ASSESSMENT OF QUALITY MANAGEMENT PRACTICES OF BUILDING CONSTRUCTION FIRMS IN ABUJA, NIGERIA

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BY

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Declaration

I declare that the work in this Dissertation **Assessment of Quality Management Practices of Building Construction Firms in Abuja, Nigeria** was carried out by me in the Department of Building. The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this Dissertation was previously presented for another Degree or Diploma at this or any other Institution.

Abdulrahim Abdulsalam ZUBAIRU	Signature	Date

Certification

This Dissertation entitled **"ASSESSMENT OF QUALITY MANAGEMENT PRACTICES OF BUILDING CONSTRUCTION FIRMS IN ABUJA, NIGERIA"** by Abdulrahim Abdulsalam ZUBAIRU meets the regulations governing the award of the Degree of Master of Science in Construction Management of the Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literary presentation.

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Dedication

This research work is dedicated to my Parents Alhaji AbdulSalam Zubairu and Hajiya Monsurat Zubairu

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Abstract

The study focused on assessment of quality management practices in building construction firms in Abuja. The quality of building construction projects in any country shows the level of development attained giving that the construction industry provides most of the fixed assets of any country. The study assessed factors affecting quality management of building construction firms, conformity of firms to quality management practices and the effect of firm size to conformance with quality management practices. Purposive sampling was used and 78 questionnaires were administered to building construction firms in order to assess quality management practices in building construction firms in Abuja. The research findings showed, adequacy of site personnel (RII=0.87), certification of materials (RII=0.86) and project control (RII=0.86) ranked highly significant as factors quality management. Whereas Onsite supervision (RII=0.87), quality appraisal (RII=0.84) and education of employee on the need for quality (RII=0.84) ranked highest as the most significant among the practices that firms conform with ensure quality management. The research also established that there is some variations with regards to firm size in conformity with quality management practices. From the research findings, it was concluded that inadequate on site supervision, quality appraisal and education of employees on the need for quality management are the major practices that firms need to conform with to ensure quality management in building construction firms. The research recommends building construction firms to conform strictly to quality management practices.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The issue of quality management in construction projects cannot be over emphasised since building facilities contribute the largest to any nations development and economy (Farooqui, Masood and Aziz, 2008). The construction sector is globally considered to be a basic industry on which the development of a country depends. To a great extent, the growth of a country and its development status is generally determined by the quality of its infrastructure and construction projects (Wasiu, Aliyu and Modupe, 2012).

The quality movement can trace its roots back to medieval Europe, where workers began organizing into Unions called Guilds in the late 13th century (American Society for Quality, 2010). Manufacturing in the industrialized world tended to follow this craftsmanship model till the mid- 1750s when the factory system, with its emphasis on product inspection started in Great Britain and developed into the Industrial Revolution in the early 1800s. In the early 20th century manufacturers began to include quality inspection in processes as a general practice, at the beginning of World War 2 quality became a critical component of the war effort as a product manufactured in one of the states had to work consistently with products from other states hence the eventual adoption of sampling techniques for inspection, aided by the introduction of military-specification standards and training courses (American Society for Quality, 2010).

The American Society for Quality (2010) notes that in the few years since the turn of the 20th century, the quality movement matured beyond Total Quality. New quality systems have evolved and quality has moved beyond manufacturing into service, healthcare,

education, construction and government sectors. A general decline in performance of the construction industry has been observed in recent past, perhaps exacerbated by the recent rate of collapsed buildings, prevalence of abandoned construction sites and general poor quality of completed projects. In Nigeria, the construction industry has been identified as occupying a significant segment of the capital base of the Nigerian economy and also attracts a significant percentage of the labour force in the economy (Sanni and Windapo, 2008). Due to its prime position within the economy, the successful or non-successful performance of the industry impacts either positively or negatively on the whole economy. The construction industry has been slow to apply total quality management, which is standard for most manufacturing concerns, despite the construction industry's capital requirement being equal to many years of output from a typical manufacturing organisation.

However expressed, quality is obtained if the stated requirements are adequate, and if the completed project conforms to the requirements (Arditi and Gunaydin, 1997). Arditi (2004) also defines quality in terms of professional liability, a legal concept that requires all professionals to know their trade and practice it responsibly. Architects, Engineers and Builders who offer his or her expertise to owners is subject to professional liability laws, some design professionals believe that quality is measured by the aesthetics of the facilities they design. According to Stasiowski and Burstein (1994) Cited from (Sanni and Windapo, 2008) this traditional definition of quality is based on such issues as how well a building blends into its surroundings, a building's psychological impact on its inhabitants, the ability of a landscaping design to match the theme of adjacent structures, and the use of bold new design concepts that capture people's imaginations because

aesthetic definitions of quality are largely subjective, major disagreements arise as to whether quality has been achieved or not. Since objective definitions of aesthetic quality do not exist, design professionals generally take it upon themselves to define the aesthetic quality of their designs (ASCE, 2005). Quality can also be defined from the view point of function, by how closely the project conforms to its requirements. Using this definition, a high quality project can be described by such terms as ease in understanding drawings, level of conflict in drawings and specifications, economics of construction, ease of operation, ease of maintenance, and energy efficiency. In the construction industry, quality can be defined as meeting the requirements of the designer, constructor and regulatory agencies as well as the owner. According to an ASCE (2005) study, quality can be characterized as follows.

1. Meeting the requirements of the owner as to functional adequacy; completion on time and within budget; lifecycle costs; and operation and maintenance.
2. Meeting the requirements of the design professional as to provision of well-defined scope of work; budget to assemble and use qualified, trained and experienced staff; budget to obtain adequate field information prior to design; provisions for timely decisions by owner and design professional; and contract to perform necessary work at a fair fee with adequate time allowance.
3. Meeting the requirements of the construction as to provision of contract plans, specifications, and other documents prepared in sufficient detail to permit the constructor to prepare priced proposal or competitive bid; timely decisions by the owner and design professional on authorization and processing of change orders; fair and timely interpretation of contract requirements from field design and inspection staff; and contract for performance of work on a reasonable schedule with reasonable profit.
4. Meeting the requirements of regulatory agencies (the public) as to public safety and health; environmental considerations; protection of public property including utilities; and conformance with applicable laws, regulations, codes and policies.

In addition, one should differentiate between 'quality in fact' and 'quality in perception'. The providers of services or goods that meet specifications achieve quality in fact. A service or product that meets the customer's expectations achieves quality in perception

(ASCE, 2005). In other words, a product can be of high quality and yet it may not meet customer's needs and vice versa. An example of not meeting customer needs is the prefabricated high-rise apartment buildings that were built in the 1970s using cutting edge technology in low-cost building processes in California, United States of America. The buildings had to be pulled down in the late 1980s because no one wanted to live in these apartments despite the low rents. The buildings failed to meet the tenants' expectations of comfort, aesthetics and function. One should also differentiate between 'product quality', i.e. the quality of elements directly related to the physical product itself, and 'process quality', i.e. the quality of the process that causes the product to be either acceptable or not. For example, 'product quality' in the construction industry may refer to achieving quality in the materials, equipment and technology that go into the building of a structure, whereas 'process quality' may refer to achieving quality in the way the project is organized and managed in the three phases of planning and design, construction, and operation and maintenance.

1.2 Statement of Research Problem

According to Kado (2010) the major weaknesses of construction firms in Nigeria are in the areas of staff training, awareness, education and skills, objective measurement, feedback and natural use of total quality tools and techniques. Also are the issues of contractors and clients engaging the services of quarks, use of inferior building materials all in the bid to cut costs which usually result in accidents and deaths during and after the construction process.

These concerns involving quality in the construction industry have been identified by various researchers. One of the major concerns of the construction industry in Nigeria is

the increasing cases of collapsed buildings across the country in recent times. Another concern is that major construction projects contribute significantly to the economy, standard of living and welfare of the society and thus regarded as an issue of national public interest (Abdulkareem and Adeoti, 2010).

While these concerns linger on, the problem of the technical professional bodies and allied government agencies have not really focused on the quality management of construction projects in such a way as to have a statistical base on the state or status of their quality management implementation (Lawal, 2000 Cited in Abdulkareem and Adeoti, 2010).

1.3 Justification of Study

Construction projects are usually capital intensive. Therefore, time and resources play a very essentials role in determining the cost factor of every project, likewise defects and failures in constructed facilities can result in delays and costs increases where re-construction may be required and facility operations impaired. Increased costs and delays are the result. In the worst case, failures may cause personal injuries or fatalities (Sanni and Windapo, 2008). By adhering to quality management practices the very first time total project cost can be reduced substantially by identifying mistakes, analyzing the situation and solving any unforeseen problem that may arise. The construction industry in Nigeria is one of the biggest industries and any extra cost means huge losses to the contractors and increased cost to the clients (Aibinu and Odeyinka, 2006). To avoid such loss in construction rework, extensive research on quality control needs to be conducted to improve the construction process and delivery. The benefits of strict adherence by professionals like Architects, Engineers, Builders and contractors to the need for quality management has not been given the required attention in spite of a major developmental

projects (Jimoh, 2012). Quality management in Nigerian construction industry is of great importance to achieve overall project cost benefits and effective service delivery, as this has already been tested and used in many countries around the world and proved to be very effective at optimizing the total cost throughout the project life cycle considering these problems faced in construction as a result of inadequate quality management (Aina and Wahab, 2011), it is justified to carry out this research in order to, suggest best practices that improve quality management in building construction firms, which in turn result to improved service delivery.

1.4 Aim and Objectives

1.4.1 Aim

The aim of this research is to analyse quality management practices in construction firms in Abuja, with a view to suggest ways for improved quality control and service delivery.

1.4.2 Objectives

1. To assess factors affecting quality management in building construction firms of Abuja.
2. To assess the conformance of building construction firms in Abuja to quality management practices.
3. To investigate the effect of firm size on conformance to quality management practices of building construction firms in Abuja.

1.5 Scope and Limitation

1.5.1 Scope

The scope of this study covered quality management practices in building construction firms registered with FCDA in Abuja. Only quality management practices of the

construction processes were assessed, not the quality of the buildings constructed by the building construction firms.

1.5.2 Limitation

The research was limited to the views of top management of firms, due to the firms reluctance to allow the researcher first hand access to assess the quality management practices on site. Some firms were not cooperative and this in turn affected the response rate.

CHAPTER TWO

LITERATURE REVIEW

2.1 Concept of Quality

The concept of quality management is as an approach to ensure that a whole organisation is involved in producing high quality outcomes in everything they do. According to Willar (2012) earlier researchers in the quality movement there is no particular definition for quality in construction. Quality can be defined according to American Society of Civil Engineering (2005) as meeting the legal, aesthetic and functional requirements of a project. These requirements may be simple or complex, or they may be stated in terms of the end result required or as a detailed description of what is to be done.

This research identified sections of quality management mainly from TQM and ISO 9001 standards, including the challenges or factors affecting quality management and quality improvement practices in the global construction industry.

For construction projects, quality management means making sure things are done according to the plans, specifications, and permit requirements. The days of embarking on projects which usually involve huge funds without due diligence and proper regulation seem to be over, making it imperative that communities get the most out of their infrastructure projects (Arditi, 2004). Gunaydin (1997) opined that one of the best ways to assure good construction projects is to use an inspector. The first step an inspector should take is to become familiar with the plans, specification, and permit requirements and, equally important, to ensure quality control during all construction phases needs to be better, and the utility system needs to know what is being installed while the work is being

done. On most construction jobs, the inspection is one of the last things to be done if it gets done at all.

