



JIMMA UNIVERSITY

JIMMA INSTITUTE OF TECHNOLOGY

SCHOOL OF GRADUATE STUDIES

FACULTY OF CIVIL AND ENVIRONMENTAL ENGINEERING

CONSTRUCTION ENGINEERING AND MANAGEMENT CHAIR

**STUDY ON QUALITY MANAGEMENT IMPROVEMENT USING DEMING'S
PRINCIPLE ON BUILDING CONSTRUCTION IN JIMMA CITY.**

A Thesis submitted to School of Graduate Studies, Jimma University, Jimma Institute of Technology, Faculty of Civil and Environmental Engineering in Partial Fulfillment of the Requirement for the Degree of Master of Science in Construction Engineering and Management.

By
Mosisa Shuma Chefo

March, 2021
Jimma, Ethiopia.

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March, 2021

Jimma, Ethiopia.

DECLARATION

I declare that this research entitled “Study on quality management improvement using Deming’s principle in building construction in Jimma city” is my own work, and has not been submitted as the requirement for the award of any degree in university or elsewhere.

Mosisa Shuma chefo _____

Signature

Date

As research advisor I hereby certify that I have read and evaluated this thesis paper prepared under my guidance by Mosisa Shuma Chefo entitled “Study on quality management improvement using Deming’s principle in building construction in Jimma city” and recommend it would be accepted as fulfilling requirement for the degree of Master of Science in construction engineering and management.

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ABSTRACT

Improvement in the quality of construction project is linked with quality management in the project life cycle because of this seeking the way of enhancement of quality management is very essential. In developing country construction industry is often criticized by low productivity, poor performance and poor quality. Great expenditures of time, money and resources, both human and material, are wasted each year because of inefficient or nonexistent quality management procedures. The purpose of this study was to identify factors influencing quality management and how to improve quality management in building construction projects in Jimma city. The study was both descriptive and exploratory research with the aim of examining the factors contributing to poor quality management in one hand and how quality management can be enhanced in other hand. The target population of the study was contractors and consultants to some extent. Since the total population was small the researcher did not sample hence used census that is capturing the entire population of the contractors and consultant. Questionnaire and interview methods were used for data collection. Data was coded; tabulated and analyzed using spears man correlation and other relevant method based on the study objectives. Descriptive statistics were computed and study findings presented using percentages and tables and interpretations. The study revealed that lack of quality management strategy (MS=4.46), lack of technical expertise (MS=4.39), lack of training and skills (MS=4.25), improper planning and scheduling (MS=4.22), limited financial capabilities (MS=4.17) and lack of well-defined organizational structure (MS=4.17) are among top factors influencing quality management in the study area with the stated mean score. Also the study revealed that only 41.67% of contractors set quality policy and ISO 9001 and quality control/assurance are practiced as the quality management system by contractors operating in the study area. In case of Deming's principles the study found that the principles are not widely utilized by the contractors in the study area. Finally the study revealed that, by incorporating those principles in to the existing quality management system, the current quality management practice can be improved.

Key Words: *Deming's principle, Quality, quality management, quality management improvement.*

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ACRONYMY

ASCE	American Society of Civil Engineering
CII	Construction Industry Institute
CQP	Company Quality Profile
EC	Ethiopian Calendar
GC	Gregorian Calendar
GDP	Growth Domestic Product
HRM	Human Resource Management
ILO	International Labor Organization
ISO	International Standard Organization
MUDC	Ministry of Urban Development and Construction
MS	Mean Score
QA	Quality Assurance
QMS	Quality Management System
SMART	Specific Measurable Achievable Realistic Timely
SQC	Statistical Quality Control
WTO	World Trade Organization

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Construction industry in Ethiopia is the major sector where public and private sectors are investing huge amount of fund. The percentage share of the construction sector to GDP at constant basic price has increased from 4.3% in 1993 E.C to 5.8% by 2002 E.C. (MUDC, 2012). According to the policy enacted by Ethiopian ministry of urban development and construction, Ethiopia is embarked on long term development strategy which aims at achieving sustainable human development with all pre-requisite for middle income country by the year 2025. The priorities identified as the essential catalyst for the attainment of the Vision 2025 objective include development of infrastructure as an important ingredient towards attainment of faster economic growth. Thus, MUDC states that the realization of Vision 2025 partly depends on the existence of a reliable and competitive local construction industry that is capable of delivering quality services and value for money in the development and maintenance of the physical infrastructure. However the quality management practices become the challenging area as a global in general and as a local in particular.

To deliver quality work to the clients and the public and to achieve the stated vision, great attention must be paid to quality management. The potential of achieving quality is in the hand of top management. Their commitment to quality improvement is very essential. According to Sherif (2010), achievement of successful quality management is highly dependent on the levels of top management commitment.

At different time various quality management principles have been developed. Among those quality management improvement principles the most commonly recognized and fame principles is the one developed by W. Edward Deming's. They are highly used in manufacturing industry of United State of America and Japan. Also some construction industries are adopted and used them. According to Knowles (2011), Deming's principles worth greater consideration than other pioneers, because his was by far the most transformational vision and he saw the need for total transformation of management practice.

1.2 Statement of the Problem

In developing country construction industry is often criticized by low productivity, poor performance and poor quality. Flett (2001), Stated in his study that quality is often claimed as the third (3rd) dimension of any project, the success of a project depends on the management of time, cost and quality. However, quality is a much more elusive substance and its management can be problematic. Whereas, (Mallawaarachchi and Senaratne, 2015) state that attainment of acceptable levels of quality in the construction industry has long been a problem. Great expenditures of time, money and resources, both human and material, are wasted each year because of inefficient or nonexistent quality management procedures. In other case, Chin-Keng and Hamzah (2011), quality management is critically required for a construction company to sustain in current construction market which is highly challenging and competitive.

Farooqui and Ahmed (2009), in their finding state that, quality is the job of the top management to have commitment to it. Quality culture cannot be developed without the initiative of them. They are the one who can create the environment and the employees tend to adapt to it. Agbenyega (2014), in his study in Ghana building construction firms revealed that; the challenges encountered during the implementation of quality management are lack of effective supervision lack of effective communication, lack of management's commitment to quality assurance, lack of proper equipment available for use and lack of a quality assurance team to lead.

Chin-Keng and Hamzah (2011), found that in construction industry implementation of quality management is greatly perceived as a means to fulfill contractual obligations instead of satisfying the needs of clients. Also, in terms of quality management tools and techniques, construction companies are commonly using the traditional methods such as experiments and inspections. However, implementation of the quality management system (QMS) is an important milestone for any construction company because sustainable development of the company and its competitiveness are directly dependent on the proper functioning of the QMS (Lukichev and Romanovich, 2016). Also Acikara et al. (2017), support the above idea stating that "lack of quality management policy or limited participation of project participants to quality management process will both negatively affect the management of the project and

competitiveness of the firms. This will also decrease the survival potential of construction firms within the industry.”

Hence, to overcome this problem and to become pioneer in their field many organizations are implementing Deming's principles in construction industry. The reason why they choose Deming's principle is that “Deming's principles worth greater consideration than other pioneers, because his was by far the most transformational vision and he saw the need for total transformation of management practice” Knowles. Also, Lucatelli (2012) gives his word to the Deming's principles stating “Deming's quality system is a practical solution to the deep philosophical ambiguities in nature uncovered by the in-depth thinking of various pioneers individual in the area of quality management.”

Though, as construction industries in different countries are improving their quality management practice using Deming's principles and since “poor quality in construction projects is a common phenomenon in the world” (Ali and Wen 2011), it is really essential to study how to improve the quality management in local construction firm using Deming's principles.

Thus, abovementioned study and reports demonstrates requirement of quality management clearly, so this research was therefore sought to look into the factors influencing quality management of building construction in Jimma city and strived to provide insight information regarding the current practice of quality management system in the study area and addresses how to improve quality management in the study area using Deming's principles.

1.3 Research Questions

The questions that are addressed by this research are:

1. What are the factors affecting quality management of building construction projects?
2. What system does the contractors of building construction practices to enhance quality management of the building projects?
3. Do the contractors in building construction projects aware and utilizing Deming's principles?
4. How quality management of building construction would be enhanced by Deming's principles?

1.4 Objectives of the study

1.4.1 General objective

The general objective of the study was to assess how to improve building quality management in Jimma city by using Deming's principle.

1.4.2 Specific Objectives

- ✓ To identify factors affecting quality management of building construction project in Jimma city.
- ✓ To assess the quality management systems that is being practiced in building construction in Jimma city.
- ✓ To assess the usage of Deming's principle in building construction quality management in Jimma city.
- ✓ To describe improvement way of building construction quality management by Deming's principles.

1.5 Scope and limitation of the study

The study was focused on how to enhance building quality management in Jimma city. First, the factors that are resulted in poor quality management are identified from literature and made to be rated by consultant and contractors. Then thorough study was undertaken on contractors companies regarding quality management practice and their quality profile and how to improve quality management by using Deming's principles. Hence, this study was limited to address the issues that are stated in the objectives.

Spatially, the research were undertaken in case of Jimma city and thematically it ranges from identifying the factors that are affecting the quality of building construction projects to its enhancement by using Deming's principles.

There are some limitations to the study. Firstly, no well-organized data is available at the city construction office to acquire accurate population of the contractors and other firms of the subject in the study area. Hence, moving around the city was compulsory to gain the firms constructing building construction. Hereafter, covering all entity in the area become difficult. Thus, limiting the sample size to recommendation of the city construction office to acquire comprehensive data is the top limitation which might have an impact on the general output of the study. Secondly, as company quality profile is obtained from head office, the time to gain the intended data becomes elapsed as the head office of entity undertaking the operation is varied.

