced. One of Deming's 14 points comes across clearly: create systems that enable people to find joy in the work. This may be by rewarding them not financially but by certificates of merit or longer work contracts.
5. Minimum cost suppliers to quality suppliers and minimum cost contractors to quality contractors. Sometimes going for the cheapest is not always cheap. It may end up being more expensive than if one had gone for a slightly more expensive contractor but one whose quality is assured.

A quality system states Ashford (1989), has to achieve two objectives: First it has to control what is produced to make sure it meets the requirements of the purchaser and, secondly it has to provide confidence or assurance that compliance has been achieved. The above-integrated model meets these two requirements and thus we could say that it is a proper quality system.
References:


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CHAPTER THREE

3.0.0 RESEARCH DESIGN AND METHODOLOGY

3.1.0 Methodology

The main purpose of the study was to find out if Quality Management concepts are practiced in the Construction Industry in Kenya. It was therefore a descriptive assessment research.

The study conformed to ethical standards and legal safeguards for research participants. Information relating to quality is normally very sensitive especially as concerns contractors and thus they were assured that the information was for purposes of research only and would be treated with confidentiality.

The study concentrated on quality performance at the Project level, which meant at specific sites. To find out factors that impact on Quality Management it was necessary to interview several contractors on different sites plus some designers and clients.

3.2.0 Research Design

This is a case study based on five projects studied. The aim of the case studies was to analyse the data collected in order to come to some useful conclusions and recommendations. A case study was preferred to other designs because it provides an in-depth analysis into the issues being studied and one is able to identify specific characteristics in a case to study that is typical of other cases.

The study utilised survey and descriptive designs.

3.3.0 Population and Sampling design

The five cases chosen for the study were chosen conveniently on the premise that based on the information being sought any project could do just as well. Other factors such as experience of the contractors and designers, location of the project and accessibility to the client were considered in choosing these sites. For the purposes of this study, data was collected from on-
going construction projects in order to identify those factors that the contractors had to deal with on site. Since this is a case study, the five projects were simply chosen in order to give greater credibility to the case study as one would have worked as well.

**Sample**

No sampling was done. It was a skewed selection of five building projects. The skewing was done on the basis and consideration of the following factors:

1. **Accessibility** - the five building projects were all within Nairobi but in the outskirts of the City Centre, thus they were easy to spot and to get to.
2. **Nearness to researcher** - the researcher had to choose projects that were near the Central Business District to save on travelling time and expenses.
3. **Size and complexity of the project** - the projects varied both in size and complexity. This variation was required in order to assess if size and complexity had anything to do with Quality.

**Independent Variable**

An independent variable is defined as a variable whose available categories are designated in advance by the researcher. Normally these variables are selected because they are seen to be causative or very important to the particular logical purpose of the research project. The term independent means that the categories of the variables are chosen by the researcher independently of the measurement taken in the project and normally prior to it. (Francis, 1979)

In this study, the nature and characteristics of construction projects were viewed as the independent variable. Such factors include labour intensity, cause of failures, separation between product design and construction.
Dependent Variable

Dependent variables are so named because their results are presumed to depend upon differences in the independent variable. The variation in them is seen as being related to, caused by, or in some way influenced by differences in the independent variable. (Francis, 1979)

Quality of performance of the product and customer satisfaction were viewed as the dependent variable because they should vary in some relationship to the independent variable.

Intervening Variables

These are factors, which influence the way the independent variable acts upon the dependent variable.

Experience of the Contractor, Size and nature of the Project, were viewed as intervening variables because their effect would influence the relationship between the characteristics of a construction project and the quality of performance of the product and thus customer satisfaction. Experience of the contractor is indicated through the Ministry of Public Works rating, size and nature of project are indicated by the size of the project in financial terms and whether the project is an extension, refurbishment of existing or new works.

Null Hypothesis

The null hypothesis is a statistical statement, a mathematical representation of the condition expected when no factors other than chance are operating to influence the relationship between two events or entities.

3.4.0 Data collection methods

The study was a descriptive survey study. Data was collected using questionnaires, interviews and through observation. Effect of construction project characteristics (that is, product, technological, environmental and labour market) was measured by studying the specific
characteristics of each project and the quality actions that are undertaken under each project to ensure quality of performance.

Quality of performance was measured through surrogate indicators by finding out if the products are fully performing the functions for which they were intended or otherwise. Customer satisfaction was investigated by finding out from various clients how far the intended product satisfies the functions for which they were intended.

Intervening variables were also determined to find out their contribution to quality of performance.

3.5.0 Data Analysis

Data was analysed and presented in form of tables, i.e. charts and figures. Since this qualitative study, descriptive analysis was mostly used to make inferences.

3.6.0 Long Range Consequences

As a consequence of this study on Quality Management in the Construction Industry in Kenya, useful information was gathered for all those concerned with Quality Management in Construction. For instance designers, contractors, clients, standardisation bodies such as the Kenya Bureau of Standards and the society at large.

Certainly, the doubts concerning quality management of construction projects can be mitigated to some extent by findings of the study. From an institutional point of view, a study of this nature will provide guidelines for those considering the implementation of Quality Management Programmes in their firms.
References:


CHAPTER FOUR

4.0.0 DATA COLLECTION, PRESENTATION AND ANALYSIS

4.1.0 DATA COLLECTION

4.1.1 Introduction

The data collected includes that from questionnaires administered to Contractors, Developers, Site Agents and Foremen, Architects and a limited number of Quantity Surveyors.

The questionnaires are supplemented by interviews held with the above named parties and site observations.

Five Construction sites were selected as case studies for the research. They were selected on the premise that they are typical of construction projects and thus the findings can be related to other projects. Four parties were interviewed on each site to find out if they address the issues of Customer satisfaction, Communication, Defects prevention and continuous improvement in Quality Management. These were:

- The Client- four of these were corporate clients while one was a private developer
- The Main Contractor
- The Site Agent/Clerk of works
- The Architect

The main reason for interviewing the client was to find out what their perception of Quality Management is and the level of expectation on their part from other parties and whether they were satisfied with the products or not.