2.1.1 Quality Management in Nigeria

The Nigerian construction industry produces nearly 70% of the nation‘s fixed capital formation, And its performance within the economy has been, and continues to be on the increase. But despite the increased growth of the sector the Nigerian construction industry’s contribution to the country’s Gross Domestic product (GDP) of 3.05% as at the close of 2012 is still below the World Bank’s average of employment in the construction sector of about 3.2% in developing countries. Whereas the sector has remained consistently on the increase in terms employment to about 7.6% of the total employed citizens both directly and indirectly after rebasing of the Nigerian economy according to reports from National Bureau of Statistics (2015).

The construction sector is globally considered to be a basic industry on which the development of a country depends. To a great extent, the growth of a country and its development status is generally determined by the quality of its infrastructure and construction projects (Wasiu *et al.*, 2012).

According to Kado (2010) the acceptance of the BSI publication and standard by Nigeria, establishing SON/NSI and the development and National Building Code (2006) in 2007 are all steps towards improvement in the quality of building construction in Nigeria among many other things. In addition, there are laws, decrees, associations, authorities and regulatory bodies that are responsible for regulating building construction practices in the country. The Nigerian Society of Engineers (NSE) was established on February 6, 1958 in London, England and later inaugurated in Lagos on August 20, 1960, had its foundations

laid at Abeokuta in January 18, 1959. It was however unfortunate that Nigerian engineers had to cope with a very hostile environment occasioned by the invasion of the profession with quacks and imposters of all sorts. This has resulted in very poor standard, numerous abandoned projects everywhere, structural failures, fires and outright collapses (Yusuf, 2010). The consequences of this problem led to colossal waste of human and material resources and the terribly battered image and morale of Nigerian engineers. The devastating effect of this state of affairs was slowing down the progress of this young country in hurry to develop, this attracted the attention of Government, Thus the Engineers (Registration, etc) Act (1970) was promulgated.

Unfortunately, the registration of engineers alone could not stop the continuing bastardization of engineering profession by quacks and attendant consequences. Thus further through further hard work and representations of the Nigerian Society of Engineers the amended Act (1992) was promulgated by which the Council for registration of Engineers in Nigeria (COREN) was now renamed the Council for the Regulation of Engineering in Nigeria with full powers to register, control, monitor and enforce compliance. It also has affiliation with the international Federation of Consulting Engineers (FIDIC). Also there is the Association of Consulting Engineers Nigeria (ACEN) which was founded and registered in 1972 and 1979 respectively, The focus of ACEN is to ensure that the highest level of technical competence and business ethics are brought to bear on the consulting engineering practice in Nigeria which will in turn result in the highest level of quality of infrastructure for Nigerians at the most cost effective prices (Kado, 2010). ACEN has strong affiliation with the National Society of Engineers (NSE) which is the umbrella association of all Engineers and individuals involved in engineering activities.

It is noteworthy that Association of Consulting Engineers Nigeria (ACEN) has partnered with the International Federation of Consulting Engineers (FIDIC) for the provision of standards in the use of construction contracts. The FIDIC Conditions of Contracts comprise of the Conditions of Contract for Construction (Red Book), Conditions of Contract for Plant and Design-Build (Yellow Book), Conditions of Contract for EPC/Turnkey Projects (Gold Book) and Short Form of Contract (Green Book). The Red Book is the most widely used of the FIDIC books. Nigerian engineering firms and indeed the various engineering associations should consider the adoption of one or more of these international construction contracts (FIDIC, ICE, NCE) with established DRB mechanisms for the standardisation of the Nigerian engineering and construction industry, in line with international standards.

Further development which sought to regulate professional practices in the construction industry led to the founding of The Architects Regulation Council of Nigeria (ARCON) from CAP A19 Laws of the Federation of Nigeria 2004. According to the Law, ARCON derives the power to register and control practices of Architecture in Nigeria (Yunusa, 2009). ARCON has a strong affiliation with Nigerian Institute of Architects (NIA), which is equally the umbrella body of architects and individuals involved with architecture. Also there is the National Institute of Builders (NIOB) which is the umbrella association of builders and individuals involved in building activities, there is also the National Institute of Quantity Surveyors (NIQS) which is also umbrella body for individuals involved in quantity surveying activities.

2.2 Quality Management Systems in Construction

Some of the recognised quality management standards include; The ISO9000 series, Total Quality Management, Quality Control, Quality Assurance, Malcolm Baldridge (MB)

standard and BS 5750 of the British Standard Institute (BSI), European Construction Institute (ECI) which produced the (ECI) Matrix in 1993 (Kado, 2011).

According to the ASCE manual, (2012) the primary purpose of codes and standards is to protect the public's health and safety, compliance with codes and standards should be an issue addressed early in the design phase. Without early identification of the appropriate codes and standards, reworking plans and specifications can result in considerable cost and delay. The design professional must be knowledgeable about the provisions of codes and standards before starting the design process because the building codes directly control the minimum standards of many components of a building project, and are responsible for much of the finished product quality. Kubal (1994) claims that regulations controlling the construction processes are much more restrictive than in most manufacturing and service industries. (Stasiowski and Burstein, 1994) underline that quality design begins with sound engineering and scientific principles which must satisfy the criteria of applicable codes and standards, but also the owner's project requirements. Codes and standards refer to the minimum criteria. Owners, however, may have particular requirements.

Table: 2.1 shows the gradual evolution and metamorphosis of quality improvement which have been catalogued by various authors and researchers over the years.

Table 2.1: Evolution of Quality Movement in Construction

Duration	Quality Systems
Pre – 1900	Quality as in integral element of craftsmanship
1900 – 1920	Quality Control by Foremen
1920 – 1940	Inspection-based Quality Control
1940 – 1960	Statistical Control
1960 – 1980	Quality Assurance and Total Quality Control
1980 – 1990	Total Quality Management (TQM)
1990 – 2000	TQM and Culture of continuous improvement
2000 – Present	Organisation-wide Quality Management

Source: http://content.authorstream.com/ppt/157007_633714122495836250.pptx

2.2.1 Quality Assurance/Quality Control

According to Ferguson and Clayton (1998) "Quality Assurance (QA) is a program covering activities necessary to provide quality in the work to meet the project requirements. (QA) involves establishing project related policies, procedures, standards, training, guidelines, and system necessary to produce quality. The design professional and constructor are responsible for developing an appropriate program for each project. (QA) provides protection against quality problems through early warnings of trouble ahead. Such early warnings play an important role in the prevention of both internal and external problems". On the other hand Quality Control (QC) is the specific implementation of the (QA) program and related activities. Effective (QC) reduces the possibility of changes, mistakes and omissions, which in turn result in fewer conflicts and disputes. As mentioned earlier, quality in construction is too important to be left to chance. A look at history gives some

insight into the problem. Through the first half of the 20th century, engineers and architects were in total control during the design phase. During the construction phase they carried out a role described as 'supervision', insuring that the owner received his money's worth in terms of quality. In the 1950s and 1960s, owners became increasingly concerned with cost, schedule and areas where design professionals were not providing good control (O'Brien, 1989). The emphasis continued to be on quality and control of exposure to liability. At about the same time, the widespread use in the public sector and, to a large degree, in the private sector, of the sealed competitive bid gave the owner the advantage of competitive pricing, but also forced the general contractor to look for every advantage during construction to control cost and maintain a profitable stance. As mechanical and electrical systems became more complex, the general contractor turned responsibility for such work over to subcontractors, including quality control of their workmanship (ASCE, 2005).

2.2.2 ISO 9000 Series

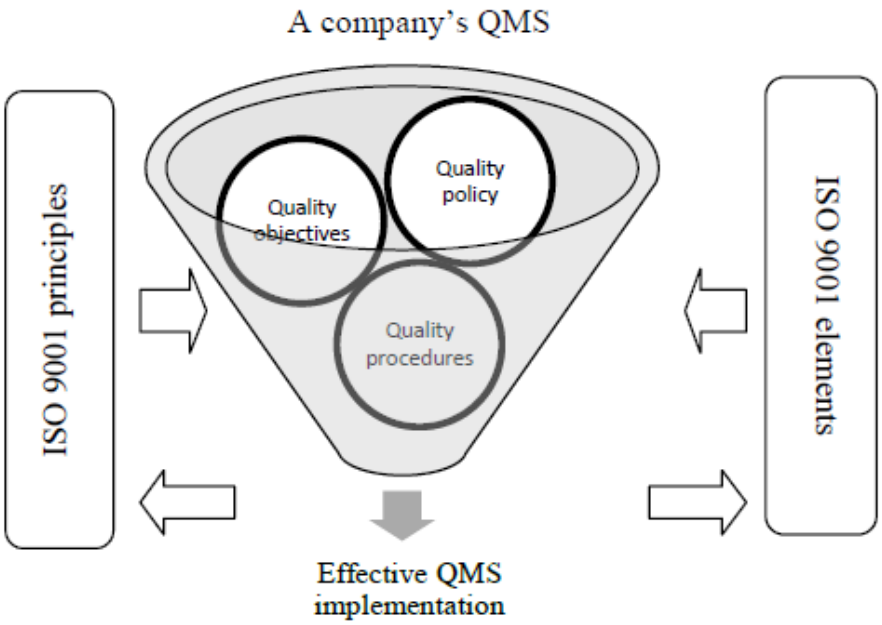
The Geneva-based International Organization for Standardization first published a series of standards in 1987. The term ISO describes the series of international standards dealing with product design, production, delivery, service and testing. The ISO 9000 series comprises two basic types of standard: those addressing quality assurance and those addressing quality management. The quality assurance standards are designed for contractual and assessment purposes and are ISO 9001, ISO 9002, and ISO 9003 (British Standards Institution, 2008). The quality management standard is ISO 9004 and is designed to provide guidance for companies developing and implementing quality systems, (Doyle, 1994). A company registered as complying with ISO standards has demonstrated to

an accredited third party (an approved outside auditor) that its processes have been documented and that the company is systematically auditing and being audited that they are following the policies and procedures necessary to produce high quality products. ISO standards are directed towards improving a firm's production processes (Arditi, 2004). A TQM system is the big picture and is concerned with customer satisfaction and all activities conducted by a firm. A good way of viewing ISO is that the emphasis in the ISO registration is on the management of process quality. This is not meant to minimize the role of ISO in a TQM system. The ISO standards provide an excellent beginning point for a firm starting a TQM program (Arditi and Gunaydin, 1997).

Fig: 2.1 Shows An Effective ISO 9001 Quality Management System

Recent publications on construction quality management highlight the important activities that should be performed in relation to the application of an effective QMS-ISO 9001. According to Rumane (2011), an organisation needs to demonstrate its ability to consistently provide products that meet or exceed customer expectations and satisfaction, while also adopting appropriate processes for the continued improvement of the QMS and related assurances of conformity to customer and applicable regulatory requirements. Watson and Howarth (2011) also emphasize that for ISO 9001 to remain a process-based system with heavy emphasis on compliance, an organisation is required to rigorously conduct an assessment of organisational performance, set against a standard and leading to accreditation. Clearly, the context of an effective QMS implementation is to ensure that work is performed according to specifications, throughout the design and development phases, manufacturing and construction, and servicing, and also ensure that customers are

satisfied with the resulting products and services (Beaumont 2006). Figure 2.3 illustrates the process model of ISO 9001, with the focus on customer requirements and satisfaction.