1.6 Significance of the study

This study would have a great significance to all parties in the industry and also for academics. Hence, it could provide the factors contributing to poor quality management of building construction and how the quality management of building construction can be enhanced by using the fourteen (14) principles developed by W. Edward Deming thoroughly to all parties in construction industry. Also, it would encourage the parties in construction industry to adapt different philosophy in other industry to improve their performance. Academically it would be utilized as initial information for further detail study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Conceptual Framework of Quality

There is no single commonly accepted definition of quality. For each and every one of us the concept of quality is varied from each other. Nonetheless, according to oxford dictionary, quality means the degree of goodness or worth or the degree of excellence of the thing. Also, Ethiopian standard agency (2010) defines quality as “the general characteristics of products or services which describe the level of fulfillment of those direct and indirect requirements”. The product or service may be of high quality but because of affordability it may fail to attain customer need or it may be of inferior quality and it may meet customer satisfaction. According to Rad and Khosrowshahi (1998), to attain concrete definition of quality it needs to examine from different perspectives and usage that is from producer, end user and third party perspective. In case of Deming, it is satisfying the customer, not merely to meet the expectation but to exceed them. Montgomery (2009) in his book titled introduction to statistical quality control he defined quality as fitness for use.

In construction industry, quality can be defined in various ways like: the conformity to the specification, meeting functional requirement, aesthetic requirement and legal requirement. When we access the definition forwarded by construction related institution like American Society for Civil Engineering Association (ASCE) and Construction industry institute (CII), ASCE(2012) defines quality as “conformance to predetermined requirement” whereas CII defines as ”conformance to established requirement”. Both institutions cogently support quality to be the achievement of the requirement. Arditi and Gunayidin (1997) stated that, in construction industry, quality can be defined as meeting the requirement of the designer, the constructor and regulatory agencies as well as the owner. On behalf of Ambika and Shokona (2015), for construction projects quality means making sure the thing are done according to plans, specification and requirement. Both the definition stated above can be supported by the quality characteristics stated by American society of civil engineering (ASCE).

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According to ASCE quality can be characterized by:

- Meeting the requirement of the owner as to functional adequacy; completion on time and within budget, life cycle cost and operation and maintenance.
- Meeting the requirement of design professional as to provision of well-defined scope of work; budget to assemble and use a 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.
- Meeting the requirement of the constructor as to provision of contract plan, specification and other document prepared in sufficient detail to permit the constructor to prepare priced proposal or competitive bid; timely decision by the owner and the design professional on authorization and processing of change order; fair and timely interpretation of contract requirement from field design and inspection staff; and contract for performance of work on a reasonable schedule which permits a reasonable profit.
- Meeting requirement of regulatory agencies (the public) as to public safety and health; environmental consideration; protection of public property including utilities; and conformance with applicable laws, regulations, codes and practices.

According to ISO 9001:2015, deviations in desired quality or specific client requirements in a construction process are referred as nonconformities. The organization is required to fix the detected nonconformities, identify their causes, plan and implement corrective action to eliminate the causes of nonconformities.

Now days, it is common to observe poor quality building project which are characterized by collapse, crack, dissatisfaction of dwellers to occupy and etc. That is why Ethiopian construction industry policy (2012) briefly pointed that the project executer's i.e. local consultants and contractors are facing low productivity and poor quality of services. Hence, due to growing quality demands by customers, the local construction industry must mount a productivity and quality improvement revolution through improved quality management system to achieve international competitiveness.

2.2 Reviews on Quality Management

If quality is the end point, quality management is the approach and process for getting there. According to More et al. (2017), the recent trend of adopting quality management strategies to improve work quality has benefited many industries. Quality management has been an important component of the overall organizational movement for the past twenty years (Lee et.al. 2003). From the perspective of a construction company, quality management in construction projects should mean maintaining the quality of construction works at the required standard so as to obtain customers' satisfaction that would bring long term competitiveness and business survival for the companies (Tan & Abdul-Rahman, 2005) as cited in Chin-Keng (2011).

According to (Laszlo 2000), as cited by Sherif (2010) quality management is the quality of management. Which contains leadership, communication, team work and ability to change and improve and pleasing the customer. Sherif, reinforces the above idea stating that "Successful quality management is highly dependent on the levels of top management commitment", adding management has to take the leading role in all aspects related to quality management and improvement; it also has to devote enough time to these issues and show visible commitment to them by their actions.

For Deming, top managements are responsible for most quality problems. Likewise, the potential of quality improvement is laid in the hand of top management. Rework and delay are not acceptable in construction industry. Like manufacturing industry construction industry must focus on process improvement. Thus quality policy which is essential for overall quality intentions and direction of an organization, determined by top management is required. The ISO 9001:2015 quality standard specifies that, a quality policy will be appropriate to the purpose of the organization, provide a framework for establishing quality objectives, and be communicated and understood within the organization. Also it specifies that objectives (goal) should be measureable and consistent with the quality policy.

Syaj (2015), in her research undertaken in Palestine found that most of the company operating there has no quality policy. Hence, to overcome this, the argument forwarded by Bawane (2017), which argues that, construction industry in developing country suffers from inherent problems, so challenge of resolving the issue of construction quality and its

management lies in seeking the long lasting solutions though a strategically devised approach and guiding every action by a well-defined quality policy, can be considered as the best recommendation.

The target of quality management is maintaining of quality of construction work, so it is mandatory to know how to achieve that. Hence, according to Montgomery (2009), maintaining quality means reduction of variability, which means reducing the difference between an ideal and an actual. Achieving an ideal is not an easy task but by continuous improvement we can reduce its variation. Arditi and Gunayidin (1997) found that, there is a great potential in construction industry. In today's competitive world quality and its concept are vital for construction industry.

Arditi and Gunayid (1997) found that, management commitment to continuous quality improvement, management leadership in promoting high process quality; quality training of all personnel; efficient teamwork to promote quality issues at corporate level; and effective cooperation between parties taking part in the project are generic factors that affect process quality. Shahraki et al. (2018), in their study observe that, an important factor in maintaining and controlling quality and reinforcement of building is continuous supervision. Rustom and Amer (2003) found that, the most significant factors affecting building construction are; experience of site staff, consistency of design document, the financial power of the contractor, availability of construction material, subcontractors and the control system used.

Management toughness in improving quality of construction project by continuously improving each factor plays enormous role in attaining the intended requirement. Jha and Iyer (2006) in their research even though they found many factors affecting quality of construction project they strongly suggest that competence of project managers and top management plays great role in achieving the predetermined requirement.

Implementation of the quality management system (QMS) is an important milestone for any construction company, because, according to (Lukichev and Romanovich, 2016) sustainable development of construction company and its competitiveness are directly dependent on the proper functioning of the quality management system. Also Acikara et al. (2017) support the above idea stating that "lack of quality management policy or limited participation of project

participants to quality management process will both negatively affect the management of the project and competitiveness of the firms. This will also decrease the survival potential of construction firms within the industry.

According to Tigistu (2013), QMS implementation is on an infant stage. This argument can be supported by Asefa's (2018) finding which states "majority of contractors in Ethiopia doesn't implement quality management system and those who are implementing are using ISO 9001 and QA as their quality management system". According to Said et al. (2009), lack of awareness in the benefits of QMS, lack of QMS exposure among workers, lack of QMS understanding and lack of continuous professional's development are major problems that are encountered by construction companies to implement QMS.

According to Knowles (2014), poor quality has cost. These costs can be further classified as prevention cost, appraisal cost, internal failure cost and external failure cost. Nikolay (2016), also classify cost of poor quality as the costs of the correction of nonconforming product which appeared as a result of nonconformity, and the costs of corrective actions aimed at addressing the causes of the nonconformities. Hence, since quality is the end point and quality management is the approach and process for getting there critical attention must be paid toward quality management by top managements.

2.3 Factors Affecting Quality Management in Building Construction Project

Studying factors affecting quality management in building project is very essential to go in-depth in searching for improvement way and to adapt improvement philosophy in other industry to construction industry. There are many factors forwarded by different researchers that are affecting quality management of construction project in general and building construction in particular.

There are many inputs to achieve desired quality. These inputs are like material, equipment, human resource, method of execution, client or end users need, and etc. To achieve the predetermined requirement or quality the coordination among the inputs are mandatory. Hence, responsibility of coordinating the input is laid in the hand of the management at each level.

Quality management can be affected by ample factors. Oni et al. (2019), in their study revealed that; lack of adequate sanction by the standard assurance organization, non-implementation of national building code, lack of proper inspection at every construction stages, award of contract to unqualified contractor, lack of construction quality control inspection programme, lack of effective quality policy implementation and inadequate personnel and craftsmen training to be the top most factors affecting quality management. Whereas, Chidinma et al. (2018), in their study found that, unfeasible scheduling, inadequate cost estimate, poor technical specification, substandard materials, inadequate consultation and resource wastage, poor planning and control techniques, poor-on-site project management/supervision and lack of design-project analysis are top factors affecting quality management.

In other case, Abdullahi et al. (2018), in their study found that; inadequate/lack of planning for quality, poor communication of quality requirements among the project team, lack of awareness on the benefits of quality management, high cost of implementing quality management, inadequate motivation of workers for achieving desired quality level, lack of commitment/support from top management, inadequate training/education of construction workers, lack of attention to quality/ inadequate supervision, lack of clear assignment of responsibility among project members and poor documentation procedures on quality issues to be the top factors affecting quality management. Mane and Patil (2015) argue that poor planning, lack of proper training, bad attitudes/abdication of responsibility/management infallibility, competitive markets, lack of leadership for quality, lack of effective measurement of quality improvement, lack of management commitment, resistance of the workforce and deficiency of cultural dynamism are among leading factors influencing quality management.