The Contractor is the main person who is in charge of construction on site and so a questionnaire was administered to him as well. These were supplemented by interviews to find out the challenges they experience in delivery of quality construction products.

The site agent and clerk of works were interviewed, as they are the main people who supervise workers on site to find out the challenges they face.
The Architects were interviewed in order to establish design factors that affect Quality in construction.

Apart from the above, an interview was also carried out in a construction firm that mainly specialises in the manufacturing of steel components and products. This firm has a Quality Control department from which valuable information was obtained.

4.1.2 RESPONSE TO THE QUESTIONNAIRES

The response to the questionnaires was quite positive. All the questionnaires to the Clients were filled in and answered and three of the clients gave an interview. The Contractors all answered their questionnaires apart from one who went back to his home of origin and did not leave the questionnaire. 100% response and more was obtained from the Site Agents and clerk of works. However, only three Architects out of five agreed to answer, others claimed to be busy. The Researcher then supplemented the two vacancies with the same questionnaires to Quantity Surveyors as independent observers. These responses are the ones that were used in the analysis of data.

4.2.0 DATA PRESENTATION AND ANALYSIS

Descriptive analysis has been used with some of the data being presented in form of tables showing broad percentages and ratios and by way of describing the responses to various questionnaires.

The results obtained are then analysed to give a basis for drawing up conclusions.

4.2.1 Response from the Customers/ Clients/ Developers

The developers were asked questions and interviewed with the purpose of finding out what in their opinion constitutes a quality product and therefore what their expectations are. This was to help the researcher determine what customer satisfaction constitutes.
**TABLE 4.1: CHARACTERISTICS THAT MAKE A QUALITY PRODUCT**

The table indicates the responses obtained from the clients' questionnaires.

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>RESPONSE (out of 5)</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Defect free</td>
<td>4</td>
<td>80</td>
</tr>
<tr>
<td>2. Aesthetics</td>
<td>2</td>
<td>40</td>
</tr>
<tr>
<td>3. Functional</td>
<td>4</td>
<td>80</td>
</tr>
<tr>
<td>4. Cheap</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>5. Proper Finishes</td>
<td>4</td>
<td>80</td>
</tr>
</tbody>
</table>

**SOURCE:** Own Field Survey 2004

From the above table, one can conclude that the three important characteristics that make up a quality product are that it has to be:

1. Defect free
2. Functional
3. With finishes done well

This tallies well with the definition of quality in chapter one: a summation of all those characteristics, which together make a product acceptable for its intended use or market. Only one client thought that cheap was also an important characteristic, however they clarified that this should not be confused with value for money. The client deserves to get value for his money no matter what amount he is paying for the product. Few however were of the opinion that aesthetics had anything to do with quality. One could have a very beautiful building but non functional and of what use would its beauty be then?

After establishing these characteristics, the clients then were asked what in their opinion were the reasons that cause unsatisfactory construction products. This question was asked to try and establish what clients think are the main causes of defects. 80% of the respondents agreed that
unclear specifications and lack of proper supervision were the major causes of unsatisfactory products. The next inline was poor workmanship and in the last place defective materials.

One client however was of the opinion that the issue of specifications does not come in at all. The specifications, he argued, are in part, a creation of the client himself. If the client has specified to the consultants what he wants and they comply, he does not see why there should arise a problem later.

Other factors that hinder achievement of quality products were found to be poor workmanship, poor quality of details/drawings and carelessness of workers on site implying lack of supervision. Contrary to belief weather conditions does not contribute to poor quality of construction products. It was argued that the weather (especially) in Kenya is predictable and thus contractors should know when to carry out work and when not to. 60% of the clients, said they in no way hindered the achievement of a quality product while the remaining 40% admitted that sometimes clients do contribute to the poor quality of products especially by not making decisions on time and also wanting to pay less for better products forcing the contractor to use substandard materials.

And this poor quality is manifested in many ways in a building but to sum it up, it is mainly through non functional aspects such as leaking roofs, peeling paint, uneven finishes, to aspects caused due to use of substandard materials such as warping ceilings, shrinking timber and so on.

And what help can the design team especially the Architect offer? This question was testing the clients on what they think can prevent defects even before they occur. All the clients agreed on the fact that the most important thing is to get approvals from the client on time. This facilitates work and prevents re-works. It also helps the contractor to carry out the work in a given order and to follow his work programme. Other important factors are communication and experience of contractors. Communication plays an important role in attaining a quality product. Communication between the architect and other consultants and they with the contractor assists the contractor to sequence his work properly without having to wait endlessly for a decision from the consultants.

More hours of supervision by the consultants was not thought to be very effective, as their work cannot entail in camping on the site. On the contractors side however the clients responded that employing a qualified and capable site agent who will constantly supervise the works is a sure
way to achieving quality. Constantly assessing what is being done, the contractor will be able to curb mistakes before they occur or rectify errors before it is too late. One client responded by saying that if workers are motivated then they will work well and so avoid many errors out of carelessness.

Other contributory factors include suppliers and workers. The suppliers have to be quality driven and their materials have to be guaranteed while the workers have to be qualified.

In the study, clients were asked on what basis they selected their contractors. The table below shows their response:

**TABLE 4.2: BASIS FOR SELECTING CONTRACTORS**

The aim of asking the clients the basis for selection of contractors was to judge whether clients take into consideration the quality aspect or they are only interested in the price.