Source: (Willar, 2012)

Fig 2.1: An Effective ISO 9001 Quality Management System

2.3 Total Quality Management Factors

Establishing the project requirements for quality begins at project inception. As opined by Artidi and Gunaydin (1997), a careful balance between the owner's requirements of the project costs and schedule, desired operating characteristics, materials of construction, etc. And the design professional's need for adequate time and budget to meet those requirements during the design process, it is essential that owners balance their requirements against economic considerations and, in some cases, against chance of failure. The design professional is obligated to protect public health and safety in the context of the

final completed project. The constructor is responsible for the means, methods, techniques, sequences, and procedures of construction, as well as safety precautions and programs during the construction process. Project requirements are the key factors that define quality in the process of construction. The process of construction can be broken down into three main phases, namely,

1. the planning and design phase,
2. construction phase, and
3. operation and maintenance phase.

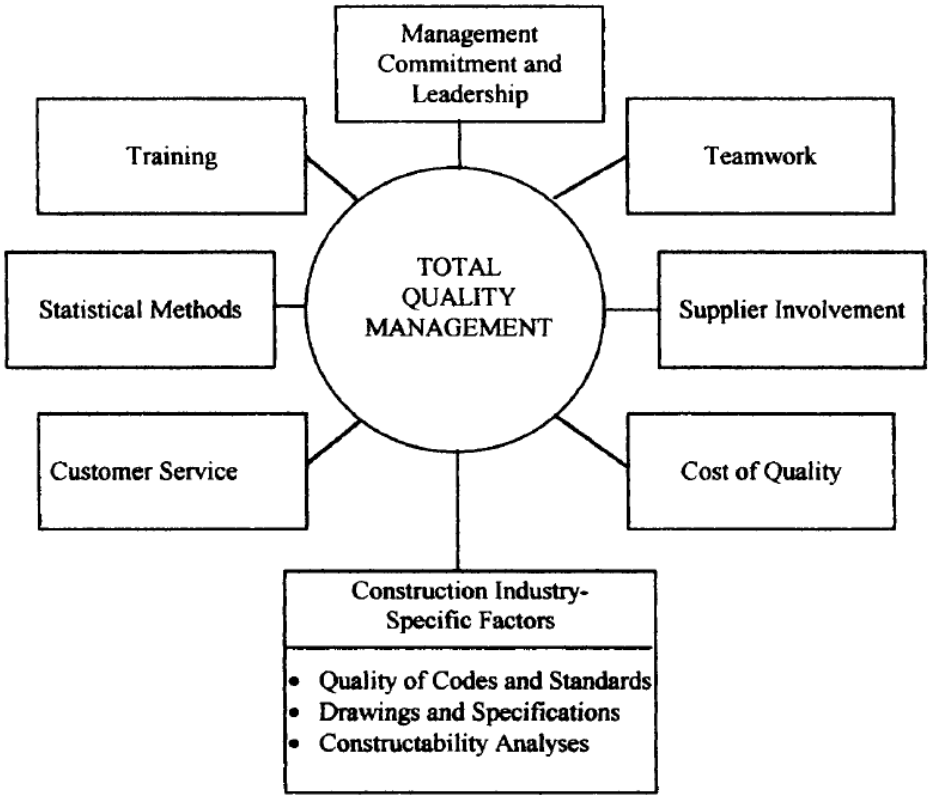


Figure 2.2: Total Quality Management in Construction Process

Source: Arditi and Gunaydin (1997)

Total Quality Management shows in Fig 2.2 generally accepted elements of TQM and construction industry-specific factors that affect quality of the process of a building project. Some of the factors that affect quality in each phase of the construction process have been identified through a literature review and are discussed in the following sections.

2.3.1 Management and Leadership

The Business Roundtable construction industry cost effectiveness study concluded that the primary causes for the decline of construction productivity directly or indirectly involved poor management practices (Burati, Michael and Satyanarayana 1992). Since quality is part of productivity, the first step for management is to recognize that there is a problem. The success of a TQM program first of all depends on management practices. TQM is a culture and philosophy that must permeate an organization as the method of management. It can thrive only under a senior management that establishes TQM as a top priority. This commitment must be coupled with a thorough understanding of TQM. Only if supported by this commitment and understanding, can senior management lead the company toward the realization of higher quality in its undertakings. The prominent method of management practiced in the United States today, including the construction industry, is management by control, not by participation. Forced by international competitive pressures and increasing demands for quality products and services, industries are re-evaluating the effectiveness of management by control. According to Joiner and Scholtes (1988) in this style of management, the emphasis is on the organizational chart and the key control points within the structure. All managers, beginning at the top, are given certain goals for the next year. They in turn, set goals and impose controls on each of their subordinates. In construction terms, cost, schedule, and possibly quality goals are established for each project. Project

managers are rewarded on the basis of meeting these goals. This method has been somewhat successful. It is simple, logical, and consistent. But there are problems when the work gets displaced by the controls themselves (Burati *et al.*,1992). Also, competition to meet short-term goals can lead to internal conflict, adversarial relationships, reduced communication, accusations.

In figure 2.1 Elements of total quality management in the construction process when goals are not achieved, and even fabricated reports of conformity. Management by control encourages an organization to look inward rather than outward to the customer and the customer's needs (Juran, 1988). Once it acknowledges that there is a problem, the second step for management is to develop a clear understanding of the underlying principles and elements of TQM. Management then demonstrates its commitment to quality through action. Without this understanding, management's action will most likely contradict TQM, confirming the doubts of the labour force and dooming the effort to failure (Oberlender, 1993). The findings of a survey conducted by construction managers, designers, contractors and facility managers to investigate TQM in the design, construction, and operation phases of projects undertaken in the USA, indicated that the level of management commitment to continuous quality improvement was rated as one of the most important factors that affect the quality of the constructed facility (Gunaydin, 1995).

2.3.2 Employee Training on Quality

The importance is recognized by every quality expert. Under TQM, quality becomes everyone's responsibility and the training must be targeted for every level of the company. There should be customized training plans for management, engineers, technicians, home and field office staff, support personnel and field labour (Smith, 1988). It can be argued

that the transient construction work force is quite different from the relatively stable manufacturing work force. This transient nature may make it more difficult to train workers, particularly craft labour, for the construction industry (Burati *et al.*, 1992). However, there are many aspects, such as training and awareness that are similar between the safety consciousness of construction firms and the implementation of TQM concepts. Many US construction companies that had safety forced upon them with the formation of the Occupational Safety and Health Administration have proven the cost effectiveness of their safety programs and now use their safety records as a marketing tool. Some of the same techniques used to instil safety awareness in craft labour may be adaptable to instil a similar quality awareness. It is easy to envision using a good quality performance record as a strong marketing tool. If TQM concepts become widely accepted throughout the construction (Oberlender, 1993) industry, workers switching from one company to another should require less TQM training since all workers would have received basic quality awareness in their previous employment (Burati *et al.*, 1992). The training effort may include instruction in the basics of TQM, cause-and-effect analysis, team problem solving, interpersonal communication and interaction, rudimentary statistical methods and cost of quality measurement. A study of TQM in more than 200 companies found that skills in human interaction, leadership, and initiative are instrumental to the success of any quality improvement effort.

The demands on these interpersonal skills increase as the complexity and sophistication of the technical systems increase. The training effort follows a specific plan, and its implementation and effectiveness are carefully tracked. It is initiated in a limited number of pilot teams. The success stories of the pilot teams are then used to fuel the training effort.

Follow-up training is essential, and is part of the overall training plan and a job requirement for each individual. The training of employees in the design phase was found to be not very important, in the construction phase moderately important, and in the operation phase very important by the respondents in Gunaydin's (1997) study of TQM in US construction projects (Gunaydin, 1997). It follows that operation and maintenance crews working in constructed facilities should be the main recipient of training efforts, Findings are parallel to ISO 9001 which emphasizes the importance of training and underlines that activities demanding acquired skills should be identified and the necessary training provided (Doyle, 1994).

2.3.3 Teamwork Among Professionals

Quality teams provide companies with the structured environment necessary for successfully implementing and continuously applying the TQM process. Quality training is conducted and the continuous improvement process executed through a well-planned team structure (Lukman *et al.*, 2011). The ultimate goal of the team approach is to get everyone, including contractors, designers, vendors, subcontractors, and owners involved with the TQM process. At the industry level, extending the TQM concept to the parties mentioned above in the form of joint teams achieves higher customer satisfaction. These joint teams are responsible for establishing joint goals, plans, and controls. The teams provide a mechanism for listening to and communicating with the owner and for measuring the level of customer satisfaction. Two obstacles to establishing joint teams are the state of legal independence between companies and their traditional methods of working individually (Juran, 1988). These obstacles can be overcome in the construction industry however, if the owner is dedicated to doing so. There are several case studies of successful partnering

arrangements. For example, on a large refinery project, TQM was applied on a project team basis; representatives of the owner and the two major contractors on the project served on the project quality steering committee. While this is a new concept, early progress is encouraging (Burati *et al.,* 1992). At the company level, teams composed of department representatives are necessary to implement TQM throughout the organization. The same team approach can be used at the project level. "Extent of teamwork of parties participating in the design phase" was found to be the most important factor that affects quality in Gunaydin's study (1997) of TQM in construction projects. In the same study, construction managers and designers ranked this factor as the most important factor. This result shows that teamwork among parties such as structural, electrical, environmental, civil engineers, architects, and owners is essential to reach the quality goals for design. In the construction phase, "extent of teamwork of parties participating in the construction process" was found to be very important and ranked 2nd by constructors and 4th by construction managers (Gunaydin, 1997). It appears that the importance of teamwork in the design phase was relatively more pronounced than in the construction phase.

2.3.4 Statistical Methods

Statistical methods provide problem-solving tools to the TQM process. According to Perisco (1989) they provide teams with the tools to identify the causes of quality problems, to communicate in a precise language that can be understood by all team members, to verify, repeat, and reproduce measurements based on data, to determine the past, present, and to a lesser degree, the future status of a work process, and to make decisions on facts that are based on data rather than the opinions and preferences of individuals or groups. The importance of statistical techniques is also underlined by ISO 9000. However, contrary

to TQM philosophy, the use of statistical methods was found to be in Gunaydin's (1997) survey the least important factor that affects quality in the construction process and ranked at the very bottom of the importance lists in the design and construction phases by designers, constructors, and construction managers. It can be concluded that all the professionals involved in this study agree that the use of statistical methods has relatively very little effect on the quality of the construction project. This finding supports Hellard's (1994) contention that individual construction activities are typically unique and eliminate the potential for any kind of statistical process control.

2.3.5 Cost of Quality

The cost of quality is considered by both (Crosby, 1976) and (Juran, 1988) to be the primary tool for measuring quality. In their approach, it is used to track the effectiveness of the TQM process, select quality improvement projects, and provide cost justification to doubters. By bringing together these easily assembled costs of review, inspection, testing, scrap, and rework, one can convince management and others of the need for quality improvement." Cost of quality has received increasing attention in recent years. It is effective in its intended purpose of raising awareness about quality and communicating to management the benefits of TQM in terms of money.