Also Jha and Iyer (2006), identifies that “conflict among project participant, hostile socio-economic environment, harsh climatic condition, project manager's ignorance and lack of knowledge, faulty project conceptualization and aggressive competition during tendering” are the factors that are adversely affecting quality performance in construction project.

According to Bawane (2017), there are several factors that impede the management of construction quality in developing countries. The challenge in managing and ensuring the

construction quality is posed by many critical factors that stem from both internal and external shortcomings of the industry.

Internal reforms within the construction industry alone will not yield the desired results with regard to the construction quality unless the industry also addresses the issues stemming from the other fronts. So factors external to construction industries are yet critical to quality and its management. Those factors both from internal and external includes factors such as:

A. Contractual Provisions

Decades old tendering and contracting procedures prevailing in most developing countries lack focus on quality. It is interesting to look at the weightage assigned to various capabilities of a bidding firm by an Indian public sector organization while evaluating the pre-qualification criteria: financial strength: 20 marks, experience in similar nature of work: 20 marks, performance of work: 40 marks (performance of work comprises quality of work, financial soundness, technical proficiency, resourcefulness and general behavior.), personnel and establishment: 10 marks and plant and equipment 10 marks.

The above criteria indicate that the whole procedure of awarding the contract assigns little importance to quality. Apart from the pre-qualification criteria, the following also have serious implications on quality: award of contract to the lowest bid, inadequate compensation to contractor against escalation, unrealistic time schedule and unachievable specifications. Thus, it is imperative for the construction industry to design an effective system of tendering and contract that can enforce the quality.

B. Organizational Structure

Baring few corporate firms, most construction companies lack the well-defined organizational setup. The Indian construction sector comprises of approximately 250 corporate firms as against 7.2 lakh (100,000 unit) Class A contractors and sub- contractors who execute 90% of construction jobs. Most contractors operate with skeletal and have an ad-hoc approach towards resource mobilization. Quality management through sound organizational setup is still an alien concept to these firms.

C. Lack of Technical Expertise

Construction industry in developing countries needs to equip itself with technical capabilities, both the human and nonhuman, to ensure effective quality assurance on and off the construction sites. Most contractors lack the financial capabilities to support such kind of in-house facility. The staff responsible for implementation of quality is inadequately trained and in most construction projects on-site quality checks are carried out by relatively less experienced supervisory personnel.

D. Slow pace of Mechanization

Construction in developing country is a labor-intensive activity that provides extensive employment with little investment. Like any other labor-intensive industry, the construction industry is also characterized by low productivity and poor quality.

Mechanization of construction activities could be a solution to overcome the limitations of laborers that are involved in onsite operations. The level of mechanization of construction industry in developed countries is about 60-70 per cent, compared to 15-20 per cent in Indian construction industry. The slow pace of mechanization of construction industry in developing countries can be attributed to the high investment and low turnover. Smaller firms which execute 90 per cent of total work, usually opt for hiring the equipment as owning the expensive machineries is not a viable proposition. The imminent reflection of mechanization will be seen on the construction quality as it eliminates the human error.

E. Lack of Training and skills

Construction sector in developing countries provides employment to those with little education or skill. A study of construction workers in five major cities India reveals that 73 per cent of workforce did not have any schooling (Vaid, 1999). The situation in China is very similar where 50 per cent of construction workers in Beijing received no more than primary education (ILO, 2001). These facts may support the popular notion that one can do a construction job without much schooling.

The objective of improving the construction quality can be realized by upgrading the skills of workforce. Thus training becomes vital in meeting the skill requirements of the construction industry. Unlike manufacturing industry which meets its requirement of skilled workforce through large number of vocational training institutes, the construction industry in most

developing countries, relies on informal and traditional apprenticeship where labourers learn the trade skills from the master craftsmen. However, such training may not satisfy the demand for higher quality. The developing countries need to have an institutional framework to impart quality oriented training for construction sector.

F. Limited Financial Capabilities

To match the requirements of prevailing competitive environment, it is crucial for the construction industry in developing countries to enhance the capabilities of its human and non-human resources. The available capital is not adequate to meet the resource requirements. The industry and governments need to evolve a mechanism to allow the flow of funds to the construction industry. The banking sector may be encouraged to develop lending norms that could address the requirements of the construction industry. The contractors' credit cooperative bank established in the Indian state of Karnataka is one successful example of specialized financial institution that caters to the needs of the contractors

G. Technological Developments in Allied Industries

The construction sector has major linkages with the building material industry since material accounts for 58-60 per cent of construction cost. These materials include cement, steel, building blocks, roofing material, fittings/fixtures, glass, paints, chemicals etc. Bulk of these materials is manufactured in the unorganized sector using low-grade technology. The quality of materials is critical in ensuring the construction quality; ironically the locally produced materials are characterized by lack of quality and standards. The building material industry in developing countries suffers with obsolescence. It is imperative that the industry invests into technology up gradation of building material industry. The industry needs to have sound research and development facilities to equip itself with the state of art technology. It obviously requires a huge investment that most developing countries may not afford.

H. Globalization

Emergence of globalization provided the multinational organizations with opportunities of extending their business operations in developing countries. Construction is one sector where globalization made a significant impact. Consequently, one can see the presence good number of foreign construction firms in developing countries. While investigating into the implications of globalization on Asian construction industry, Raftery et al (1998) identified

three important trends: a) greater private sector participation in infrastructure projects; b) increased vertical integration in the packaging of construction projects; and c) increased foreign participation in domestic construction.

Equipped with superior technical and managerial capabilities, the international firms can deliver the projects within stipulated time, cost and quality. The dominance of foreign firms will continue until the local industry acquires the capabilities and expertise to handle large and complex projects without compromising the quality. On the positive side of globalization can be seen as an opportunity to upgrade the local industry through technology transfer and skill enhancement of the construction manpower.

I. Quality Certification:

With the emergence of new trade regime under WTO, companies are being persuaded to adopt quality management systems in order to meet the demands of customers in a globalized market. During last two decades, ISO 9000, a series of international quality standards, has emerged as a system that can be applied to different types of business organizations to obtain improvements in quality procedure and product. The appropriateness of ISO 9000 to construction industry is still a matter of debate since the end product of construction process is not a repetitive unit but an endeavor that may be unique in its design and composition.

International construction firms operating in developing countries pursuing ISO certification as it is increasingly becoming mandatory for bidding in projects funded by national and international agencies.

2.4 Concept and review on Deming's principles

According to Ashokumar (2014), quality is the critical factor in a success of construction project. Improvement in the quality of construction project is linked with quality management in the project life cycle.

W. Edwards Deming as he wrote in his book titled "out of crisis" which is published first in 1982 G.C and updated in 1986 G.C he strongly believe that top management are responsible for most quality problems. Likewise, the potential of quality improvement is laid in the hand of top management and associated with statistical process control, adding; process improvement and variation reduction plays a vital role in quality advancement. He also determinedly promotes the employee participation.

Knowles (2011), stated that, Deming's principles worth greater consideration than other pioneers, because his was by far the most transformational vision and he saw the need for total transformation of management practice, whereas the others contribution is basically about re-focusing management attention.

2.4.1. Deming's 14 key principles.

According to Deming "hope without a method to achieve them will remain mere hopes." Any organization can gain a short term profit by differing maintenance, cutting research and extra, but long term profit will come only by improving quality and productivity. Quality does not come by motivating people to work faster or harder but by applying the 14 Deming principles. Montgomery (2009) stated that "the Deming's philosophy is an important framework for implementing quality management and productivity improvement.

The 14 principles are:

1. Create constancy of purpose toward improvement of product and service:

To stay in a business and to be competitive every company (may be of different type and size) must focus on long term profit. Planning for quality, resisting reacting with short-term solution, being dedicated to constancy of purpose is very essential for every company. Investment in research, development and innovation will have long term pay back to the organization.

According to Reddy (2012) in his study on OPCO construction company, he forwarded that by identifying past mistake, observing current trouble and by looking in depth the performance of the company in future OPCO designs clear vision of statement and develops clear plan of continuous improvement.

2. Adopt the new philosophy.

We are in new economic age. Mistakes, delays, outdated training, outdated technology defective material; defective workmanship and ineffective supervision are no longer acceptable.

3. Cease dependence on inspection to achieve quality.

The use of inspection to improve quality is costly, ineffective and unreliable. Inspection does not improve quality but they are merely used to find lack of quality. Hence, by developing quality in the process replacing mass inspection by statistical quality control is essential. Since Statistical quality control (SQC) involves everyone in the process of improvement and defect prevention, SQC provide means for analyzing the process, continually improving the process, and controlling product quality through control of the process.

4. End the practice of awarding business on a basis of price tag alone.

Minimize total cost by having single suppliers on long term relationships of loyalty and trust. Total cost of the item must be considered not just the purchase price.

5. Improve constantly and forever the system of production and service.

Continually identify the problem and improve every activity in the company, to improve quality, productivity and to constantly reduce costs. Initiate innovation and constant improvement of product, service and process.

6. Institute training on job.

Initiate modern method of training on the job for all, including management to make better use of employee. New skills are required to keep up with change in material, methods, product and service design, machinery, techniques and service.

7. Institute leadership.

The aim of super vision should be to help people and machine and gadgets to do a better job. Supervision of a management is in need of overhaul, as well as supervision of production worker.