Scale: 1-most important, 5-least important

<table>
<thead>
<tr>
<th>BASIS</th>
<th>RESPONSE PER CLIENT</th>
<th>weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>2 1 5 3 4 15</td>
<td></td>
</tr>
<tr>
<td>Previous performance</td>
<td>1 2 2 4 1 10</td>
<td></td>
</tr>
<tr>
<td>Quality</td>
<td>3 3 1 1 2 10</td>
<td></td>
</tr>
<tr>
<td>Delivery time</td>
<td>4 5 3 2 3 17</td>
<td></td>
</tr>
<tr>
<td>Market Name &amp; reputation</td>
<td>5 4 4 5 5 23</td>
<td></td>
</tr>
</tbody>
</table>

Source: Own Field Survey 2004

From the table above, the weighting shows that Previous performance and Quality are the most important factors that client look at when choosing a contractor followed by price and delivery.
time. Contrary to popular belief and practice, the client does not look at the price first. This however is most common in privately sponsored projects and not public ones where accountability demands that the lowest price be selected. Apart from the above, the researcher also found out that what some clients do is to carry out an industry check on the contractors to establish the performance of the contractor and other details.

Other clients however felt that previous performance comprises price, quality and delivery time so that when carrying out an industrial check on previous performance the three factors should automatically be included.

Quality management theory advocates for every one being responsible for quality from top management to the tea girl. Thus the clients were asked who they thought should be responsible for maintaining quality on site. Two of the respondents said all parties are responsible, from the client to the contractor while the rest said both the architect and contractor should be responsible for the quality. To be able to learn from their mistakes, the contractors should evaluate performance and set new improvement targets, but for this to be done they need feedback from the client. The respondents affirmed that they always give information feedback to both designers and contractors on the performance of the project and not only at the end of the project but throughout the project life.

Information feedback assists in the continuous improvement process because then the contractor / designer knows what to improve on. Apart from that, there is also training workers in quality issues. 100% of the respondents thought this a very important factor, in fact the most important. There was a general implication that workers know very little regarding quality issues and not just workers alone but the contractors themselves. The other important factor is learning from experience/ Like one respondent put it: “training is very important but experience is everything”. However not a single respondent thought that there was any hope of achieving quality without inspection on site. Inspection has just got to be there. Another factor that was suggested was for contractors to set individual objectives for workers and pay them for performance of those targets achieved. These would likely cause an improvement in Quality.

So, clients agree that it is most important to have Quality Management on Site for the following reasons:

* In order to monitor achievement of set standards
4.2.2 Response from Contractors

Out of the five sites selected as case studies, two were being done by the same contractor but different personnel. Three out of five contractors answered their questionnaires. The other two did not respond as one went back to India with the questionnaire and the other wanted the Architect to answer on his behalf which would have been biased thus this questionnaire has not been used in the analysis. To supplement these two however, the researcher chose to administer questionnaires to other contractors who did not form part of the case studies since questions are general.

Apart from the Main Contractors, interviews were also conducted with site agents of the various sites and thus sufficient information was gathered about the site activities.

All the contractors interviewed fall in Class A of registration under the Ministry of Roads and Public works. 90% of the firms have more than 40 employees and the works were mostly new works although two sites were extending existing office blocks. None of the case studies was a refurbishment of existing premises. In financial terms, the projects were all above Kshs 100 million except for one where the cost was less than Kshs 20 million.

One of the aims of the study was to find out if the contractors know the value of quality. The following table below depicts their response:
The Contractors were asked the meaning of quality. This was important in establishing if they value quality in construction. X stands for affirmation.

<table>
<thead>
<tr>
<th>Meaning</th>
<th>Respondent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Fitness for Purpose</td>
<td>x</td>
</tr>
<tr>
<td>Value for Money</td>
<td>-</td>
</tr>
<tr>
<td>Cheap and affordable</td>
<td>-</td>
</tr>
<tr>
<td>Customer satisfaction</td>
<td>x</td>
</tr>
<tr>
<td>All of the above</td>
<td>-</td>
</tr>
</tbody>
</table>

From the table above it is clear what contractors think Quality is. All the contractors responded that quality has to involve customer satisfaction. However about only 60% and 40% respectively included value for money and fitness of purpose respectively. What they all agree however is that cheap and affordable does not equate to quality. So, so long as the customer is satisfied that is what matters.

100% of the Contractors affirmed that Quality Control is necessary to have in the firms. Various reasons were given for this. Some of them are mentioned below:

1. Quality Control will translate into customer satisfaction, which will earn the firm a good reputation.
2. To ensure standards and specifications are met
3. In order to maintain quality levels

In order to ensure that their services or products satisfy the customer, contractors resort to the following methods:
The above responses show that employees' decisions are not thought important in improving quality on site. Although the above response shows that training of employees is important, contractors do not often train their employees. One said they train them whenever necessary, two said once in a year, one did not respond while the other said that they are trained on project basis. Thus, employees are hardly involved in decision-making.

In a separate interview with one contractor, whose firm has obtained the ISO certification the researcher learnt that training on quality issues has to be organisation based. In that firm for instance, training begins from the top level and is submitted down the managerial line up to the operations level.

As was discussed in literature review, employee empowerment is important in continuous improvement. It seems like we are a long way from achieving it. Only one contractor affirmed that employee satisfaction would lead to improved quality. In order to motivate these employees, most contractors rely on bonuses for target achievements. That is, workers are paid per piece of work. The more work they do and the better the more bonuses they get. The contractors concurred on the fact that permanent employment for workers would not assist in improving quality because workers prefer to work on labour contracts.

As for suppliers selection on the following factors were considered very important:

1. Quality
2. Previous Performance
3. Delivery time

The quality of materials supplied affects the quality of the final product and eventually the quality of performance. Thus, a contractor has to choose suppliers wisely. Their delivery time
also affects not only quality of the works but also production. When material supply is delayed, work is either done in hurry or the contractor is forced to do the activity that is next in line in the work break down structure while awaiting materials for the previous one and that may need re-doing once materials are delivered thus affecting quality, for instance, tiling before roofing.

Continuous Improvement

In order to improve quality in an Organization, several factors contribute towards it. 100% of the contractors responded that they are taking team approach to achieving quality. However, from the other choices, only 20% affirm that they are empowering and delegating authority to employees. And only 40% affirm that they are trying to improve company processes and regulations. These responses show a contradiction and that most contractors are not sure what team approach really means.