Quality costs consist of the cost of prevention, the cost of appraisal, and the cost of deviation. Prevention costs are those resulting from activities used to avoid deviations or errors, while appraisal costs consist of costs incurred from activities used to determine whether a product, process, or service conforms to established requirements. The cost of design or constructability reviews, as well as the cost of modifying work procedures to adhere to quality standards might be considered prevention costs, while inspection is an

example of an appraisal cost. A survey of US firms indicates that the major obstacle to using the ISO 9000 standards is the additional cost of modifying work procedures and the additional cost of revising standard deviation costs are those resulting from not meeting the requirements. Some deviation costs are incurred on the project site due to scrap, rework, failure analysis, re-inspection, supplier error, or price reduction due to nonconformity. Other deviation costs are incurred once the owner takes possession of the constructed facility. These include costs for adjustment of complaints, repair costs, costs for handling and replacing rejected material, workmanship or equipment costs for correcting errors, and litigation costs (Ledbetter, 1990). In the construction industry, contractors are selected by owners on a competitive basis. Even though the bid is considered to be the major criterion of selection, especially private owners also consider the contractors' safety record, technical support, equipment capabilities, and especially reputation regarding the quality of the work performed. Contractors with a reputation for poor quality are not likely to be awarded many projects in the existing competitive marketplace. It therefore pays for contractors to invest in measures to achieve high work quality in order to increase chances of winning contracts.

2.3.6 Supplier Involvement

The ability to produce a quality product largely depends on the relationship among the parties involved in the process; the supplier, the processor, and the customer. The quality of any stage in a process is contingent upon the quality of the previous stages. The quality of the project built by the constructor is directly related to the quality of the plans and the specifications prepared by the designer, the quality of the equipment and materials supplied by the vendors, and the quality of work performed by the subcontractors. Close

and long-term relationships with these suppliers to the construction process are required if the constructor is to achieve the best economy and quality (Oberlender, 1993). Traditionally, in the construction industry, contractors, subcontractors, and vendors are all pitted against one another to compete on the basis of low-bid contracts. Yet, the fourth of Deming's recommendation in Arditi and Gunaydin (1997) recommendations for reaching a high level of quality stresses that companies must end the practice of awarding business on the basis of price tag alone. According to Peters (1987) successful projects in the future are likely to be decided based on quality, life-cycle costs (not initial cost), and supplier responsiveness, which can only be achieved through partnership relationships; these relationships will involve fewer suppliers, and they are expected to be based on mutual trust. This is already being proven true in certain areas of the industrial construction market. Long-term partnering agreements have been formed between a number of owners and contractors. Some owners are requiring their contractors to have formal TQM programs, and both owners and contractors are requiring their vendors to implement TQM if they wish to be considered for future work (Burati *et al.*, 1992).

2.3.7 Customer Service

TQM is a process that requires universal involvement to be successful. This includes customer involvement. As more and more companies become involved in the TQM process and demands for improved quality increase, this concept becomes increasingly important. Customers may be either internal or external (Palaneeswaran, 2006). Satisfying the needs of these customers is an essential part of the process of supplying the final external customer with a quality product. Juran (1998) claims that the parties in a process (supplier, processor, and customer) have a "triple role". Figure 2.3 shows "triple role" concept

applied to construction. The designer is the customer of the owner because the designer has to receive the project requirements from the owner in order to provide a feasible design (Arditi, 2004). The designer supplies plans and specifications to the constructor; in this case the constructor is the designer's customer because the constructor uses the designer's plans and specifications, then conducts the construction process, and finally supplies the completed building to the owner. The owner is now the constructor's customer. Quality in each phase is affected by the quality in the preceding phases. Therefore customer service in each phase is important for the overall quality performance of the process.

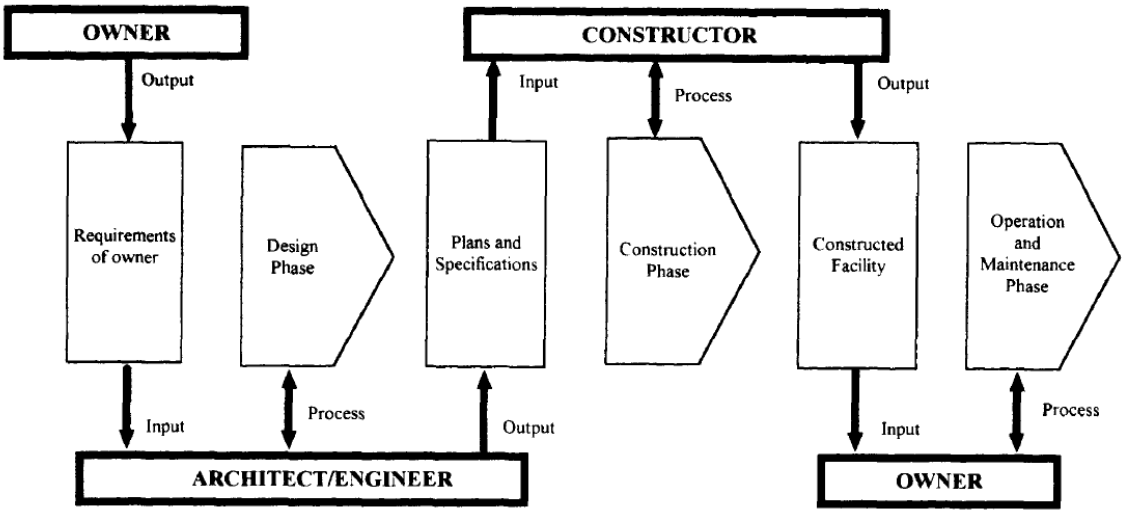


Figure 2.3: Construction Process

Source: Arditi and Gunaydin (1997)

The designer is the customer of the owner because the designer has to receive the project requirement from the owner in order to provide a feasible design. The designer supplies plans and specifications to the constructor; in this case the constructor is the designer's customer because the constructor uses the designer's plans and specifications then conducts the construction process, and finally supplies the completed building to the owner. The owner is now the constructor's customer. Quality in each phase is affected by the quality in

the preceding phases. Therefore customer service in each phase is important for the overall quality performance of the process. According to Mears (1995) project design and construction planning are carried out based upon a standard derived from relevant codes, owners' requirements, and design company standard practice.

2.3.8 Contractor Performance

Contractor quality performance indicators have been divided into corporate level as adapted from manufacturing industries by Yasamis, Arditi and Mohammadi (2002) and project level indicators which consist of the most common tools used in project management Yasamis *et al.* (2002), Arditi and Lee (2003, 2004), Ling and Chong (2005) and Lee and Arditi (2006) conducted their researches corroborating this division of corporate level quality performance and project level quality performance. Corporate level quality performance is process an organization uses to achieve the following attributes of leadership; employee empowerment, partnership development information and analysis, continuous improvement, client focus. These attributes have been identified as critical success factor in achieving total client satisfaction for construction firms. By using these corporate-level processes it may be possible for owners to predict whether they will be satisfied with the quality performance of the construction firm. Project level quality performance is tools, techniques and processes an organization uses to achieve product quality and service quality attributes.

Lists of product and service attributes with their definitions were found in literature (Yasamis *et al*, 2002; Arditi and Lee, 2003; Arditi and Lee 2004). Product quality attributes include: performance, reliability, conformance, durability, serviceability, aesthetics and perceived quality. The service quality attributes include: time, timeliness, completeness,

courtesy, consistency, accessibility and convenience, accuracy and responsiveness. According to Yasamis *et al* (2002), such a dissection of construction activity facilitates developing strategies to define, operationalize, measure and improve construction quality. Their study established a framework for the assessment of a contractor's quality performance from a list of contractor quality performance indicators that are derived from various quality-related practices of the contractor at the corporate and project level. Ling and Chong (2005) found that design and build contractors did not meet clients' expectations in service quality. Smallwood and Rossouw (2008) reported that majority of general contractors do not implement written documented quality management systems.

2.3.9 Construction Industry-Specific Factors

While the evolution of quality control in the construction industry is parallel to that of the manufacturing industry, many dissimilar characteristics distinguish the two industries. The following differences, some of them significant, must be considered when applying a quality program to construction (Rounds, 1985).

1. Almost all construction projects are unique. They are single-order, single-production products.
2. Unlike other industries, which usually have a fixed site with similar conditions for production,
3. each construction production site always displays different conditions.
4. The life-cycle of a construction project is much longer than the life-cycle of most manufactured
5. products.
6. There is no clear and uniform standard in evaluating overall construction quality as there is in
7. manufactured items and materials; thus, construction projects usually are evaluated subjectively.
8. Since construction projects are a single-order design project, the owner usually directly
9. influences the production.
10. The participants in the construction project--owner, designer, general contractor, subcontractor, material supplier, etc differ for each project. Because of these distinguishing characteristics, the construction industry has generally been considered to be quite different from manufacturing industries. That is why, quality

control procedures that work effectively in a mass production industry have not been considered suitable for the construction industry. Consequently, quality control throughout the construction industry has not evolved to the level attained in manufacturing industries. According to Adriti (2004) project design and construction planning are carried out based upon a standard derived from relevant codes, owner requirements, and design company standard practice. Construction is then managed to conform to this composite standard as interpreted by the constructor. Quality assurance via owner, designer, or building authority, or a combination, occurs after completion, and in some cases, after partial compensation. This process results in the following trends.

11. Quality is designed into and evaluated for each individual project each time. Except for some specialized areas of construction such as nuclear power plants and interstate road construction, there is no comprehensive quality policy employed to establish quality assurance for the entire industry or large segments of the industry.
12. No feedback system exists for re examining quality control work. Correction only occurs when the owner, designer, or building authority points out defects in the project. This makes quality evaluation difficult. It is difficult to establish a data collection system to build an information base that could lead to early identification of defects. Since post-completion correction of unacceptable work is damaging to a company's or an individual's reputation, or both, the defect that occurs during construction is usually corrected or concealed before top level management or the owner discovers it. Thus, lack of information means no change in procedures, and allows the defect to reoccur during the next project.
13. No mechanism exists for practical implementation of standards. This is not only because too many standards exist, but also because there are no efficient means for inputting new information and, thus, maintaining relevant standards.
14. No system exists to manage quality throughout the design/construction process. While a 'construction management' block appears in Figure 2.2, it is only the execution of the construction plan, and does not contain a quality management component. According to Kubal (1994), the concept of quality control should be changed from "controlling quality" to "controlling management for quality". This would result in using an integrated quality standard, based upon current industry wide experience, to define policies and organization to manage quality. Policies are defined for the quality, for the control of quality, and for management of the quality control system. The organization created to implement quality control policies must have well-defined responsibilities and authority.

In construction, failure can result from malfunction on the part of constructor, designer, or even owner. In most cases however, it is the result of a combination of actions by several or all of these parties.