8. Drive out fear.

Many workers are afraid to ask question, to report a problem, or point out conditions that are barrier to quality and effective production. Hence, encourage effective two way communication and other means to drive out fear throughout the organization so that everybody may work effectively and more productively for the company.

9. Break down barrier between departments.

Peoples in different area of specialization must work in team to foresee different problems that may encounter.

10. Eliminate slogans exhortations and targets

Eliminate the use of slogans, posters and exhortation for the work force, demanding zero defect and new level of productivity without providing methods.

11. Eliminate numerical quotas for the work force and numerical goals for management.

Eliminate work standard that prescribe quotas for the work force and numerical goal for the people in management. Substitute aids and helpful leadership in order to achieve continual improvement of quality and productivity.

12. Remove barriers that deny people pride of workman ship.

Remove the barrier that rob workers, and people in management, of their right to pride of workman ship. This implies among other things, abolition of the annual merit rating (appraisal performance) and management by objective. Again, the responsibility of managers, supervisors, foremen must be changed from sheer numbers to quality.

13. Institute vigorous program of education and self-improvement.

What organization need is not just good people; It needs people that are improving by education. Advances in competitive position will have their roots in knowledge's.

14. Take action to accomplish the transformation.

Clearly define top management permanent commitment to ever improving quality and productivity, and their obligation to implement all of these principles. Everyone in the organization must know that continuous improvement is a common goal. As it is clearly observed from these 14 principles Deming has strong emphasis on organizational change to improve quality and productivity. Also the role of management in guiding this change process is of dominating importance.

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According to the study undertaken in OPCO construction Company by Reddy (2012), regarding implementation of Deming's principles each and every principle must be undertaken without neglecting a single point.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introductions

The aim of this research was to found out the main factors that are contributing to poor quality management of building construction and to address how poor quality management can be improved by using Deming's principles. Hence, proper research methodology that can effectively achieve the aim was followed. Therefore, under this chapter; research area, research design, sampling techniques, study variables, source of data, data collection procedure and data presentation and analysis techniques was discussed.

3.2 Research Area

This research was under taken in south western Ethiopia, Oromia region, in Jimma city.

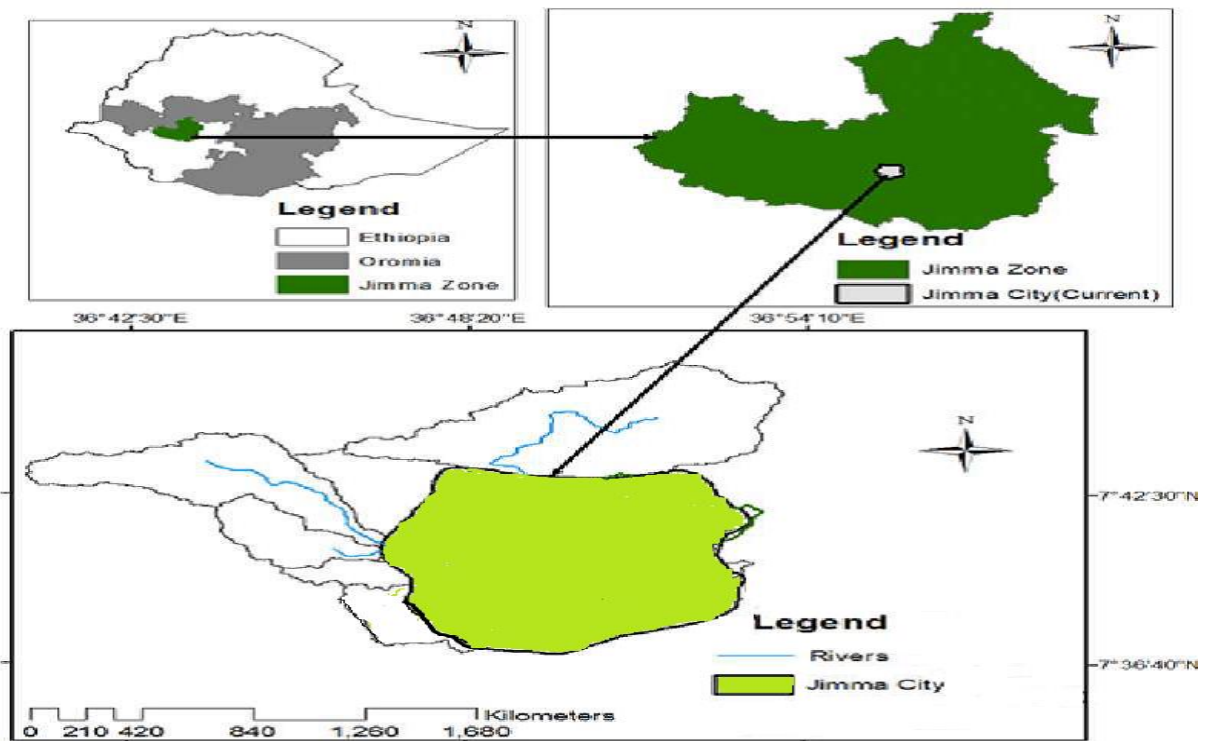


Figure 3.1 study area

3.3 Research Design

This research was both descriptive and exploratory research with the aim of examining the factors contributing to poor quality management in one hand and how quality management can be enhanced by using Deming principles in other hand.

In line with the above strategy, this research was carried out using four phase approach to achieve the objective of the research. The first approach is that literature review were under taken to identify the factors that are affecting quality management in building construction projects and how the stake holders are responding to the problem. Also the literature was reviewed in depth to assess the practice of different construction organization and other industry in implementing the Deming principle.

The second approach was that, questioner were prepared in two forms. The first form was for stakeholders (contractors and consultants) in the building construction industry to rate the factors that are affecting quality management in building construction and the second questioner was prepared and made to be filled by contractors operating in the study area to acquire Deming's principle based CQP (Company Quality Profile) of their company.

In third approach the organizations was interviewed deeply regarding their consent about the principles. These approaches were used to describe how to improve quality management using the principles. Lastly thorough discussion both qualitatively and quantitatively was under taken and followed by conclusion and recommendation based on the finding obtained.

3.4 study variables

The following listed variables are the study variables of the research.

Dependent variables

- ✓ Quality management improvement

Independent Variable

- ✓ Quality management
- ✓ Deming's principles.

3.5 Population and Sampling Method

Target population is the total number of the subjects of interest to the researcher. Sampling is a procedure, process or technique of choosing a sub-group from a population to participate in the study. A sample is a smaller group or sub-group obtained from the accessible population. The sample is selected in such a way as to ensure that certain sub-groups in the population are represented in the sample proportion.

According to Jimma city construction office, exact number of contractor and consultant operating in the city was not identified. However, they respond their number to be small. Since the total population was small and exact number of contractor and consultant operating in the city was not identified the researcher did not sample instead, used census that is capturing the entire population of the contractors and consultant. Hence the study targeted 12 contractors and 5 consultants operating in the city.

3.6 Source Data

Primary and secondary source of data was used in this study.

3.6.1 Primary Data

The primary data was collected through site observation, questioner and interview from consultant and contractors. Most data collected through questioner and interview were used to collect the data that are primarily affecting building construction quality and the company quality profile and the consent of the stake holders regarding the Deming principles.

The answer to the structured part of the questioner was based on Likert-scale of five ordinals from one to five (1-5) measures of agreement for each factors influencing quality management of building construction identified from literature review and the addition factors. The Likert scale was used because by calculating their mean value it is easy to rank the factors relatively. Whereas closed ended questioners was used to collect the primary data from contractors about their quality profile.

3.6.2 Secondary Data

Secondary data which involves information from published books, journals, articles, company quality strategy and objectives, government publication dictionaries, dissertations and reliable internet sources was used to compliment the primary data.

3.7 Data collection procedure

3.7.1 Questionnaire Design

Questionnaire is simplest and time saving method to collect data effectively from a huge numbers of respondents. Formulating questions from the identified variables, the questionnaire was designed to gather data from professionals with building contractors that are involved in building project activity in Jimma. This questionnaire survey has both open-ended and closed-ended questionnaires. The respondents were asked to rate the questions on the five-point scale of ordinal measures. Part one: asks general information Part two: asks factors affecting quality management in building construction project. Part three: asks company quality profile which was prepared mainly depending on fourteen Deming's principles.

3.7.2 Interviews

The interviews were conducted face-to-face with the interviewees. The interview was a useful technique for collecting data which would probably not be accessible using techniques such as desk study and questionnaires. Unstructured (open) types of interview were conducted with building contractors representative (engineers) to gather information regarding their presumption about the principles and how to utilize those principles to improve quality management in building construction projects.

3.8 Data Presentation and Analysis

The data collected was analyzed both qualitatively and quantitatively. Statistical data analysis method was used to analyze the data quantitatively. Descriptive statistics were constructed to display results with respect to each of the questions of general information and factors affecting quality management in building construction project.

Spearman (Rho) rank correlation was used to rank the common types of factors affecting quality management of building construction and to identify significance of relationship between the mean responses of the respondents. The Spearman (Rho) rank correlation coefficient for any two groups of ranking was given by the following formula:

$$\text{Rho (rcal)} = 1 - \frac{6 \times (\sum di^2)}{N(N^2 - 1)} \dots\dots\dots \text{equation 1}$$

Here:

Rho (r_{cal}) = Spearman rank correlation coefficient

d_i = Difference between rank given by two respondent for each variables.

N = Number of pair of value in the data set.