However, most contractors know that there are benefits that come from implementation of quality assurance and these are:

i) Client satisfaction
ii) Improved production
iii) Better chances of getting jobs

Most of the respondents did not seem to think that improved profits can be a benefit of implementing quality which shows that quality is very much still equated to higher costs. But this can be explained by the fact that none of the contractors whatsoever keeps a record of quality costs that is, costs of preventing and rectifying defects.

Three of the contractors said they do not have a company quality manual. One said they provide samples, which the Architects approve or reject while the other said that they use manuals provided by multinationals or banks, that is, the client. We can conclude from this that Quality Management at the organization level of the firms is limited if any. At the project level, there is some Quality Management.
All the contractors interviewed when asked if they plan for Quality said yes. However, the researcher did not come across any quality plan in any of the sites. Quality plans are derived from specifications and monitor each step of construction, characteristics to be checked and action to be taken.

Moving on to the causes of quality problems in Construction the following were the responses. The table below shows the responses from the contractors on what are the most common causes of quality problems. The aim of establishing the cause of quality problems from the Contractors was to identify barriers to Quality achievement.

**TABLE 4.4: CAUSES OF QUALITY PROBLEMS**

Ranking: 1-most important 5-least important

<table>
<thead>
<tr>
<th>CAUSE</th>
<th>RESPONDENTS' RANKING</th>
<th>TOTAL (Divide by 5)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>Design Faults</td>
<td>5 5 5 5 5</td>
<td>5</td>
</tr>
<tr>
<td>Workmanship</td>
<td>2 1 3 3 2</td>
<td>2.2</td>
</tr>
<tr>
<td>Materials</td>
<td>4 2 4 4 4</td>
<td>3.6</td>
</tr>
<tr>
<td>Carelessness</td>
<td>3 3 2 2 3</td>
<td>2.6</td>
</tr>
<tr>
<td>Lack of supervision</td>
<td>1 4 1 1 1</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Source: Own Field Survey 2004

From the above table, we see that Quality problems arise (starting with the most common) due to:

a) Lack of supervision
b) Workmanship
c) Carelessness
d) Materials
e) Design faults
According to the contractors, design faults and materials do not contribute towards quality problems. Design faults if there were any would mostly be detected before construction begins even by the contractor himself. Materials also are not likely, as the suppliers have to give a guarantee that their materials meet required standards. So, the major problem goes back to the workers. It is either through carelessness; poor workmanship or merely negligence that causes problems and this is if there is no proper supervision. One has to keep an eye on them all the time. These problems come about especially when the workers are inexperienced and this is common in construction because workers move from site to site and they may not have the experience needed in a project.

Apart from workers, the other major barrier to achieving quality is lack of experience in quality management. All the contractors admitted that little is known about quality management especially in construction. In fact, one contractor was positive that the term quality simply does not exist in construction. Communication was the other barrier. Communication especially between the Contractor and the consultants and amongst the consultants themselves is very important in achieving quality. This is because it brings about efficiency in carrying out tasks and limits re-works. The respondents thought that bureaucracy, unfair competition and high interest rates were not relevant to quality.

To overcome these two major barriers i.e. lack of knowledge on quality issues and communication, they suggested the following:

a) Improved management practices
b) Information feedback and communication especially from the client and consultants

The following factors were considered important in improving Quality:

1. Setting new improvement targets- Very important
2. Improved training and learning- Very important
3. Selection criteria- Important
4. Cease dependence on inspection- Not important

Inspection and supervision are here with us to stay and for long. Very long.
The table below shows the response of the contractors to factors that impact on Quality achievement. This question was asked to gauge where the contractors place the blame for lack of quality achievement.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials</td>
<td>80%</td>
</tr>
<tr>
<td>Site Factors</td>
<td>20%</td>
</tr>
<tr>
<td>Workers</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: Own Field Survey 2004

Most contractors responded that site factors have little impact on quality. A contractor should still be able to achieve quality in spite of difficult site conditions. What site factors does affect is construction time and cost. But related to this is site management, the better the site management, the better the quality of work done. Some reasons why quality of product might not be to required standard are: Shifting client expectations and nature of construction as such. Shifting client expectations means that clients keep changing their requirements, goals and minds as construction goes on making it difficult for the contractor. Nature of construction is in so far as production is concerned. The products cannot be mass produced, they are exposed to extreme temperatures and vary due to site conditions so while it may be possible to achieve quality in one site, the same contractor may find it hard to achieve it the same in a different site.

So, is it possible to achieve zero defects in construction? the contractors were asked. NO. Not in Kenya, not at the moment anyway. Some of the reasons given for this were:

1. Nature of construction projects is unpredictable
2. Weather conditions
3. Materials
4. Level of supervision
5. Workers
The above question was asked to see if contractors believe that it is actually possible to work towards defects prevention rather than rectification and in the end achieve continuous improvement.

The Construction Industry is an assembly Industry and this means that quality depends on very many parties not just on the contractor alone and other external factors as well. Unless all these conditions work together unto the good, defects will always be there. This however does not mean that there cannot be a marked improvement but all parties on their part have to implement it.

Apart from the questionnaires, the contractors were also interviewed to find out if they normally go back to the client to ask for a feedback on how their projects are performing. This was to find out if they are at all interested in customer satisfaction. 100% said they don’t because the clients are the ones who come back to them to tell them to rectify defects.

4.2.3 Response from site agents

These people supervise the actual work going on, on site. The site agents were interviewed on their experience in handling workers and how to achieve quality. In this category too are included the foremen and clerk of works.

The foremen were asked the most common quality problems they encounter on site. The following were their responses:

i) Lack of clear communication between Architect and Engineer

ii) Misinterpretation of drawings by workers

iii) Low quality of raw materials like ballast/sand

iv) Workmen’s experience

v) Lack of proper supervision

vi) Unskilled workers

It may be that the question was not very clear but from the above one can deduce that these are causes of quality problems and not quality problems themselves. When asked what were the major causes of these problems, the following were mentioned:
The question on causes of quality problems was asked here too in order to see if the answers tally with what the contractors answered.