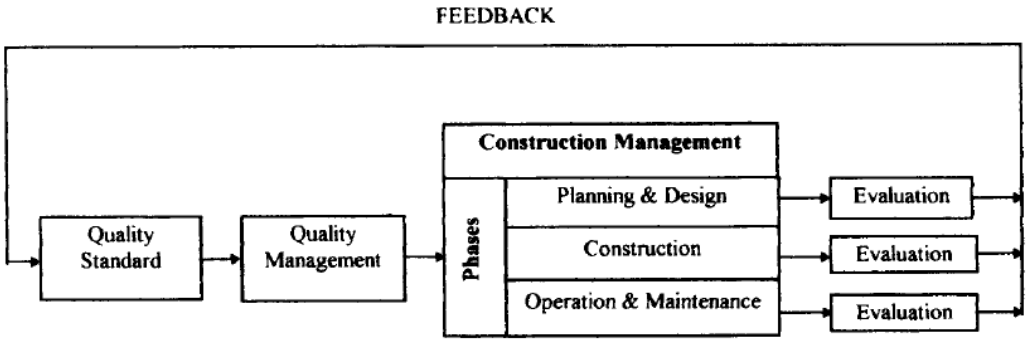


Figure 2.4: Total Quality Control Flow Chart

Source: Arditi and Gunaydin (1997)

The quality management organization must, therefore, have the ability to deal effectively with all parties involved. A quality flow chart Figure 2.4 demonstrates the following characteristics for a properly organized quality control program in the construction industry;

1. The quality standard is derived from a current database created through feedback from previous projects, providing a more uniform and comprehensive standard.
2. Quality management in the planning and design, construction, and operation and maintenance phases is integrated through the construction management project delivery system.
3. Defects are identified and corrected early.
4. Feedback expands the quality data base to eliminate repetition of the identified defects. According to the ASCE manual (2012), the primary purpose of codes and standards is to protect the public's health and safety. Compliance with codes and standards should be an issue addressed early in the design phase. Without early identification of the appropriate codes and standards, reworking plans and specifications can result in considerable cost and delay. The design professional must be knowledgeable about the provisions of codes and standards before starting the design process because the building codes directly control the minimum standards of many components of a building project, and are responsible for much of the finished product quality. Kubal (1994) claims that regulations controlling the construction process are much more restrictive than in most manufacturing and service industries.
5. Stasiowski and Burstein (1994) underline that quality design begins with sound engineering and scientific principles, must satisfy the criteria of applicable codes and standards, but also the owner's project requirements. Codes and standards refer to the minimum criteria. Owners, however, may have particular requirements. Gunaydin's (1997) survey of US designers and construction managers indicates that

the effect of codes and standards on the quality of the operation is perceived as minimal.

2.3.10 Drawings and Specifications

Drawings and specifications are the two sets of documents given to the constructor that provide technical information on materials, performance of the constructed facility, and quality requirements. Drawings are the only documents given to the constructor that show the design concept, size and scope of the job, number and size of materials or items, and how they are assembled into a final project. Oberlender (1993) also underlines that the final product of design work is a set of contract documents (drawings and specifications) to guide the physical construction of the project. There are often inconsistencies between the drawings and specifications. That is why it is critical that drawings be clear, concise, and uniform (Ferguson and Clayton, 1998). Indeed Gunaydin's findings in (2004) indicate that the quality of the drawings and specifications received from the designer affect the quality in the design and construction phases, and consequently the quality of the constructed facility.

2.3.11 Constructability of Design

Constructability is one of the major factors that affect the quality of design. According to the ASCE manual (2008), the design professional must consider the requirements of the constructor. The project must be constructible by those retained to build the project. Like codes, constructability and construction techniques vary in different geographical areas. Kubal (1994) indicates for example that in addition to general reviews of constructability, designs must also be reviewed for effectiveness and compatibility with local requirements, including both the initial construction and post-construction operations. Both the initial design constructability and the completed operational design should be reviewed in the

quality construction programs instituted by the design team members. In addition, design professionals must clearly and adequately communicate the design intent to the constructor. This is done initially with the contract documents, both plans and specifications. Quality design extends throughout the construction phase of the project. Oberlender (1993) indicates that traditionally, engineering and construction have been separated early in the project. The adoption of new technology such as three-dimensional computer-aided drafting and design, robotics, and automation in construction has generated increased interest in the constructability of the project. With these new innovations, designs can be configured to enable efficient construction, which places more emphasis on merging engineering and construction to include constructability's input in the design effort. The desired result is to facilitate the exchange of ideas between construction and design before and during design, rather than after design. According to the ASCE manual (2010), the project design team should include engineers with field experience. Many organizations have these engineers on staff. However, it may be necessary in some cases to retain engineers with the necessary expertise, or form a joint venture with an appropriate concern.

2.4 Quality Improvement in Construction

Through contracts, subcontracts and sub-subcontracts, the general contractor ends up delegating responsibility for quality. In the 1980s came the advent of the construction management project delivery system whereby construction management firms emerged as entities not responsible for design and/or construction, but performing only managerial functions on behalf of the owner from the inception phase to the completion of the construction phase (Pheng and Hui, 2004). Inspection and quality control that had traditionally been performed by architects and engineers were now performed by

construction management firms. According to O'Brien (1989) one way in which more attention will be given to quality control is development of a project quality control plan. Presently, testing and inspection requirements are scattered throughout the contract specifications. To develop a firm plan, the testing and inspection requirements can be combined into a new division of the specifications. This would emphasize quality control and provide an organized location in which all quality control issues are identified to the bidders. As a part of a quality control plan, the manner in which the construction manager will apply quality control procedures should be described to the bidders, this will permit them to assign appropriate costs to the testing procedures. According to Alexander (2008) when discussing quality enhancement or improvement the terms quality assurance (QA) and quality control (QC) are frequently used interchangeably. Since quality control is a part of quality assurance, maintaining a clear distinction between then is difficult but important. Quality assurance is all planned and systematic actions necessary to provide adequate confidence that a structure, system or component will perform satisfactorily and conform with project requirements. On the other hand, quality control is a set of specific procedures involved in the quality assurance process. These procedures include planning, coordinating, developing, checking, reviewing, and scheduling the work. The quality control function is closest to the product in that various techniques and activities are used to monitor the process and to pursue the elimination of sources that lead to unsatisfactory quality performance (Wick and Veilleux, 2003). Most design-related quality assurance and quality control activities are covered by a design organization's standard office procedures. Developing and monitoring the activities within the quality assurance program in the

construction phase are the responsibility of either the designer or the construction management firm depending on the project delivery system in use.

2.4.1 Quality Improvement in Nigeria

The Federal Government of Nigeria and States in Nigeria have their various planning regulatory authorities. In the Federal Capital Territory (FCT), the Federal Capital Development Authority (FCDA) is saddled with the regulatory authorities and it was created under Decree No.6 of February 5, 1976 cited as the Federal Capital Territory Act. The Decree which vested ownership and control of all land in the area to the Federal Government also gives the FCDA the onus of handling the design, planning and construction of the Federal Capital Territory. In 2007 the Development Control Department of the Federal Capital Territory (FCT) issued a revised edition of 'Abuja Development Control Manual'. In which the then Minister, Mallam. Nasiru el-Rufai said the overall objective of this document Development Control Manual (2007) is to set out the bases to decide planning application, conditions to planning permission, while Design and Development guide lines and execute the polices by setting out a number of detailed planning and environmental technicalities.

Kado (2010) asserted that, although there are such laws and regulatory organisations and their manuals, yet shortcomings still persist in the construction industry. Also Bamisile (2004) observed that "in certain instances, unqualified persons prepared both architectural and engineering designs and/or working drawings are poorly prepared even in some cases without drawings number and the name of the designer or drawn by column completed not to talk about name of the person that checked the drawings before they are issued for construction" In addition, some of the drawings are uncoordinated, grossly

inadequate for construction, specifications are not used by the design team, in many instances they are left to quantity surveyors to write. References are often made to certain standards and codes of practice without the writer having seen copy of them before. Their current status and relevance to the specific project are also hardly checked. In conclusion, Bamisile (2004) remarked that "one could say that the design team has not yet adopted any quality culture in their contribution to production of buildings in Nigeria".

2.4.2 ISO 9001 Quality Management Practices

Successful implementation of Quality Management Practices (QMP), as espoused in the relevant ISO 9001 standard, requires effective planning, operation and review, as well as continuous improvement of the system at all levels of an organisations effectiveness has been defined

by the British Standards Institute (BSI) (2008) as the extent to which planned activities are realised and planned results are achieved. The term „effectiveness" is particularly pertinent to quality management system implementation, as companies that adopt a QMP must meet their specified quality requirements and prescribed quality objectives without any shortfalls, in order to be seen to have successfully implemented their QMPs (Willar, 2012).

Effective implementation of a quality management system (QMS), and espousing quality values or adopting a high-level quality philosophy, whether by virtue of operating a QMS-ISO 9001 or applying a TQM approach, potentially provides benefits that are needed, even in the most competitive construction environments.

The summary of ISO 9001 Series quality practices are shown in Fig:2.5. This an international standard for QMS (in comparison with other quality standards and awards -

Six Sigma, Malcolm Baldridge National Quality Award Criteria, The European Foundation for Quality Management Excellence Model-EFQM EM (Willar, 2012).

ISO 9001 Principles / ISO 9001 Clauses	Customer focus	Leadership	People involvement	Process approach	Systems approach	Continual improvement	Factual approach to decision making	Mutually beneficial supplier
4.0 Quality Management System								
4.1 General requirements			■	■	■	■		■
4.2 Documentation requirements			■	■	■	■		■
5.0 Management Responsibility								
5.1 Management commitment	■	■	■			■		
5.2 Customer focus	■	■						
5.3 Quality policy	■	■	■		■	■	■	
5.4 Planning		■		■	■	■	■	
5.5 Responsibility, authority and communication	■	■	■	■		■		
5.6 Management review	■	■		■		■	■	
6.0 Resource Management								
6.1 Provision of resources			■					
6.2 Human resources	■		■				■	
6.3 Infrastructure								
6.4 Work Environment			■					
7.0 Product Realization								
7.1 Planning of product realization				■	■		■	
7.2 Customer-related processes	■		■					
7.3 Design and development			■			■	■	
7.4 Purchasing							■	■
7.5 Production and service provision	■			■			■	
7.6 Control of monitoring and measuring devices							■	
8.0 Measurement, Analysis and Improvement								
8.1 General	■			■		■	■	
8.2 Monitoring and measurement	■			■		■	■	
8.3 Control of nonconforming product	■							
8.4 Analysis of data	■					■	■	
8.5 Improvement				■		■	■	

Score: (Luke, 2006).

Fig 2.5 : Matrix of the Five Clauses and Eight Management Principles of ISO 9001 Standard

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter focuses on the methodology adopted for the study, data collection, research tools, sample size and method of analysis used for this research. Research methodology is a systematic way to solve a problem. Essentially, the procedures by which researchers go about their work of describing, explaining and predicting phenomena is called research methodology (Rajasekar, Philominathan and Chinnathambi, 2006).

3.1 Research Methods

According Rajasekar *et al* (2006), Research methods are the various procedures, schemes, algorithms, etc. used in research. They are essentially planned, scientific and value-neutral. They include theoretical procedures, experimental studies, numerical schemes, statistical approaches, etc. Research methods help us collect samples, data and find a solution to a problem. Particularly, scientific research methods call for explanations based on collected facts, measurements and observations and not on reasoning alone. They accept only those explanations which can be verified by experiments. Rajasekar *et al* (2006) maintained that basic and applied research methods could be either qualitative and quantitative approaches. According to De Vos *et al* (2002) cited in (Burn and Grove, 2003), qualitative research refers to any research that elicits participants accounts of meaning, experience or perceptions. It produces descriptive data in participant's own written or spoken words. A quantitative study is concerned with non statistical methods and small purposively selected samples. Polit and Hungler (1999) maintained that a qualitative method is especially useful in exploring the full nature of a little misunderstood phenomenon. Burns and Grove (2003) maintain that text is considered a rich source of data qualitative studies and text

provided by respondents may be a component of a larger study using a variety of sources of data. Rajasekar *et al.* (2006) opined that quantitative research is an approach used by researchers in the social sciences that is more formalised in nature than qualitative research, as well as explicitly controlled, with a more carefully defined scope. Burns and Grove (2003) also described quantitative research as formal, objective, rigorous and systematic process for generating information about phenomenon. Evidences for quantitative study is gathered according to specific plan in which formal instruments are used to collect the needed information. This information is translated into numeric information and analysed using statistical procedure (Polit and Hungler, 1999).