(Forthofer et al. 2007) To found the value of rho, first based on their mean score each factor was rank ordered separately. Next for each pair of ranks, their difference (d_i) was computed. Then the square of the difference (d_i^2) was computed and then the sum of the squared differences ($\sum d_i^2$) was determined. Finally the value of rho was computed using equation 1 and its value was compared with the critical value in appendix C to made decisions.

The interviewee data was analyzed using grounded approach as recommended by O'connor and Gibson (2003). So first the data were transcribed. After transcribing, the data were organized in a way to look at easily. After that the coding (i.e. inductive coding style was used in this research) and categorizing idea and concept was done. Finally, since each of the response categories have one or more associated themes and provide a deeper meaning to the data, different categories were collapsed under one main over-arching theme.

3.9 Data Quality Assurance

To assure quality of the data, the questionnaires were tested prior to distribute to the intended respondents. The questions then amended based on the comment collected from those who participated in the test. Also, during distribution of the questionnaire the respondent was informed politely that they can ask any question unclear to them at any time on the given address. Similarly enough time were given to the respondent to administer the questionnaire because if the time is tight they might refrain from providing intended data as required. Finally, all data acquired from different sources was compared and cross checked. Similar action has been taken to assure quality of data obtained by using interview.

3.10 Ethical considerations

All respondents were treated with politeness and respect. Hence, to avoid misunderstanding between the enumerators and respondents they were informed of the purpose of the study. Each respondent were politely requested to fill the questionnaires and assured of confidentiality with regard to any information they gave.

CHAPTER FOUR

RESULT AND DISCUSSION

4.1 Questionnaire Response Rate and Firms profile

Two different questionnaires were administered, the same questionnaire for factors affecting quality management system for both contractors and consultants and as the quality management in building construction mainly executed during the construction process, the other questionnaire on company quality profile using Deming's principles administered only to contractors. The questionnaires comprised of two parts for the consultant and three parts for the contractors. The research analysis and discussion is done based on the response from the distributed questionnaire representing 94% percent response rate that indicates a good confidence limit; as shown in Table 4.1.

Table 4.1 Questionnaire response rate

No	Respondents	Questionnaire Distributed	Returned Questionnaire		Incomplete Questionnaire		Analyzed Questionnaire	
			No.	percent	No.	percent	No.	percent
1	Consultant	16	16	100%	1	6.25%	15	93.75%
2	Contractor	34	33	97.05%	1	2.95%	32	94.11%
	Total	50	49	98%	2	4%	47	94%

Note: -No=number and percent=Percentage

The firm's years of experiences are summarized in Table 4.2 the result shows 58.33% of the contractors have more than 10 years experiences in the construction industry. The others 41.66% of the contractors have less than 10 years' experiences in the construction industries. This helps the researcher to get enough information on quality management and factors affecting quality management.

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Table 4.2: Firms year of operations

	Firms years of operations	Number	Percentage (%)
Contractor	Less than 10 year	5	41.66
	Greater than 10 year	7	58.33
Total		12	100
Consultant	Greater than 10 year	2	40
	Less than 10 year	3	60
Total		5	100

Classification of contractors participated in the study was summarized in table 4.3 the result shows that 58.33% of the contractors are general contractor and 41.67% are building contractors.

Table 4.3: Classification/ types of contractors

Classification/ types of contractors	Number	Percentage (%)
General contractor	5	41.67%
Building contractor	7	58.33%
Total	12	100.00%

4.2 Factors Affecting Quality Management in Building Construction

Contractors and consultants in building construction were asked to rate factors affecting quality management in building construction in accordance with the degree of impacts they are laying in their respective organization. Those factors were identified from literature review and presented to respondents in questionnaire. The mean score and rank of a total of 20 factors are presented in Table 4.4.

Table 4.4 Factors affecting quality management.

NO.	Factors Affecting quality management	Contractor		Consultant		Weighted Average	
		MS	Rank	MS	Rank	MS	Rank
1	Lack of Quality management strategy	4.59	1	4.33	1	4.46	1
2	Lack of Technical Expertise	4.59	1	4.2	2	4.39	2
3	Lack of Training and skills	4.44	3	4.06	6	4.25	3

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NO.	Factors Affecting quality management	Contractor		Consultant		Weighted Average	
		MS	Rank	MS	Rank	MS	Rank
4	Improper Planning and scheduling	4.31	5	4.13	4	4.22	4
5	Lack of well-defined organizational Structure	4.34	4	4	7	4.17	5
6	Limited Financial Capabilities	4.21	6	4.13	4	4.17	5
7	Lack of knowledge regarding quality management	3.94	10	4.2	2	4.07	7
8	Customer satisfaction	4.06	8	3.93	8	3.99	8
9	Unavailability of material and equipment	4.15	7	3.6	11	3.87	9
10	Project management ignorance	3.75	12	3.73	9	3.74	10
11	Slow pace of Mechanization	3.78	11	3.46	12	3.62	11
12	Contractual Provisions	4	9	3.13	16	3.56	12
13	Faulty project conceptualization	3.65	13	3.4	14	3.52	13
14	Technological developments in allied Industries	3.62	14	3.46	12	3.54	14
18	Aggressive competition during tendering	2.90	19	3.66	10	3.28	15
16	Quality certification	3.40	15	3.13	16	3.26	16
17	Non implementation of national building code	2.78	20	3.4	14	3.09	17
18	Globalization	3.22	16	2.86	18	3.04	18
19	Lack of adequate sanction by the standard assurance organization	3	18	2.73	19	2.86	19
20	Harsh climatic condition	3.22	16	2.26	20	2.74	20

From the aggregate mean score and rank identified, the respondents agreed on lack of quality management strategy as the most factors affecting quality management in building construction in the study area with mean value of 4.46. From the result; lack of technical expertise, lack of training and skill and improper planning and scheduling follows lack of quality management strategy with the mean value 4.39, 4.25 and 4.22 respectively. Subsequently limited financial capabilities and lack of well-defined organizational structure are among the top factors affecting quality management with mean score of 4.17 each.

Generally, from this finding; it can be deduced that the identified factors are laying impacts on quality management of building construction with their respective mean score and order of rank. Hence, the firms operating in the study area are required to pay due attention to the stated factors in accordance with their rank of impact. Also, factors affecting quality management of building construction in the study area includes all factors identified in finding of this study, but not merely limited to the stated factors alone.

4.2.1 Tests for Agreements on factors affecting quality management among Stakeholders

One of the purposes of this thesis was to identify factors affecting building construction quality management in Jimma city. Hence, in this section respondent's response were tested for correlation using Spearman rank correlation coefficients, to see if there is difference in ranking between two groups of respondents, which is between contractors versus consultants on the different variables of factors affecting quality management in building construction. This test was helped to evaluate whether the consensus of opinions exists among respondents.

Table 4.5 Summary of Correlation Test on the Ranking of factors affecting quality management in building construction

Respondent	Rho (ρ) = $1 - \frac{6 \times (\sum di^2)}{N(N^2 - 1)}$	A critical value of r (Appendix C)
Contractor verses consultant	0.77	0.380

In this case, with a significance level of 95 percent ($P = 0.05$), the calculated value of ρ (rho) for contractor verses consultant is greater than the critical values of r , so it can be concluded that there is a strong correlation between the attitudes of respondents. This indicates that the

respondents are agreed on factors affecting quality management in building construction in Jimma city.

4.3 Quality management system

As stated in literature review, Implementation of the quality management system (QMS) is an important milestone for any construction company because sustainable development of the company and its competitiveness are directly dependent on the proper functioning of the QMS. Also lack of quality management policy or limited participation of project participants to quality management process will both negatively affect the management of the project and competitiveness of the firms. This will also decrease the survival potential of construction firms within the industry. The following table 4.5 depicts the responses of the respondents while they were questioned whether they implement formal quality management system in their organization or not. From the 12 respondents, 6 (50 %) of the companies do not implement quality management system. Whereas, the other companies 1 (8.3%) have intention to implement and they are constructing quality management system to implement and 5 (41.67%) of companies have implemented a quality system.

Table 4.6 Quality management system implementation

QM implementation	Number	Percent (%)
yes	5	41.67
no	6	50
Yet to implement	1	8.33
Total	12	100

In current era, plenty of quality management systems are available worldwide. So the respondents were asked types of quality management system they are implementing in their company. Among those company implementing quality management system, two (16.67%) of them respond that they are using ISO 9001 and three (25%) of the respondent has been using quality control /quality assurance as their quality management system. But, there is no company mentioned other types of quality management system. So from the above presented data we can observe that majority (58.33%) of contractor still doesn't have quality management system. so we can observe that majority of them are neglecting the urgent issue of the period.

4.3.1 Quality policies and objectives of companies

The quality policy is an important document because it acts as the driver for the organization. It provides the direction and formally establishes goals and commitment. Top management should ensure that the policy is appropriate and compatible with strategic direction. The policy needs to be communicated to all employees and they need to understand the part they have in its deployment. The respondents were asked whether their company establish quality policy or not, and to state their quality policy if they set. For this question from the total respondents, 6 (50%) of them said NO. and 5 (41.67%) said yes. The rest 1 (8.33%) respond it is under construction. Table 4.6 shows this result. The implication of the finding reveals that the most company operating in the study area has no quality policy.

Table 4.7 Quality policy

Establish quality policy	Number	Percent (%)
yes	5	41.67
no	6	50
Yet to establish	1	8.33
Total	12	100

The quality policy of those companies comprises, delivering buildings, bridges, roads, and other construction services that can satisfy the requirement of the clients related statutory and regulatory requirements of ISO 9001 quality management system through the active involvement of its competent and motivated employees and other stakeholders, drive continual improvement throughout the organization by improving the efficiency of its employees: by engaging in quality construction materials production and by using appropriate machinery and technologies.