<table>
<thead>
<tr>
<th>Cause</th>
<th>Importance per respondent</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inexperienced workers</td>
<td>5 2 6 2</td>
<td>2.5</td>
</tr>
<tr>
<td>Lack of proper supervision</td>
<td>1 6 3 1</td>
<td>1.6</td>
</tr>
<tr>
<td>Poor materials</td>
<td>3 4 2 4</td>
<td>2.1</td>
</tr>
<tr>
<td>Design errors</td>
<td>4 1 1 6</td>
<td>2.0</td>
</tr>
<tr>
<td>Carelessness of workers</td>
<td>2 3 5 3</td>
<td>2.1</td>
</tr>
<tr>
<td>Poor preparation</td>
<td>6 5 4 5</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Source: Own Field Survey 2004

From the above table, lack of proper supervision seems to be the predominant cause of Quality problems followed by design errors. In the third place is carelessness of workers and poor materials. The rest don't seem to be major causes. One site agent said that the question of inexperienced workers is highly unlikely as all the workers who perform different trades are experienced. This answer differs with what the contractors said about workers being inexperienced.

In order to combat the quality problems, site agents use the following methods to achieve quality:

1. Supervision
2. Inspections
3. Tests

All the three were mentioned as important. However, one site agent stated that sometimes to make workers work well there has to be cordial relations between the workers and the foreman. But supervision is mandatory if quality is to be achieved. This response shows that Inspection is
still heavily relied upon as a means of achieving quality which implies that continuous improvement is therefore far from being achieved.

Factors affecting quality of construction on site

Unlike popular belief, site conditions do not really affect quality of work on site. What matters on site is the experience of the site agent followed by quality of materials and in the place experience of the workers and contractor. This takes us back to the issue of supervision on site.

Asked who should be responsible for quality on site, three parties were voted: Contractors, client of works and supervisor. None of the contractors thought that the worker should be held responsible for quality even though most said experience of workers was a major cause affecting quality. This shows that the worker is simply held in the position of an executor. His contribution towards quality is only in so far as his work is concerned and no more. It also implies that there is little team effort in improving quality if any.

The role played by the site agent in quality management on site is crucial and as one designer put it, it all boils down to site management. So when a defect is detected, what action does the site agent take? 100% of the respondents stated that one has to find out the root cause of the problem then take corrective action. If necessary inform the Architect but there is no point in informing the client.

To prevent errors from occurring, it is necessary to have strict supervision according to 3 of the respondents. Two of them thought it important to hold meetings often with workers and educate them on the need to do work right first time. This is likely to achieve better results than reporting to the Architect or the Main Contractor. However, 4 out of 5 site agents admitted that workers do not work well without supervision. This is because they prefer short cuts and since sometimes they are paid per piece of work, they might try to work hurriedly in order to finish and make quick money.

Since workers seem to play an important role at the site, the site agents were asked on what basis workers are selected. 80% said experience, 20% said affordability. Taking all these responses as
still heavily relied upon as a means of achieving quality which implies that continuous improvement is therefore far from being achieved.

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Since workers seem to play an important role at the site, the site agents were asked on what basis workers are selected. 80% said experience, 20% said affordability. Taking all these responses as
genuine, it shows that the major problem lies with the workers and it is not experience as the contractors stated. Quality costs are kept neither by the agents nor by the contractor.

Challenges faced by site agent in ensuring quality

Most of the site agents said that the major challenge is trying to please both the employer (contractor) as well as the workers. Another challenge was the very act of supervision. This skill requires tact since it involves managing human beings. One has got to be patient and understanding with the workers knowing that experience and learning take time.

Specific role played by the site agent in Quality Assurance on site include:

- Checking Quality of Materials brought to site
- Holding meetings with workers and contractors
- Making sure workers follow specifications

4.2.4 Response from Architects

In a preliminary survey, it had been established that design played a crucial role in the final quality of constructed facilities and in their performance. This interview was intended to give an overview of the contribution of design towards quality.

Architects were asked if they always provide all design details required at the time of signing the contract. This is a contributory factor towards defects prevention. The answer was no. And the following were the reasons given:

1. The client never makes decisions early enough
2. The design duration given is always too short
3. Inadequate briefing of the design

Many architects don’t do details until the construction stage due to slow decision-making on the part of the client. When interviewing the clients, some of them had said that slow decision-making on their part will contribute to quality problems. One client however did not agree since
he said that the client should give the Architect detailed briefing and after that, he doesn’t see why decisions should affect anything.

80% of the respondents said that only about 75% of details in the drawings express the intentions of the client at the time of tendering. 20% said it is about 50-75%. All the architects interviewed claimed to have a quality plan. 50% said they always train their personnel in preventing errors. 25% responded that they train whenever error occurs while one said he never trains.

Verbal Instructions, details and drawings are the most common elements of quality issued on site. The majority of the architects interviewed said they visit the site once a week. The architect cannot always be on site since he has other jobs to do as well. This question asked was to test the contribution of the architects towards communication.

Why the product fails sometimes to satisfy the customer despite conforming to specifications is due to:

i. Non-Involvement of the customer from the design stage

ii. Poor product selection

iii. Inadequate specifications

Should there be non-conformance the Architects advise that, first one has to find out the root cause of the non-conformance and then advise the contractor to redo the work. Other suggestions are that the contractor /designer should liaise with the product manufacturer, Kenya Bureau of Standards and other satisfied or dissatisfied product users.

From the design side, the kinds of mistakes that can lead to quality problems are:

- Lack of proper communication
- Insufficient details. This is a major cause
- Many variations
- Insufficient inspection
- Lack of detailed knowledge of specified materials i.e. performance and durability
- Experience of the designer
While all these reasons contribute to low quality in construction, it is always still possible to please the client no matter how demanding. This is because the designer always builds around the client's "ideas bank". The designers interviewed affirmed that they keep notes of experience to learn from their previous mistakes. This helps in continuous improvement.

4.3.0 STUDY LIMITATIONS

The study was limited by various factors,

1. The topic of research was very technical and sometimes most respondents answered what they thought they understood by the questions rather than what was being asked.