3.2 Research Method Adopted for the Study

This research was carried out using quantitative analysis to obtain data in other to assess quality management practices in building construction firms in Abuja, Nigeria.

3.2.1 Research Design

Burns and Grove (2003) define a research design as "a blueprint for conducting a study with maximum control over factors that may interfere with the validity of the findings".

This research was carried out in five stages as seen in Figure 3.1 with each of the phases representing each of the chapters one to five. The stages are highlighted and explained below;

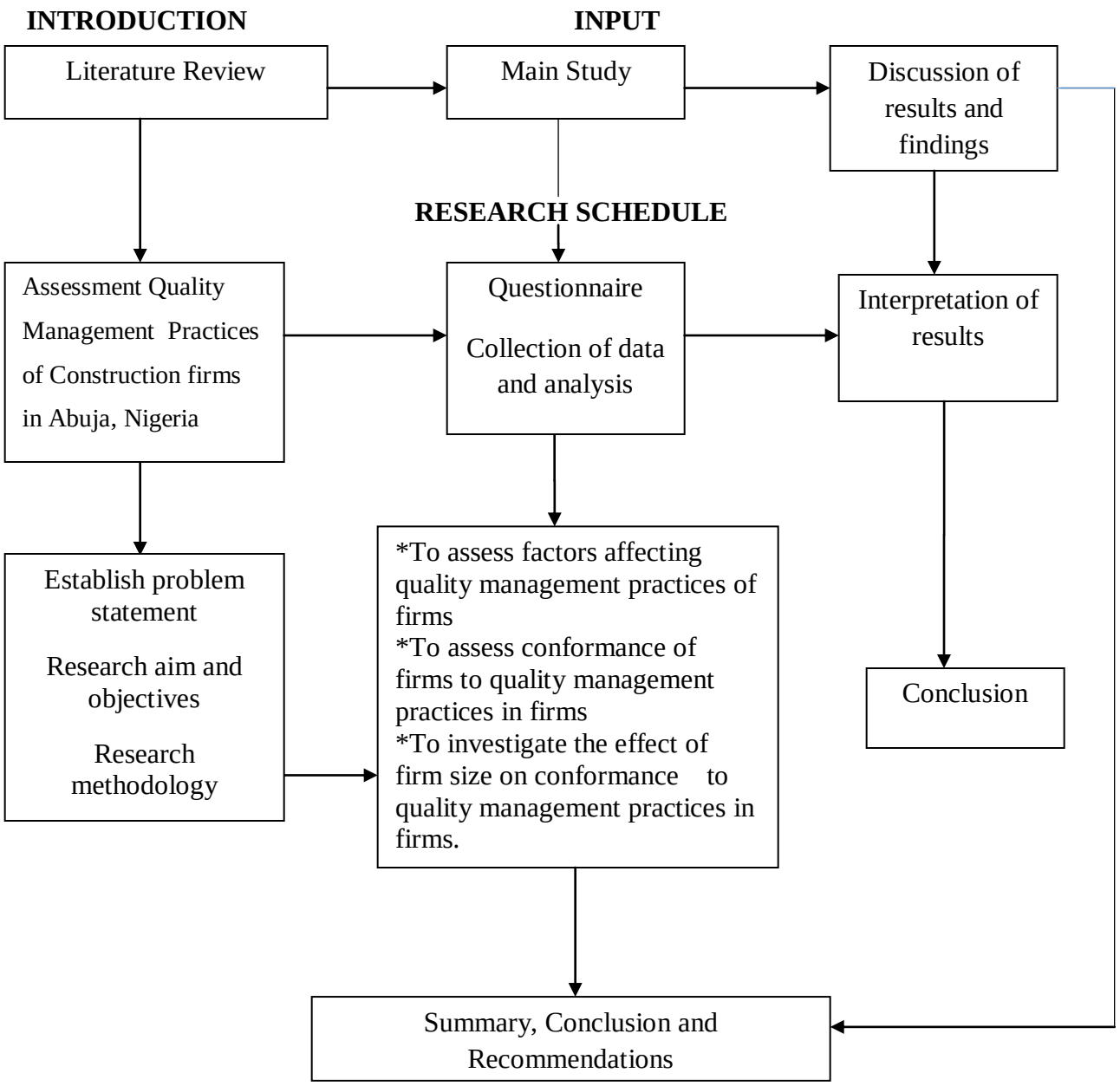
Phases 1: Phase one (1) introduced of the dissertation, it included Preliminary reading, selection of topic, identification of research problem(s), aim and objective of research and determining of scope of research.

Phases 2: The second phase of the research (stage 2) included an extensive review of literature on quality management practices in the building construction industry. It also included review of both global and local materials and sources.

Phases 3: Phase 3 described the methodology used in the research. It focused on the research used to achieve the objectives of this research.

Phases 4: Analysis of results obtained from the questionnaires used is contained in this stage. Discussions were made from data obtained from questionnaires distributed, subsequently inferences were made from the results.

Phases 5: Phase 5 entailed summary, conclusion and recommendation. Summary of the major findings of the research, conclusions were drawn from the various findings and recommendations made on how the problems identified by the research could be addressed.



Sources: (AbdulAzeez, 2012)

Figure 3.1: Research Design

3.3 Data Collection Technique

Questionnaires served as the primary sources of data. Questionnaires were administered to building construction firms registered with Federal Capital Development Authority (FCDA) within Abuja for this research.

3.4 Population Size and Sample frame

The population of the study consists of building construction firms in Abuja. According to FCDA (2012), there are 441 registered construction firms in Abuja Municipal Area Council (AMAC). Therefore, the sample frame of the study was 441 construction firms.

3.5 Sample Size

Purposive sampling which is also known as deliberate sampling or non-probability sampling was used. This sampling method involves purposive or deliberate selection of particular units of the population for constituting a sample which represents the population. In many cases purposive sampling is used in order to access 'knowledgeable people', top management Staff of firms i.e. those who have in-depth knowledge about particular issues, maybe by virtue of their professional role, power, access to networks, expertise or experience (Kado, 2011).

The sample size for firms was calculated using Glenn (2003) formula based on equation for 95% confidence level.

$$n = \frac{n^1}{[1 + \left(\frac{n^1}{N}\right)]}$$

Where:

n = sample size from finite population

n^1 = sample size from infinite population = $\frac{S^2}{V^2}$

Where S^2 is the variance of the population elements and V^2 is a standard error of sampling population, S= 0.1 to 0.5 and V = 0.06

N = total number of population, S= 0.5 was chosen

$n^1 = \frac{S^2}{V^2} = 49.44$, N= 441.

$n = \frac{49.44}{[1+(\frac{49.44}{441})]} = 50$

Therefore the sample frame for the study was used as 50 respondents

n = 50+28 = 78

add at least 30% of n to compensate for non response of questionnaire (Glenn, 2003)

Thus this study considered 78 firms.

3.6 Questionnaire Design

The questionnaire was designed in such a way that each section of the questionnaire contains questions that helped in achieving each of the objectives. The questionnaire was grouped into four sections. The first section focuses on the respondent's profile, it was targeted at gathering useful information about the respondents ranging from the educational background and years of experience to the category of company the respondents belongs to. The second section deals with the respondent's knowledge and involvement in the quality management practices. It gathered information about the firms best define quality, how well quality management works in the firms, level of adoption of quality, firms rating of customer satisfaction, interest in quality management practices, level empowerment of employees in terms of quality changes, satisfaction with quality management measures and forms of quality improvement programme in use. The third and fourth section contains the factors affecting quality management in construction firms and practices that conform with quality management in the various building construction firms respectively, the respondents ranked each variable in these sections.

The target respondents were Executive and Managerial staff of firms, according to (Kado, 2011) this is necessary because they are in the right position to have adequate knowledge for the study regarding Quality management practices and status. Most of the questions in the research instrument entailed ranking some identified variables on a five (5) point likert scale that assessed either frequency of use, significance of the factor and availability of inputs. For example with frequency of use;

1. = Strongly Disagree;
2. = Disagree
3. = Indifferent
4. = Agree
5. = Strongly Agree.

3.7 Data Analysis Techniques

Descriptive and inferential statistics were used for simplicity and clarity. Tables, means, percentage and charts were used to present the results. Data was analysed using SPSS

3.7.1 Relative Importance Index (RII)

Relative importance index was used in the study to rank the factors affecting quality management and also practices that conform with quality management in the various building construction firms which ensures effective service delivery.

$$\textbf{Relative Importance Index (RII)} = \frac{\sum fx}{\sum f} \times \frac{1}{k}$$

Where,

$\sum$fx = is the total weight given to each attributes by the respondents.

$\sum$f = is the total number or respondents in the sample.

K = is the highest weight on the likert scale.

Ranking of the items under consideration was based on their RII values. The item with the highest RII value is ranked first (1) the next (2) and so on.

The rating of all the factors for degree of significance was based on the value of their respective relative importance index (RII).

Mbamali and Okotie (2012), Interpreted of the RII Values as follows:

RII < 0.60, item is assessed to have a low significance.

$0.6 \leq RII < 0.80$, item assessed to have high significance.

$RII \geq 0.80$, item assessed to have very high significance.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND DISCUSSION OF RESULTS

4.1 Data Presentation and Analysis

This chapter addresses presentation and interpretation of data obtained from the field survey, analysis of the data and discussion of findings. The data obtained for the research work is presented and analysed in statistical form, showing the mean, relative importance index and their rank.

4.1.1 Questionnaire Response

In order to achieve the objectives of this research, 78 questionnaires were administered to construction firms within Abuja.