The quality management system has numerous goals as specified in literature review part. Those objectives are: increase productivity; cost reduction; involvement of employees in the quality building effort and compliance with statutory; and environment and safety requirement. Hence the respondents were asked to state the quality management objectives of their companies. Three of them state their quality management objectives as merely achieving the specification requirement. And two of them state as follow, completing projects in accordance with the approved / adjusted plans and specifications, completing the

projects within the approved project budget and timeframe, completing projects with minimal defects, completing projects in accordance with the relevant Ethiopian Standards, ensuring projects are completed with zero client disputes, ensuring projects are completed with zero work safe prohibition notices. Whereas the other contractors do not responds their quality management objectives. From this result one can deduce that the objectives are more general than specific.

Quality management system must be reviewed from time to time to improve the system. Hence, the respondents were asked at what interval they improve their system. 2(16.66%) of the respondent answered that they improve annually, where the others 10(83.33%) do not respond for the question. This shows that majority of the company have no practice of reviewing and improving their quality management system.

Hence, the firms are required to review their commitment to quality and well defined quality policy which provides clear frame work for setting quality objective. SMART quality objective which have to be reviewed frequently, must be established to acquire good quality management system which is essential for quality management improvement.

4.4 Company quality Profile (CQP) using Deming's principles

4.4.1 Strategy

Under this concept, three Deming's principles are incorporated. Those principles are; creating constancy of purpose, adopting new philosophy and involving everybody in accomplishing the transformation. Hence, the respondents were questioned about their strategy covering those three principles.

For the question associated with constancy of purpose 2(16.66%) company respond that; investing whenever necessary on training, implementing new technologies into the business and encouraging research and development, sharing experience from pioneer company to be their strategy of creating constancy of purpose. Whereas, 10(83.33) of them respond that they do not have strategy regarding creating constancy of purpose. The table 4.7 depicted the statistical description of the respondent created constancy of purpose and those who do not created. Out of 12 contractors, only 2(16.66%) of them have created constancy of purpose toward improvement, with the aim to become competitive and to stay in business, and to

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provide jobs. Whereas, the other 10(83.33%) haven’t created clear statement regarding constancy of purpose.

Table 4.8 constancy of purpose

constancy of purpose	Number	Percent (%)
Created	2	16.66
Not created	10	83.33
Total	12	100

From table 4.7, it is clear that a few companies have created constancy of purpose toward improvement of product and services, with the aim to become competitive and to stay in business, and to provide jobs, whereas most of them neglected the concept. That means most companies are following immediate reactive measure for challenge they are facing. But to ensure business survival long-term philosophy is essential than short-term commitment. Reactive, short-term solutions can only have a short-term effect. so a more farsighted approach is needed. Hence, as remaining competitive in the market requires “constancy of purpose” those company must have creates constancy of purpose.

The constancy of purpose must be supported by a buy-in to quality that runs right through the organization. Because, producing quality requires much more than merely hopes and traditional management, it requires leadership. That means, staff should be inspired to support quality rather than demanding to be forced to do so. For the question related with adopting new philosophy as presented in Table 4.8, while 2 (16.66%) of the company claimed to set keen strategy to adapt new philosophy, by following and implementing guide and procedure enacted by internationally accredited organization and acquiring experience from succeeded company by implementing a very new concept. Whereas, the others 10(83.33%) do not have/set strategy regarding the adopting new technology, shows a great desire to adopt new philosophy while they are keeping conventional management system.

Table 4.9 Adopt new philosophy

Strategy to adopt new philosophy	Number	Percent (%)
Yes	2	16.66
No	10	83.33
Total	12	100

From the 4.8 table, we can observe that very few companies have set strategy of adopting new philosophy. But, in current economic era the way we do business was moved to a leadership focus from a traditional management focus. Building a culture of quality with a commitment from every person in a business is vital. Once a company has a vision for the quality it wants to deliver as it has a vision for the future of its businesses, it can strategize so that it can realize its vision.

For the question related with the third principle incorporated under this concept, in which the researcher asked the respondent everybody involvement in accomplishing the transformation only 2(16.66%) companies respond that, creating awareness about policies and objectives of the company to some of their employees and further encouraging them to disseminate to the operational level employees are their strategy of involving everybody in accomplishing the transformation. But, as setting strategy for quality management and obligation to involve everybody in the organization to accomplish transformation requires top management commitment, the data presented earlier shows that let alone accomplishing the transformation the other 10(83.33%) companies do not set clear strategy regarding constancy of purpose, and so far they are reluctant to set strategy of adopting new philosophy.

Generally, regarding strategy very few companies have established strategy that focuses on long term benefit, with relevant management system and good employee's involvement that shall have been allowing the companies to be competitive and stay in the business. Hence, from these result and discussion contracting entity operating in the study area can vividly assess the current actual practice and the potential incorporated in the principles to transform their current status.

4.4.2 Human Resource Management

Under this concept, three Deming's principles are incorporated. Namely drive out fear, break down barriers and facilitate pride of workmanship. Hence, the respondents were questioned about their human resource management comprising those three principles.

Employee, managers and supervisors need to share an understanding of the need to drive out fear. Employees should feel free to report problems, own up to their mistakes without being asked about them first, and know that managers are there to make things better without

resorting to penal measures. If an employee feels powerless because of managers control over them and afraid to point out the problem they are facing because they thought they might be blamed, huge economic loss may resulted.

For the question related with the first principle under this concept, the respondents were asked how they manage their human resource regarding driving out fear from their employee. Among all 12 contractors, only 1 (8.33%) respond that even if understanding emotional feeling is difficult to understand but, as much as possible they encourage their employees to feel free in sharing their feeling. Whereas, the other 11 (91.67) contractors do not responds to the question. From this result, it can be deduced that few or no attention is given to the employee to have confidence in securing their job, not being hassled or esteemed. So they are susceptible to fear of loss of job.

When people work as a team, they can achieve more than they would on their own. In other word, project objectives and/or goal will be met efficiently when team members have an appreciably high level of rapport with each other as characteristics of most cohesive and effective teams.

For the question related with the second principle under this concept, the respondents were asked whether they breakdown organizational barrier between departments in their organization or not. Among all 12 contractors, 3(25%) respond that they have eliminated organizational barrier in order to facilitate good team work. Whereas, the other 9(75%) of them respond that still there is inter departmental barriers exist.

For the question related with the third principle under this concept the respondents were asked their human resource management regarding facilitating pride of workmanship. Among all 12 contractors, 2(16.66%) of them respond that, they facilitate pride of workmanship (one through incentive and the other through considering all employees as the company asset), whereas, the other 10(83.33%) of them respond that they do not facilitate pride of workmanship.

Generally, in human resource management, when the employees love what they do, they do it better and they feel good about the results. But, if they are constantly criticized and compared to others, they halt enjoying what they previously loved. Encouraging the

employees to feel proud of their work is always the characteristics of good leadership. As a leader, manager's job is to help other people do their jobs by creating systems that work, if someone falls outside of the system, managers have to correct that, but if they're working inside the system, he/she needs to work with them to figure out where the system fails. However, regarding the case of the study area, as presented in earlier result no due attention is paid to human resource as stressed by Deming's in his principles.

4.4.3 Result Measurement

In this concept, two Deming's principles are incorporated. Those are eliminating slogans, exhortations and target goal (arbitrary numerical goals) and eliminating work standard (quotas) rather using statistical quality control and continuous improvement.

Slogans sound so nifty, but productivity or quality problems any company faces won't be fixed with a slogan. Instead, they need to look into business process improvement. If the processes work well, then the business is already delivering good quality and working productively. For the principle regarding eliminating slogans, exhortations and target goal (arbitrary numerical goals) the respondents were asked whether they set numerical goal for their employee how much to achieve. 9(75%) of the respondent answered that as amount of work to be executed by a crew is known in practice, hence amount work expected to be achieved is known. From these it can be deduced that, neglecting the preconditions of creating conducive environment (process) they are expecting some target to achieve. Whereas, 3(25%) of the respondent claimed that they do not set numerical goals.

For the second principle in this concept, the respondents were asked whether they use statistical quality control and continuous improvement or not. From total of 12 respondents, 2(16.66%) of them responds they are focusing on continuous improvement. Whereas, 10(86.33%) of the respondent do not. So this results shows that, few of them are focused on continuous improvement where most are still not focusing on continuous improvement.

Generally, the result measurement profiles of the respondents in the study areas are poor and needs improvement. There are some qualities experts that point out that, numbers can serve as a motivating factor, particularly in sales environments, but management by objectives should be approached with caution. The company should prefer motivational behavior that must not compromise quality. Without a plan and a method, numbers are meaningless, so, when numerical target is to be set the company needs to avoid taking

shortcut that will affect quality. Also, a great attention must be paid to continuous improvement.

4.4.4 Training and Supervision

Under this concept, three Deming's principles are incorporated. Those are: providing modern method of training to employees, focusing on supervision and instituting rigorous program of education and self-improvement to employees. Hence, the respondents were questioned about their training and supervision profile comprising those three principles.

Most business organizations are persuaded to view training as being costly, also apart from the expense of sending people on courses, there's the productive time lost while they return. So the respondent were asked whether they provide modern method of training to their employees or not. Out of 12 contractors, 2(16.66) of them are providing only for permanent employees. Whereas, 10(83.33%) of the respondents answered that they are not providing. From this data, it can be inferred that most companies undertaking building construction in the study areas are in contrary with the intended principle.