2. Time and resources for carrying out the research was limited.
5.0.0 CONCLUSIONS AND RECOMMENDATIONS

5.1.0 CONCLUSIONS

From the results obtained in the field, one can conclude that indeed quality in the construction industry needs to be improved but it is going to take some time before the aspect Quality Management takes root in the industry. After the collection of the data and interviews held, the researcher tried to come up with a model of a system that currently exists in the industry. The figure below shows the model.

5.2.0 The Existing Quality System

From the interviews and data collected, the researcher deduced that the existing quality system in the industry revolves around supervision and inspections. The worker performs his works which the site agent checks and if they pass the test, the site agent then offers the work to the main contractor as finished. If not, the worker carries out remedial works. When the site agent offers the works to the main contractor and the work passes, the main contractor can then pass the works to the Architect who then passes the work on to the client. At each level if the works fail the test, remedial works have to be carried out. Diagrammatically, it is represented in the figure below:
FIGURE 2: QUALITY MANAGEMENT SYSTEM IN CONSTRUCTION IN KENYA

Worker performs own works. Site Agent checks

Worker carries out remedial works

Main Contractor instructs Site Agent to carry out remedial

Passed

Failed

Site Agent offers work to Main Contractor to check

Passed

Main Contractor instructs Site Agent to carry out remedial

Failed

Passed

Architect instructs main contractor to carry out remedial works

Failed

Failed

Contractor's works

Passed

Client issues defects list to Architect

Failed

Architect offers work to client

Source: Own Field Survey 2004
This is a typical model of existing Quality Management system that is currently used in Kenya and as can be seen, should work fail at one stage, there is a lot of remedial work to be carried out.

The main factors that affect Quality of Construction products can be summarised as follows:

1. Lack of proper supervision
2. Poor Workmanship
3. Design faults
4. Lack of experience in Quality issues
5. Lack of proper communication between different parties

It is also clear that from all the data that has been collected, supervision comes out as an essential element in Quality Management in construction. This could be due to the fact that the work involved is labour intensive, which means human beings are involved and to achieve good quality work, they have to be monitored closely. The implication is that Quality Management in Construction in Kenya is still in its early development stages where actually the right term to use is Quality Control rather than Quality Management. This is where inspections and supervision form a necessary step towards attaining quality, so it's not yet ingrained in the workers.

Workers' involvement in decision-making is still very low since most participants do not see how that should affect quality. All parties however should be responsible for Quality Improvement starting from the client himself. Borrowing from the literature review, if we are to follow the three elements making up the proposed Quality system model the conclusions on each element are as follows:

5.3.0 Quality Standards

1. Awareness- The idea of Quality Management is still very new in the construction industry. Most contractors practice some form of Quality Management but it is not formalised.

2. Quality planning is lacking in the construction industry. The researcher got an opportunity to look at the Quality plan of a manufacturing industry and was positive that
it lacks in construction. A quality plan for the construction company ought to look like this:

<table>
<thead>
<tr>
<th>No</th>
<th>Operation</th>
<th>Characteristics Checked</th>
<th>Method of Check</th>
<th>Extent of Check</th>
<th>Acceptance norms</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Plastering</td>
<td>Mixing procedure, application, levels etc</td>
<td>Inspection, review of previous application</td>
<td>100%</td>
<td>As per specification given in BQ</td>
<td>Endorsement by Architect after verification.</td>
</tr>
<tr>
<td>2</td>
<td>Materials verification</td>
<td>Size, grade, packing labelling, physical damages, visual defects etc</td>
<td>Verification of invoices and other identification markings on the product</td>
<td>Random check, 10% of Quantity</td>
<td>As per specification gave in purchase order</td>
<td>Materials to be supplied by (name of manufacturer)</td>
</tr>
</tbody>
</table>

Name
Date
Signature
Parties | Main Contractor | Client Representative | Architect

Source: Own Field Survey 2004

3. Design plays an important role in the final achievement of desired quality, thus even designer's need to be aware of need for Quality Implementation. This can be done by including in the tendering conditions and specifications a caption on quality and demanding that contractors submit a quality plan just like they do submit a work programme.

4. Workers are not educated on the need for Quality but rather are expected to achieve it by being supervised. There is therefore need for training in Quality.
5. Expectations for continuous improvement are not set but this is because no one contractor keeps costs specifically related to Quality. It is thus hard to gauge whether there has been an improvement from one project to another.

6. Contractors are not interested to know whether the customer is satisfied with their performance or not. This was shown in their not getting feedback from the Customers on the performance of their projects.

5.4.0 Quality Control

The main forms of Quality Control are Inspections and supervisions. Almost all (95%) of the people interviewed said it is impossible to achieve zero defects in construction. This calls for a cultural shift and change of attitude.

5.5.0 Quality Assurance

Quality Assurance is almost nil as there is no proper training of workers on experience, Improvement targets cannot be set because there are no targets to compare it with, and it is certain that no one thinks ceasing dependence on inspection can work in Construction.

The main purpose of this study was to develop an appropriate approach to Quality Management in Construction with the specific objective of determining factors that impact on Quality Management currently in use.

The factors that impact on Quality Management have been determined and also one of the things that has come out clearly is that the Quality Management System in the Industry is very traditional and needs to be changed, but this requires change of attitude as well. The existing system is therefore not appropriate and a new one needs to be adopted.
5.6.0 RECOMMENDATIONS

From the foregoing discussions and conclusions, two things have come out clearly: The first is that the Human Factor is a determining factor in achieving quality in construction. The second is that the nature of construction is unique and what can work in manufacturing cannot work in the same way in construction. From this therefore the researcher recommends the following solutions:

1. If Quality Improvement has to be achieved successfully according to the proposed model then the starting point has got to be the worker. There is need to educate the worker on the need to work right the first time and develop his abilities and morale to be able to work without supervision.