Table 4.1: Distribution of Questionnaires and Work Experience of Respondents

Type of response	Frequency(No.)	Percentage(%)
Number distributed	78	100
Number properly completed and returned	52	67
Number not returned	26	33

Years of Experience	Frequency	Percentage (%)
1-5 years	11	21.2
6-10 years	18	36.5
11-15 years	13	25
16-20 years	5	9.6
20 years and above	4	7.7
Total	52	100

Source : Field Survey (2014)

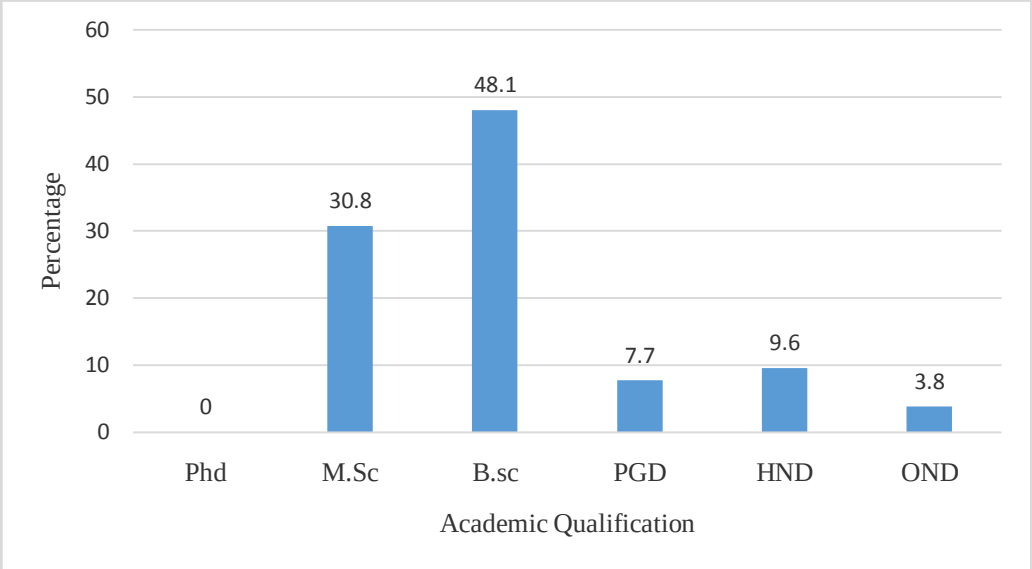
Table 4.1 shows the number of questionnaires administered to Building Construction Firms. Seventy eight (78) questionnaires were administered and Fifty-two (52) were properly completed and returned representing Sixty-seven percent (67%) response. This

percentage can be regarded appropriate and an adequate representation of the population of this study and therefore valid for consideration and use for the study based on the assertion of Albinu and Jagboro (2002) that the result of a survey could be considered as biased and of little significance if the response rate is lower than 30% to 40% of the distributed questionnaire.

4.1.2 Respondents' Profile

This section focuses on the respondents' working experience, educational background and the category of firms.

Table 4.1 shows that 36.5% of respondents have 6-10 years working experience and 20 years and above have the least working experience percentage as 7.7%. Also 25%, 21.2% and 9.6% of the respondents have working experiences of 11-15 years, 0-5 years and 16-20 years respectively. Therefore, the respondents have adequate knowledge and experience.



Source: Field Survey (2014)

Figure 4.1: Academic Qualification of Respondents

The academic qualification of the respondents are summarised in Figure 4.1 of which 30.8% are Master Science (M.Sc.) holders. The other categories of academic qualification are given as follows; First degree 48.1%, Postgraduate Diploma (PGD) 7.7%, Higher National Diploma (HND) 9.6% and Ordinary National Diploma (OND) 3.8%. None of the respondents possesses a Doctorate degree. The academic qualification of the respondents is important and supports the fact that they are knowledgeable and capable of providing the much needed professional judgment required for the credibility of the data collected for the research.

4.2 Firms Involvement in Quality Management

This section considers the involvement of the respondents in Quality management practices in their various construction firms. It also takes into account the respondents' awareness of quality management. It was relevant to ascertain the firms' knowledge on the importance of quality management provision in building construction. Furthermore inquire the measures put in place in attainment of standard quality practices in other to ensure effective service delivery in building construction projects. Firms were asked to rate their participation in quality management, level of satisfaction with quality practices in Abuja. Lastly, Firms were asked about the type of quality management they are involved in.

Table 4.2: Satisfaction with Quality Practices

Type of response	Frequency	Percentage (%)
Highly dissatisfied	5	9.8
Dissatisfied	2	3.9
Neutral	5	9.8
Satisfied	22	43.1
Highly satisfied	17	33.3
Total	52	100

Source: Field Survey (2014)

Table 4.2 Shows 43.1% of firms are satisfied with quality management being practised in their firms, also 33.3% are highly satisfied. While 9.8%, 3.9% and 9.8% are neutral, dissatisfied and highly dissatisfied with the quality standards adhered to in their firms respectively.

Table 4.3: Firms Awareness of the need for Quality Management Practices

Type of response	Frequency	Percentage (%)
Yes	52	100
No	0	0
Total	52	100

Source: Field Survey (2014)

Table 4.3 summarizes the category of awareness of Quality Management, it shows 100% the respondents are aware of the need for quality management in construction firms,. This shows all of the respondents are fully informed on the need for quality management in construction firms.

Table 4.4: Firms perception of Quality Management as Feasible

Type of response	Frequency	Percentage (%)
Yes	48	92
No	4	8
Total	52	100

Source: Field Survey (2014)

Table 4.4 presents the firms' perception of the viability and feasibility of involvement in quality management. As seen in the table 92% of firms see quality management as feasible and viable practise, while 8% see otherwise.

Table 4.5: Interest of Firms to Implement Quality Management Practices

Type of response	Frequency	Percentage (%)
Yes	52	100
No	0	0
Total	52	100

Source: Field Survey (2014)

From Table 4.5, From the results above, it shows clearly that 100% of the firms visited are aware of the importance of quality management in construction and are interested in adopting quality management measures in order to achieve effective service delivery.

Table 4.6: Empowerment of Employees to make Quality Changes

Type of response	**Frequency**	**Percentage (%)**
Fully empowered	15	29.4
Only key officials	26	51
No empowerment	8	15.7
Indifferent	2	3.9
Total	52	100

Source: Field Survey (2014)

From table 4.6 it is seen that only 29% of employees are fully empowered to carry out quality changes, while 51% of firms have key officials empowered. It is also seen that 16% and 4 % of employees have no empowerment and are indifferent respectively.

Table 4.7: Types of Quality Improvement Systems Firms are involved with

Type of response	**Frequency**	**Percentage (%)**
TQM	7	13.7
ISO 9001	12	23.5
Quality Assurance	13	25.5
Others	8	15.7
None	11	21.6
Total	52	100

Source: Field Survey (2014)

Table 4.7 shows involvement in quality improvement practices firms are involved in. According to ASCE 2005 Quality can be defined as meeting the legal, aesthetic and functional requirements of a project. Requirements may be simple or complex, or they may be stated in terms of the end result required or as a detailed description of what is to be done. With this definition of quality it is imperative to relate the above with the current quality practises in Nigeria. According Basimile, (2004) and Kado, (2011) the is no standard form of quality practice neither is there a confirmation from the Standards organisation of Nigeria (SON) as to the authenticity of claims by Nigerian construction firms to claims of conformance to the any quality practices. However results shows that 13.7% of firms utilize TQM which is the least also 25.5% of firms use Quality Assurance which has the highest percentage. 23.5% and 15.7% make use ISO 9000 and others respectively while 21.6% are not involved in any form of quality management practice.

4.3 Factors Affecting Quality Management in Construction Firms

Table 4.8 shows the factors affecting quality management in the construction firms in Abuja and has been ranked accordingly. The highest ranked factors with the values of RII $\geq$ 0.80, regarded as a factors with very high significance because the relative important index (RII) is greater than 0.8 were Adequacy of site personal and Certification of material which ranked highest with relative performance index (RII) of 0.87, while Adequacy of project control having a relative performance index (RII) of 0.86 ranked second. Knowledge of project, Site personnel, Material quality, Project quality, Adequacy of delivery, Adequacy of design ranked fourth, fifth, sixth, seventh, eight and ninth respectively with values of relative important index (RII) above 0.80 having high significance. Progress review meeting, Scheduling, Estimation, Time completion, Risk assessment, Interaction among

professionals, Site safety, Site cleanliness, Testing procedure, Project close out, Adequacy of storage ranking tenth, eleventh, twelfth, thirteenth, fourteenth, sixteenth, seventeenth, eighteenth, nineteenth, twentieth and twenty first respectively. With only Adequacy of security ranking last with relative performance index (RII) < 0.6 which is assessed to be of low significance.

Based on the above results of the study, it can be seen that Adequacy of site personnel and Adequate project control are key challenging factors affecting quality management in construction firms.

Table 4.8: Firms' perception of Factors Affecting Quality Management

Management Factors	Frequency Response					No	Total Score	Score	RII	Rank
	1	2	3	4	5					
Adequacy of site personnel	-	-	5	26	21	52	224	4.31	0.87	1
Certification of materials	-	2	4	22	24	52	224	4.31	0.87	1
Adequacy of project control	-	3	3	24	22	52	221	4.31	0.86	3
Knowledge of project	-	4	4	21	23	52	219	4.21	0.84	4
Material quality	-	2	7	22	21	52	218	4.19	0.84	4
Quality of workmanship	-	1	7	20	23	52	218	4.19	0.84	4
Project quality	1	1	10	20	20	52	213	4.10	0.82	7
Adequacy of delivery	1	2	5	31	13	52	209	4.08	0.82	7
Adequacy of design	1	2	7	27	15	52	209	4.02	0.80	9
Progress review meetings	-	2	10	28	12	52	206	3.96	0.79	10
Scheduling	1	3	12	21	15	52	202	3.88	0.78	11
Time completion	3	4	7	22	16	52	200	3.85	0.77	12
Estimating	1	8	7	18	18	52	200	3.85	0.77	12
Risk assessment	2	6	7	27	10	52	193	3.71	0.74	14
Site safety	1	5	14	25	7	52	188	3.62	0.72	15
Interaction of professionals	2	6	12	23	9	52	187	3.60	0.72	15
Site cleanliness	1	7	14	22	7	52	167	3.48	0.70	17
Testing procedure	2	8	17	14	11	52	180	3.46	0.69	18
Project close out	3	10	18	15	6	52	188	3.21	0.64	19
Adequacy of storage	4	11	18	15	4	52	160	3.08	0.62	20
Adequacy of security	3	10	18	15	6	52	151	2.90	0.58	21

Source: Field Survey (2014)
Key: 1- Strongly Disagree, 2- Disagree, 3-Somewhat Agree, 4- Agree, 5- Strongly Agree

4.4 Quality Management Practices that Firms Conform with

Table 4.9 presents the quality management practices that building construction firms conform with. On site supervision of the construction process has been ranked as the highest with the relative importance index (RII) as 0.87. Quality appraisal, Education of

employees on quality, Compliance to quality standards, Customer satisfaction, Motivation of employees, Adequacy of employee training, Budgetary allocation, Staff training and Proper planning ranked second, third, fourth, fifth, sixth, seventh, eighth, ninth and tenth respectively with relative importance index (RII > 0.8) which is assessed to be of very high significance. While Personnel management, Qualification of employees, Team work among professionals. Attention to clients needs and Administration of change order are ranked eleventh, twelfth, thirteenth, fourteenth and fifteenth respectively with relative important index (RII) assessed to be of high significance.

As shown in the results below, on site supervision and quality appraisal are very essential to the enhance conformance to quality management of Building construction firms.