Instead of focusing on traditional management style that calls for tight supervision and a very formal organizational structure, it is better to focus on leadership. So the respondent were asked whether they focus on leadership or not. Out of 12 contractors, 3(25%) of them are focused on leadership whereas, 6(50%) of the respondent answered that they are focused on tight supervision and the other 3(25%) do not respond. From this data it can be deduced that, most of the companies undertaking building construction in the study areas are against the intended principle.

Business of the company isn't always going to stay the same. Therefore, advocating personal growth through continued education is essential. Thus, the respondents were asked whether they instituting rigorous program of education and self-improvement to employees or not. Out of 12 contractors, 2(16.66%) of them respond yes whereas, 10(83.33%) of the respondent answered no they do not institute rigorous program of education and self-improvement to their employees. Thus, from these data it can be determined that most companies undertaking building construction in the study area are in contrary with the intended principle.

Generally, the training and supervision profiles of the respondents in the study areas indicate poor training and supervision practice. Thus, it is clear that education helps the employees to improve their thinking processes. When people are learning things that are relevant to their jobs or company's business, their skills improved, and they are better able to face the challenges the business faces in the present and future, as a result the new skills the employees gain could prove helpful in the longer-term. Similarly, understanding, collaboration, and a coaching approach to management is desirable. Managers will always need a certain level of supervision in a business and working to help people to deliver their best is more effective. Hence, attentions are needed to be paid toward training and supervision by the company's operating in the study area.

4.4.5 Quality Assurance

In this concept, two Deming's principles are incorporated. Those are, cease dependence on mass inspection to achieve quality and constant improvement. Hence, the respondents were questioned about their quality assurance profile comprising those two principles.

Deming wasn't impressed by the idea of after-the-fact quality control; he encouraged businesses to stop depending on inspections to get quality. He pointed out that, inspections can miss defects, they are costly, and they don't improve quality because all they can do is finding poor quality. Thus, firstly the respondents were asked whether they use mass inspection or not. Out of 12 contractors, 2(16.66%) of them respond No. whereas, 5(41.66%) of the respondent answered yes they do. And the others 5(41.66%) do not respond. Hence, from these data it can be deduced that, most companies undertaking building construction in the study areas are using mass inspection, which is opposite with the intended principle.

Finding faults may prevent harm to businesses, but it's not good enough. Instead, building quality into every process a business undertakes is recommended. Because it enables the company to track them down and change processes so that similar faults can't happen ever again. Thus, the respondents were asked whether they do have plan for constant improvement or not? Out of 12 contractors 2(16.66%) of them responds that they have plan for constant improvement, whereas, 10(83.33%) of the respondent answered no they don't set plan for constant improvement. Thus, from these data it can be concluded that most companies undertaking building construction in the study areas has no plan for constant improvement, that Deming's principles stresses to have.

Generally, the quality assurance profile of the respondents in the study areas indicates poor quality assurance practice of building contractors of the study area. So improving processes to eliminate errors is far better and less costly than trying to correct errors after they have already occurred. By doing so the companies can fix flaws in their business processes permanently.

Hence, as it is thoroughly argued in this result and discussion the contractors operating in the study area must consider the importance and significance of the stated concept (quality assurance) seriously and they have to work on it to improve their quality management system which is the paved way to achieve quality.

4.4.6 Purchasing Policy

In this concept, only one Deming's principle is incorporated. That is, "stop awarding business on price tag alone". Hence, the respondents were questioned about their purchasing policy.

Deming advocates that, businesses should build long-term relationships with suppliers. The relationship between a business and its suppliers should be a mutually beneficial one. The business should be willing to pay more for quality. So, the respondents were asked whether they do have purchasing policy or not. Out of 12 respondents, 2(16.66%) of them responds that they are governed by purchasing procedure of ISO 9001 whereas, 10(83.33%) of the respondent answered that they follow specification document to purchase material from external provider.

Thus, from this result it can be deduced that no companies are purchasing material as suggested by the principle stated in this concept. So, the construction firms operating in this study area can acquire insight significance of developing purchasing policy as forwarded in this study.

Generally, as it is clearly revealed/observed from result presented in section 4.6 (company quality profile) the usage of Deming's principles in the study area was negligible. Because, out of 12 contractors, only 2 (16.66%) of the contractors are using them, as the quality management system they are practicing comprises most elements of the principles. Also, it does not mean that those entities using the principles are using them entirely.

4.5 Analysis and discussion of data from interview

The interview was conducted face-to-face with the selected interviewees by asking questions and clarifications. Semi-structured interview were conducted with contractors representative (engineers) to gather information on how to utilize Deming's principles to improve building construction quality management system in their organizations. The interview consists of six questions. Those six questions are prepared in line with the 14 Deming's principles under each six concepts to meet the objectives of the thesis.

The interview was conducted on 5 contractors. A total of 5 respondents (1 representative from each contractor implementing quality management) are participated. From those respondents, 3 of the respondents have above 10 year work experience and 2 of the respondents have above 5 year work experience. All the respondents experienced on building projects for 5 years and above.

1. Strategy

The first question was the outlooks of the respondents to those three principles incorporated under strategy (i.e. creating constancy of purpose, adopting new philosophy and involving everybody in accomplishing the transformation.) and how to utilize them to improve quality management in building construction. For these questions, first regarding their presumption; the respondents replied that; they presume that planning for quality in the long term, avoiding reaction with short-term solution, developing quality throughout the organization and improving overall organization by having each person to take a step toward quality would be essential for their company.

Regarding how to utilize those principles, the respondents were replied that, quality in the organization is the job of the top management to have commitment to it. So ,by incorporating those principles in strategic plan of the organization and implementing them (i.e. planning for quality in the long term predicting and preparing for future challenge, by embracing quality throughout the organization, by creating quality vision and implementing and using effective change management principle) the overall quality management can be improved.

2. Human resource management

Next, the outlooks of the respondents to Deming's principles combined under human resource management (i.e. drive out fear, break down barriers and facilitate pride of workmanship.) and how to utilize them to improve quality management in building construction was asked. For these questions plenty of answers were forwarded by the respondents. First for question regarding their presumption; majority of the respondents answered that all three Deming's principles combined in this section embrace all necessary requirement that are needed for good HRM. They are also conscious that those Deming's principles incorporated in this concept encompasses, paying a great attention to the safety of employees, valuing employees as a precious asset, building confidence of employee so as to avoid fear, creating good organizational climate for employees, assuring openness, encouraging cooperation among departments, encouraging team work and treating workers equal. This shows that most respondent have positive assumption for those principles in this section.

Concerning how to utilize those principles, respondents replied that, as a manager, always address the problem, not the person, manager needs to work with employees by sharing the intended quality goals so that they distinguish what have to be achieved. Also, it is obvious that some workers can acquire skills faster than others, and it is expected that they would get better results than their counterparts. Hence, as described in Deming's principles clearly by building employee capacity, providing open line of communication, creating conducive environment for cooperation among departments and valuing employee each component of human resource management can be improved. Thus, by including those principles into their system, considering their current status quo and their relevant capacity of human resource, HRM which is an input for quality management can be improved leading to overall quality management improvement.

3. Result measurement

Outlooks of the respondents to Deming's principles incorporated under result measurement (i.e. Eliminate slogans exhortations and targets and eliminate numerical quotas for the work force and numerical goals for management.) and how to utilize them to improve quality management in building construction was another question requested the respondents. For

these question different answer were forwarded by the respondents. First for question regarding their presumption; some of the respondents reflect that; to remind the employees their goal, to motivate them and also to set the benchmark for them to achieve their target slogan and numerical quotas are necessary. Whereas, some of them respond that they consider those principles as focusing on long term instead of short term reaction. This shows that some of the respondent lack continual improvement plan where the others own.

For the question related with how to utilize those principles, even though differences are reflected in their perception after deep discussion with them respondents was reached on consensus on its utilization. They commonly forwarded; it's true that the company needs to have some numerical targets, for too many companies, setting a quota becomes a replacement for good leadership, but high attainment target is among factors that let quality suffer. So, creating well-designed process, using numbers and targets when it is necessary (reasonable) and avoiding when it is unnecessary is essential. The company also won't expect generalized goals to become personal ones. So, it needs to set individualized goals for every person, and along with the new goals, there needs to have a roadmap that shows them how to achieve.

Hence, by focusing on a well-designed process that could deliver expected results and by using numbers only when necessary, quality management can be improved.

4. Training and supervision

The fourth question was the outlooks of the respondents to Deming's principles combined under training and supervision (i.e. providing modern method of training to employees, focusing on leadership and instituting rigorous program of education and self-improvement.) and how to utilize them to improve quality management in building construction. First, for question regarding their presumption; the respondents reflect that; all three Deming's principles combined in this section gives due attention to enhance training at every level in the organization and focusing on leadership in order to update the employees regularly and continuously improve the system of production. This shows that all respondents have constructive assumption for those principles in this section.

For the question related with how to utilize those principles, the respondents were answered that as stressed in those Deming's principles and as the aim of the training is quality improvement and getting consistent and predictable results, by choosing the training carefully to acquire the intended result, by advocating employee's personal growth through continued education, by knowledge-sharing, letting the workers to see how they fit into a process and by using understanding, collaboration and a coaching approach to management the overall quality management can be improved.