2. The nature of construction in Kenya now is such that it is labour intensive and there is high mobility of workers. To improve this situation, there is need to mechanise the operations a lot and reduce the labour element. Adopting new construction practices such as building using prefabricated materials and elements can help in improving this situation.

3. A quality plan has to be requested in the tendering conditions, so that the contractor knows it is mandatory to provide one.

4. There is need to advocate for work ethics to all participants of the Construction industry but most especially to the workers. This will go a long way in reducing inspections and supervision as the sure way of achieving quality.
5.7.0 SUGGESTED AREAS FOR FURTHER RESEARCH

1. Further research could be carried out on how to implement a new model of Quality of Management in Construction and do away with inspection and supervisions.

2. There is need to study how Work Ethics could be used to improve Quality in Construction with the workers being the focus of the study.

3. Research could also be carried out on how to implement a learning programme on Quality to all parties in the construction industry.


APPENDICES

1. Questionnaire to Main Contractors

2. Questionnaire to Designers

3. Questionnaire to Client

4. Questionnaire to Site Agent/ Clerk of Works
QUALITY MANAGEMENT: A NEW CHALLENGE FOR THE KENYAN CONSTRUCTION INDUSTRY

Introduction: The construction industry is a business sector that plays a substantial role in a country's national economy and can offer a significant support to the development of the economy. To succeed in this task, all the parties involved need to work very hard and take into consideration criteria like quality, revenue; improving quality therefore can attract more clients. Clients will be willing to pay more for good quality services. This questionnaire is intended to find out factors that impact on Quality Management in construction Projects.

SECTION ONE: (Status of the company, competition and the market)

1. What is the name of your company?

2. What position do you hold in the company?

3. What class of registration under the Ministry of Public Works do you fall in? (Tick appropriately)
   i. A □
   ii. B □
   iii. C □

4. How many permanent employees have you employed?
   i. 10-20
   ii. 20-30
   iii. 30-40
   iv. More than 40

5. What type of project are you involved in?
   Refurbishment □ New Works □

6. How big is the project in financial terms? (In millions)
   i. 0-20M □
   ii. 20-50M □
   iii. 50-100M □
   iv. over 100M □
7. How would you rank your performance/service to clients with respect to your competitors? (Tick your possible strength for each of the point)

<table>
<thead>
<tr>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Quality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ii. Fair Prices</td>
<td></td>
<td></td>
</tr>
<tr>
<td>iii. Reputation for timeliness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>iv. Capital Investment</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SECTION TWO (Meaning of Quality and Quality Control system)

1. In your opinion tick the term(s) that explain what quality is.

| i. Fitness for purpose |   |
| ii. Value for money |   |
| iii. Cheap and affordable |   |
| iv. Customer Satisfaction |   |
| v. All of the above |   |

2. Quality control is generally defined as a system for maintaining the desired level of quality in a product or service. In your opinion is it necessary to have a quality control system in your firm? Yes ☐ No ☐

Give reasons for your answer............................................................................................................................................................................

3. What method(s) do you use to ensure that your services or products satisfy your customer?

| i. Inspection |   |
| ii. Strict supervision |   |
| iii. Training of employees |   |
| iv. Determining what the client wants |   |
| v. Involving employees in decision-making |   |

4. How often do you have training for your employees on quality?

| i. Once in a year |   |
| ii. Two times in a year |   |
| iv. Every three months |   |
| v. Monthly |   |
| vi. Not at all |   |
5. In your opinion what are some of the benefits that accrue from implementation of quality assurance? (Number them in order of importance)

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Very Important</th>
<th>Important</th>
<th>Less Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved profits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Client satisfaction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved production</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved personnel satisfaction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Better chances of getting jobs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any other</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. In order of importance rank the criteria you use in selecting your suppliers

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Very Important</th>
<th>Important</th>
<th>Less Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Previous performance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delivery time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market name and reputation</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. Does your company have a quality manual?

Yes ☐ No ☐

8. Do you plan for quality before starting to work?

Yes ☐ No ☐

9. Rank in order of merit the major causes of quality problems in construction projects?

<table>
<thead>
<tr>
<th>Cause</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Design faults</td>
<td>☐</td>
</tr>
<tr>
<td>Workmanship</td>
<td>☐</td>
</tr>
<tr>
<td>Materials</td>
<td>☐</td>
</tr>
<tr>
<td>Carelessness</td>
<td>☐</td>
</tr>
<tr>
<td>Lack of supervision</td>
<td>☐</td>
</tr>
</tbody>
</table>

10. Which of the following steps are you taking towards improvement of quality of your services?

<table>
<thead>
<tr>
<th>Step</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Empowering employees and delegating authority</td>
<td>☐</td>
</tr>
<tr>
<td>Improvement of employee satisfaction</td>
<td>☐</td>
</tr>
<tr>
<td>Improvement of training and learning</td>
<td>☐</td>
</tr>
<tr>
<td>Improvement of company processes and regulations</td>
<td>☐</td>
</tr>
<tr>
<td>A team approach to achieving quality</td>
<td>☐</td>
</tr>
<tr>
<td>Breaking barriers between different levels of management</td>
<td>☐</td>
</tr>
</tbody>
</table>
11. Rank in order of merit the barriers to improving quality

i. Bureaucracy
ii. Unfair competition
iii. Government policies
iv. High interest rates
v. Communication problems
vi. Lack of experience in quality issues

Any others

12. What methods do you use to overcome them?

i. Through personnel training
ii. Improved management practices
iii. Information feedback and communication

Any other

13. Which of the following factors do you consider the most important in improving quality?
(Number them in order of importance)

<table>
<thead>
<tr>
<th>Very Important</th>
<th>Important</th>
<th>Less important</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Setting new improvement targets</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>ii. Improve training and learning</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>iii. Cease dependence on Inspection</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>iv. Selection Criteria</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

14. What challenges do you encounter in achieving Quality? (Tick appropriately)

i. Inexperienced workers
ii. Difficult and demanding clients
iii. Difficult site conditions
iv. Lack of cooperation from the design team

15. What factors impact on achieving quality in construction product?

i. Materials
ii. Site factors
iii. Workers

Any others
16. Do you compile quality costs at the end of each project? i.e. cost of preventing defects and rectifying them? Yes □  No □

17. Is it possible to achieve Zero defects in Construction? Yes □  No □

Give reasons for your answer

18. What are some of the reasons why quality of product may not be to required standard even though all specifications have been followed?

i. Site factors □

 ii. Nature of the project □

 iii. Client expectations □

Any others

19. What is being done to motivate workers to work right the first time? (Tick in box)

Increase their wages □

Employ a supervisor who knows them □

Give them longer work contracts □

None of the above □

Any other

20. Would employing workers on a permanent basis help improve quality?

Yes □  No □

Explain your answer
QUESTINNAIRE TO DESIGNERS

This questionnaire is intended to find out the contribution of the design team towards achievement of quality products in the construction process.