Table 4.9: Firms' Ranking of Quality Management Practices they Conform with

Management Practices	Frequency Response					No	Total Score	Score	RII	Rank
	1	2	3	4	5					
On site supervision	-	1	7	15	29	52	228	4.38	0.87	1
Quality appraisal	-	2	5	19	24	52	220	4.23	0.84	2
Education of employees on need for quality	-	2	7	21	22	52	219	4.21	0.84	3
Compliance to quality standards	1	3	5	22	21	52	216	4.13	0.83	4
Customer satisfaction	1	3	4	24	20	52	215	4.13	0.83	5
Motivation of employee	3	2	5	20	22	52	212	4.08	0.81	6
Adequacy of employee training	1	5	5	21	22	52	210	4.04	0.81	6
Budgetary allocation	2	1	9	19	21	52	212	4.08	0.81	6
Staff Training	1	5	5	22	19	52	209	4.02	0.80	9
Proper planning	2	2	9	20	19	52	208	4.00	0.80	9
Personnel management on site	2	3	9	22	16	52	203	3.90	0.78	11
Qualification of employee	2	4	9	23	14	52	199	3.83	0.76	12
Teamwork among workers	2	3	13	21	13	52	196	3.77	0.75	13
Attention to client needs	1	5	11	20	15	52	199	3.83	0.76	14
Administration of change order	6	6	23	15	2	52	157	3.02	0.60	15

Source: Field survey 2014
Key: 1- Strongly Disagree, 2- Disagree, 3-Somewhat Agree, 4- Agree, 5- Strongly Agree

4.5 Effect of Firm Size on Practices they Conform with to Enhance Quality Management

Table: 4.10 shows the highest significantly ranked practices by the large firms as Compliance to quality standards with (RII=0.89), Quality appraisal, On site supervision, Customer satisfaction, Education on need for quality, Budgetary allocation, Staff training, Team work and Attention to clients needs also ranking as highly significant. While the

medium sized firms ranked On site supervision (RII=0.92) as highest and employee training, Customer satisfaction, Quality appraisal, Need for education of quality, Budgetary allocation, Employee training, Compliance to Standards and the small sized firms ranked customer satisfaction, Proper planning, Team work, Motivation of Employees and personnel management also as highly significant. Small firms ranked Customer Satisfaction (RII=0.86) as the most significant practice with Education on need for quality, Quality appraisal, On site supervision, Budgetary allocation, Proper planning, Personnel management, staff training also ranking as highly significant.

Table 4.10: Effects of Firm Size on Ranking of Practices that Firms Conform with to Enhance Quality Management

Management Practices	Small Size Firms		Medium Size Firms		Large Size Firms		Mean RII	Final Rank
	RII	Rank	RII	Rank	RII	Rank		
On site supervision	0.82	4	0.92	1	0.86	2	0.87	1
Customer satisfaction	0.86	1	0.86	3	0.86	2	0.86	2
Quality appraisal	0.83	3	0.85	4	0.86	2	0.85	3
Education on need for quality	0.85	2	0.84	6	0.83	5	0.85	4
Compliance to quality standards	0.77	9	0.85	4	0.89	1	0.84	5
Budgetary allocation	0.82	4	0.80	8	0.83	5	0.82	6
Staff training	0.82	6	0.80	8	0.80	9	0.81	7
Adequacy of employee training	0.76	11	0.88	2	0.77	13	0.80	8
Proper planning	0.80	8	0.80	8	0.80	9	0.80	9
Motivation of employee	0.77	9	0.80	8	0.78	11	0.78	10
Personnel management	0.82	6	0.80	8	0.71	14	0.77	11
Qualification of employee	0.73	12	0.78	13	0.79	12	0.77	12
Attention to client needs	0.70	13	0.78	13	0.83	5	0.77	12
Team work among workers	0.63	14	0.82	7	0.82	8	0.76	13
Administration of change order	0.59	15	0.64	15	0.57	15	0.60	14

Source: Field Survey (2014)

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary of the Findings

The summary of the results of this study are as follows.

1. Inadequacy of site personnel (RII=0.87), certification of material (RII=0.87) and inadequate project control (RII=0.86) are the most important challenges faced by firms in achieving quality delivery in building construction projects.
2. Firms perceive these practices; on site supervision of construction process (RII=0.87), education of employees on quality standards (RII=0.84), constant quality appraisal by firms (RII=0.84), conformance to relevant quality standards (R=0.83) and customer satisfaction (R=0.81) would enhance the quality management and improve construction service delivery.
3. Large firms ranked compliance to quality standards (RII=0.89) as most important, while medium sized firms and small size firms ranked on site supervision (RII=0.92) and customer satisfaction (RII=0.86) as most important practices respectively.

5.2 Conclusion

Based on the objectives of the research stated, the following conclusions were made in relation to the findings:

1. The main factors affecting quality management of building construction firms include; inadequacy of site personnel, adequate knowledge of project, poor material quality and poor quality of professionals and workmanship.

2. The major practices that firms conform with to enhance quality management are; proper site supervision, training of employees on the need for quality, quality appraisal and compliance to quality standards.
3. No significant different in the effect of firm size was discovered on the overall ranking of conformity to practices that improve quality management, however there were variations in the ranking by firms on the most important practices. Large firms ranked compliance to quality standards as most important, while medium sized firms and small size firms ranked, on site supervision and customer satisfaction as most important practices respectively.

5.3 Recommendations

Based on the results of the studies carried out, the following recommendations were made;

1. Firms should ensure all site personal are adequately qualified to delivery on the tasks assigned to them, materials used on site should be properly certified before usage and all stakeholders on a project should posses adequate information and full knowledge of such project before work commences.
2. Firms need to invest more in the education and training of employees on quality management systems and the need to adhere to suitable quality management practices, also firm need to ensure all employees in charge of supervision on site are adequately qualified for such positions, firms should also embark on frequent quality appraisal of their activities and comply to laid down industry standards.
3. A frame work needs to be developed for effective quality management to ensure uniformity in Nigerian building construction project delivery by firms.

5.4 Contributions to Knowledge

1. This research identified the major factors affecting quality management practices in building construction firms in Abuja.
2. The study has provided an insight into the main quality management practices building construction firms in Abuja adhere to.
3. The study established that there are variations in the importance firms attach to conformance of different quality management practices due to their sizes.

5.5 Recommendation for Further Research

1. A frame work needs to be developed for quality management practices that suits building construction projects in Nigeria.

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APPENDIX I

QUESTIONNAIRE TO CONSTRUCTION FIRMS

Assessment of Quality Management Practices of Building Construction firms in Abuja, Nigeria.

Department of Building, Ahmadu Bello University Zaria, Kaduna State.

SECTION A (Profile of Respondents)

1. Name of Company;

_____

2. Profession
   - ☐ Architect
   - ☐ Builder
   - ☐ Engineer
   - ☐ Surveyor
   - ☐ Others (Specify) _____

3. Company size
   - ☐ Small 1 - 9
   - ☐ Medium 9 - 99
   - ☐ Large 100 Above

4. Age of Company
   - ☐ 1-5 Years
   - ☐ 5-10 Years
   - ☐ 10-15 Years
   - ☐ More than 15 Years

5. Level of qualification
   - ☐ Ordinary National Diploma
   - ☐ Higher National Diploma
   - ☐ Degree
   - ☐ Master's Degree
   - ☐ Doctorate Degree

Others _____

SECTION B : (Assessment of Firms involvement in Quality Management Practices)

6. In your view, which of these best defines quality?
   - ☐ Expensive
   - ☐ Satisfying the company
   - ☐ Satisfying the Costumer
   - ☐ Appearance

- ☐ Increased profit
- ☐ Value for money

7. Do you feel Quality Management will/does work in your organisation?
   - ☐ Very well
   - ☐ To some extent
   - ☐ Won't work
   - ☐ Can't say
8. How would you rate customer satisfaction?
   - ☐ Very important
   - ☐ Important
   - ☐ Somewhat important
   - ☐ Not important
   - ☐ Can't say
9. Rate the statement, Your Organisation is interested in Quality Management?
   - ☐ Strongly Agree
   - ☐ Agree
   - ☐ Neutral
   - ☐ Disagree
   - ☐ Strongly Disagree
8. Are employees empowered to make significant change in operations
   - ☐ Fully empowered
   - ☐ Only key employees are empowered
   - ☐ Empowerment not needed
   - ☐ Can't say
9. Are you satisfied with the Quality Management measure in your organisation?
   - ☐ Highly Satisfied
   - ☐ Satisfied
   - ☐ Dissatisfied
   - ☐ Highly Dissatisfied
   - ☐ Can't say

10. What form of quality improvement programme is in use in your organisation?
    - ☐ Total Quality Management
    - ☐ ISO 9000
    - ☐ Quality Assurance/Quality Control
    - ☐ Others (please specify)

      _____

11. Which of the following factors would/provided the need for Quality Management?
    - ☐ Pressure from competitors
    - ☐ Demanding customers
    - ☐ Environmental condition

- ☐ Company Management
- ☐ Need to reduce cost

SECTION C (Factors Affecting Quality Management of Building Construction Firm of Abuja)

Please rank appropriately the factors affecting quality management

Management Factors	**Ranks**				
	Strongly Agree	Agree	Neutral	disagree	Strongly disagree
1. Project quality					
2. Material quality					
3. Adequacy of job site personnel					
4. Time completion of each phase					
5. Knowledge of project					
6. Quality of workmanship					
7. Site cleanliness					
8. Project close out					
9. Site safety					
10. adequacy of security					
11. Adequacy of storage					
12. Adequacy of delivery					

	Strongly Agree	Agree	Neutral	disagree	Strongly disagree
13. Adequacy of project Control					
14. Adequacy of Design					
15. Testing procedures on job site					
16. Certification of materials					
17. Progress review meetings					
18. Estimating					
19. Scheduling					
20. Interaction of Professionals					
21. Risk assessment					

Others _____

SECTION D (Firms' Conformance To Quality Management practices in Abuja)

Please rank appropriately quality management practices you conform to

Management Practices	**Ranks**				
	Strongly Agree	Agree	Neutral	disagree	Strongly disagree
1. On-site supervision					
2. Attention to needs of Clients					
3. Proper planning					
4. Adequacy of employee training					
5. Administration of change order					
6. Personnel management on site					
7. Team work among workers					
8. Education of employees on the need for quality					
9. Compliance to standards of relevant agencies					
10. Customer Satisfaction					
11. Motivation among employees					
12. Qualification of Employees					
13. Budgetary allocation					
14. Quality appraisal					
15. Staff training					

Others _____

APPENDIX II

Elements of ISO 9001 Standard

ISO 9001 Elements	Quality Functions Required	
1	Management responsibility	Define document and quality policy, responsibility, and provide adequate resources. Appoint quality manager. Review quality systems on a regular basis.
2	Quality system	Establish document and maintain quality system Prepare and effectively implement documented procedures.
3	Contract review	Review tender before submission. Review contract before signing. Review variation order before acceptance and transfer amended requirements to functions concerned.
4	Design control	Plan design activities. Identify and review design input Review, verify, and validate design input.
5	Document and data control	Review and approve document changes prior to issue. Control distribution and updating of documents.
6	Purchasing	Evaluate and select subcontractors on basis of capabilities for quality. Verification and product release of subcontractors product.
7	Control of customers‟ supplied product	Control verification, storage, and maintenance of customer-supplied product.
8	Process control	Identify, plan, and control procedures and suitable equipment. Assign qualified personnel to carry out specific processes.
9	Inspection and testing	Conduct inspection and testing of materials and components. Conduct in-process inspection and testing of semi-finished work in accordance with quality plan.
10	Inspection and test status	Indicate by suitable means the conformance or non-conformance of product or work with regard to inspect and performed.

11	Control of non-conforming products	Identify and segregate any nonconforming product or work. Inspect and/or test the product or work again after repair.
12	Corrective and preventive action	Investigate cause of nonconformities Take corrective/preventive action. Implement and record changes.
13	Control of quality records	Maintain quality records to identifiable, retrievable and secured against damage, deterioration, or loss.
14	Internal quality audits	Plan and schedule internal quality audits. Assign independent personnel to carry out internal quality audits. Conduct follow-up audits if necessary
15	Training	Identify training needs of staff, Provide training where required.

Source: Willar, (2012).