1. Is the contractor always provided with all the design details required at the time of signing the contract? Yes □ No □

If NO what are some of the reasons that hinder the provision of details at the signing of the contract? (Name them)

2. In your opinion about what percentage of details in the drawings express the intentions of the client at the time of tendering.
   i. 100% □
   ii. 75% □
   iii. 50% □
   iv. Below 50% □

3. Does your firm have a quality plan? Yes □ No □

4. How often do you train personnel in preventing errors?
   i. Whenever error occurs □
   ii. Once a year □
   iii. Twice a year □
   iv. Always □
   v. Never □

5. What elements of quality do you include in the job instructions issued on site?
   i. Details □
   ii. Drawings □
   iii. Scales □
   iv. Verbal Instructions □

6. In your opinion how often should an Architect go to site to inspect the works?
   i. Once a week □
   ii. Everyday □
   iii. Once every two weeks □
   iv. Once a month □
7. In your opinion why do docs products sometimes fail to satisfy the customer despite conforming to specifications?

8. In construction as in other service sectors clients always come first. Is it always easy to accommodate the clients' wishes and still achieve quality? Yes □ No □ 

9. What kind of action should the designer take should there be non-conformance of the product to specifications?

   i. Tell the contractor to redo the work □
   ii. Find out the cause of the non-conformance □
   iii. Advise client to get another contractor □

   Any other

10. Does your firm keep notes of experience from other projects in order to avoid typical mistakes in future? Yes □ No □

11. What kind of mistakes from the designer's side can lead to quality problems?

   i. Lack of proper communication □
   ii. Insufficient details □
   iii. Many variations □
   iv. Insufficient inspection □

   Any other

QUESTIONNAIRE TO CLIENT

1. What do you think are some of the reasons that make a construction product unsatisfactory?
   i. Unclear specifications □
   ii. Lack of proper supervision □
   iii. Defective materials □
   iv. Poor workmanship □
   v. Any other __________________________

2. Tick the qualities that in your view make a quality construction product?
   i. Defect free □
   ii. Aesthetics □
   iii. Functional □
   iv. Cheap □
   v. Proper finishes □

3. What can be done by the design team to improve quality of construction products?
   i. Put in more hours of supervision □
   ii. Select experienced not necessarily cheap contractor □
   iii. Coordinate communication □
   iv. Get approvals from the client on time □
   v. __________________________

4. What can be done by the contractors to improve the quality of the product?
   i. Employ a strict site agent □
   ii. Employ qualified workers □
   iii. Select qualified suppliers □
   iv. Constantly supervise the works □
   v. Any others __________________________
5. At the end of a project do you provide feedback information to the designers/contractor on the performance of the project?

Yes □   No □

6. In your opinion what are some of the reasons that hinder achievement of a quality product?
   i. Interference by the client □
   ii. Poor workmanship □
   iii. Poor quality of drawings □
   iv. Weather conditions □
   v. Carelessness by the workers □
   vi. Any other

7. In order to achieve continuous improvement in quality of construction products, what advice would you give to contractors?
   i. Train workers in quality issues □
   ii. Cease dependence on inspection □
   iii. Learn from experience □
   iv. Set new improvement targets □
   v. Any other

8. On what basis do you select contractors? (Rank in order of importance)
   i. Price □
   ii. Previous Performance □
   iii. Quality □
   iv. Delivery time □
   v. Market name and reputation □

9. In your opinion who of the following parties should be held responsible for the quality of the product?
   i. Client □
   ii. Contractor □
   iii. Architect □
   iv. Architect and Contractor □
   v. All of the above □
10. How does poor quality manifest itself in construction products?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>i.</td>
<td>Leaking roofs</td>
</tr>
<tr>
<td>ii.</td>
<td>Cracking paint</td>
</tr>
<tr>
<td>iii.</td>
<td>Warping Ceilings</td>
</tr>
<tr>
<td>iv.</td>
<td>Regular repairs</td>
</tr>
<tr>
<td>v.</td>
<td>Any others</td>
</tr>
</tbody>
</table>

12. In your opinion is it important for there to be Quality Management on site?

Yes □ No □

Explain your answer

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5. What factors affect quality of construction on site? (In order of importance)

   i. Experience of the contractor
   ii. Experience of the workers
   iii. Experience of the site agent
   iv. Site conditions
   v. Quality of materials
   vi. Any other

6. When a defect is detected, what action should be undertaken? (In order of priority)

   i. Inform the Architect
   ii. Inform the client
   iii. Find out the root cause of problem
   iv. Fire the one responsible
   v. Take corrective action

   Any other

7. Do you compile quality costs? That is the cost of preventing defects and rectifying defects?

   Yes ☐ No ☐

8. What action should be taken to prevent errors from occurring?

   i. Train workers
   ii. Report to the Contractor
   iii. Report to the Architect
   iv. Hold meetings with workers
   v. Strict supervision

   Any other

9. Do the workers work well without Supervision? Yes ☐ No ☐

10. On what basis are the workers selected?

    i. Experience
    ii. Affordability
    iii. Friendship

    Any other


11. What problems do you as a site Agent experience in controlling quality?

12. What role does the site Agent play in ensuring Quality of products?