5. Quality assurance

In this concept the respondents was asked their outlooks to Deming's principles combined under quality assurance (i.e. cease dependence on mass inspection to achieve quality and constant improvement.) and how to utilize them to improve quality management in building construction. First for question regarding their presumption; the respondents reflect that; inspection do not improve quality but merely indicate lack of quality and if lack of quality is revealed during inspection it would resulted in rework and that is costly, thus both principles embraced in this section are directed toward creating statistical quality control in the system of production and continual improvement of the system. This shows that the respondents have good views for those principles combined in this concept.

For the question related with how to utilize those principles, the respondents was replied that by reviewing their current status quo and setting relevant policy for continual improvement and focusing on process improvement by incorporating statistical quality control as recommended in the principle's the initial goal i.e. quality, which must be achieved only through quality management can be improved.

6. Purchasing policy

The final question the respondents were asked was their outlooks to a Deming's principles incorporated in purchasing policy (i.e. stop awarding business on price tag alone.) and how to utilize it to improve quality management in building construction. First for question regarding their presumption; respondents answered that, purchasing of materials only from list bidders without quality consideration may resulted in inferior quality material that would resulted in loss of more money at the time and could leads to not only loss of reputation but

also may leads from bankruptcy to loss of jobs in a long run. This shows that, the respondents view to the principle is good.

Regarding how to utilize the principle, the respondents' response can be reported as, paying attention to quality is essential during procurement. Procurement have to be obtaining quality material not list bidder. So, to reduce variation between ideal and actual material, developing stable relationship characterized by trust with supplier with the willingness to pay for quality should allow improved quality management. Thus, they believe that quality management can be improved as such by establishing and utilizing purchasing policy that gives due attention to quality.

4.6 Summary of results and findings

The factors affecting quality management in building construction are assessed in section 4.2 of this thesis. The first emphasis was to identify factors affecting quality management in building construction in the study area. According to the result lack of quality management strategy, lack of technical expertise, lack of training and skill, Improper planning and scheduling, limited financial capabilities and lack of well-defined organizational structure are among top factors influencing quality management in the study area.

The other issues in this chapter respectively assessed in section 4.3 and 4.4 are quality management system and quality policy and objectives of contractor's executing building construction in the study area. According to the result obtained among 12 contractors included, 2(16.66%) of the contractors practices ISO 9001. Whereas, 3(25%) of the them practices quality assurance/ quality control as their quality management system and the rest of them do not use any formal quality management system. On other hand only 41.67% of contractors operating in the study area set quality policy and quality objectives while the rest of the contractors do not set both quality policy and quality objectives.

The company quality profile (CQP) obtained using fourteen Deming's principles and response of the contractors to interview question revealed that, even though contractors executing building construction in the study area show great aspiration to use those principles as it contain potential of quality management improvement, but only 2 (16.66%) of the contractors are using the principles, as the quality management system they are practicing

comprises most elements of the principles. This shows usage of Deming's principles in the study area to be insignificant.

Also as it is clearly revealed in response to interview question the quality in the organization is the job of the top management to have commitment to it. So quality culture cannot be developed without the initiative of the top management. Because they are the ones who can create the environment and the employees tend to adapt to it. There are many ways to stimulate and involve the employees in the implementation of quality management. Hence by considering the current status quo of their company and urgency of the issue the management of the company needs to incorporate the principles into their system then finally it resulted to quality management improvement.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The following conclusions are made based on the objectives of the thesis:

1) As revealed in aggregate result of analyzed questionnaire from both contractors and consultants in the study area; lack of quality management strategy (MS=4.46), lack of technical expertise (MS=4.39), lack of training and skill (MS=4.25), improper planning and scheduling (MS=4.22), limited financial capabilities (MS=4.17) and lack of well-defined organizational structure (MS=4.17) are among top factors affecting quality management from the 20 identified factors with their respective mean score and rank.

2) Among the contractors executing building construction projects in the study area majority of them (58.33%) don't implement quality management system in their company and only 41.67% of them are practicing quality management. Among those practicing quality management 16.67% of them are using ISO 9001 and 25% of them are using quality assurance/ quality control as their quality management system. And, those who are implementing quality management system have their own quality management policy and quality management objectives.

3) The company quality profile (CQP) obtained using fourteen Deming's principles and response of the contractors to interview question revealed that, even though contractors executing building construction in the study area show great aspiration to use those principles as it contain potential of quality management improvement, but only 2 (16.66%) of the contractors are using the principles, as the quality management system they are practicing comprises most elements of the principles. This shows usage of Deming's principles in the study area to be insignificant.

4) It is clearly revealed in response to interview question that the quality in the organization is the job of the top management to have commitment to it. Hence, by considering the current status quo of their company and urgency of the issue the management of the company needs to incorporate the principles into their system and required to be committed for its full implementation. That is the way in which quality management can be improved by Deming's principles.

5.2 Recommendations

The following points are recommended to contractors to improve their quality management system using Deming's principles.

- 1) The contractors should give great consideration on the factors affect quality management such as; lack of quality management strategy, lack of technical expertise, lack of training and skill, improper planning and scheduling, limited financial capabilities and well-defined organizational structure and extra according to their magnitude of impact.
- 2) Insight review of their quality management practice should be done, to take a footstep forward the practice of quality management and in order to develop favorable quality management system in their company.
- 3) The management of contractors in the study area must focus on continuous improvement than short term reaction.
- 4) The management of the contractors could reap better result if they incorporate fourteen Deming's principles in their quality management system and committed to its implementation.
- 5) The concerned government body should work on quality management issue as the country infrastructure development is among the main agenda of the nation, to be focused on to achieve the vision of becoming among middle income country.

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APPENDICES

APPENDIX- A

QUESTIONNAIRE

FOR BUILDING CONSTRUCTION PROJECT STAKEHOLDERS

STUDY ON QUALITY MANAGEMENT IMPROVEMENT USING DEMINGS PRINCIPLE IN BUILDING CONSTRUCTION

Dear respondent, this questionnaire prepared to obtain necessary data for the partial fulfillment of an MSc thesis in Construction Technology and Management at Jimma University. The objective of this thesis is to identify how to improve building quality management in Jimma Town by using Deming's principle. Therefore, the information you are going to give will help me to identify how to improve building quality management in Jimma Town by using Deming's principle and suggest possible solutions. In this respect, you are the one who can give the correct information; hence I kindly request you to respond to the questions. I would like to confirm that the information you provide me will be kept strictly confidential and will not be shown to other persons. As such the quality of this study highly depends on the information provided by you. If you have any inquiry please contact through the following addresses.

MOSISA SHUMA CHEFO

Phone Num. +251917435345

E: mail: mosisashuma04@gmail.com

Post Graduate Student at Jimma University, School of Civil and Environmental Engineering,
Construction technology and management stream.

Thank you in advance for your valuable cooperation!!

PART ONE: GENERAL INFORMATION

1. Type of organization

Consultant

Contractor

2. Please specify classification of your organization _____

3. Please specify your position in the company _____

4. Educational Background

Graduate (MSC) _____ Undergraduate (BSC) _____ Diploma, _____

If other, please specify _____

5. Years of experience in the construction industry

< 1 year

1 - 3 years

3 - 5 year

5 - 10 years

10 – 15 years

15 - 20 years

> 20 year

6. Your company/ firm years of operation

1-5 years

5-10 years

10-15 years

>15 years

**PART TWO: - COMMON FACTORS AFFECTING BUILDING CONSTRUCTION
QUALITY**

As identified from different literature, below are the common factors affecting quality management in building construction from inception to completion. Please think their relevance and rank on a scale of 1-5 by ticking (X or √) in the column representing your selection.

NO.	Factors Affecting quality management	Rate of impact				
		1	2	3	4	5
		Not affecting	Low	moderate	High	Very high
1	Lack of adequate sanction by the standard assurance organization					
2	Non implementation of national building code					
3	Contractual Provisions					
4	Lack of well-defined Organizational Structure					
5	Lack of Technical Expertise					
6	Slow pace of Mechanization					
7	Lack of Training and skills					
8	Limited Financial Capabilities					
9	Customer satisfaction					
10	Improper planning and scheduling					
11	Unavailability of material and equipment					
12	Project management ignorance					
13	Faulty project					

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Construction in Jimma City

	conceptualization					
14	Lack of Quality management strategy					
15	Technological developments in Allied Industries					
16	Globalization					
17	Quality Certification					
18	Harsh climatic condition					
19	Aggressive competition during tendering					
20	Lack of knowledge regarding quality management					

Please specify if there are any other factors affecting building quality management in your company.

PART THREE: COMPANY QUALITY PROFILE (CQP)/ TO BE FILLED BY ONLY THE COMPANY MANAGER OR THE REPRESENTATIVE.

Dear respondent the next questionnaire especially from question number six to eleven (5-10) are prepared based on W. Edward Deming's fourteen principles. I kindly inform you that you are required to respond them on basis of your company only. In the question the term "you" represent only the company you are working at.

1. Does your company establish quality policy/ strategy to increase quality while simultaneously lowering cost and increasing productivity?

YES NO

Please write your quality policies here _____

2. Does your company have quality management system from inception to completion of your building construction project?

YES NO

If you have any annotation _____

3. What is the type of quality management system your company is implementing?

4. What are your company quality management objectives? Please list down here.

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5. At what interval does your company improve your quality management system?

6. What is your company strategy regarding

A. Creating constancy of purpose

B. Adapting new philosophy

C. Involving everybody in your company in accomplishing transformation (quality objective)

7. How does your company manage its human resource? regarding:

A. Driving out fear

B. Breaking down barrier between departments

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C. Facilitating pride of workmanship

8. How does your company measure its result?

A. Do you set arbitrary numerical goals?

B. Do you use statistical method of quality control and continuous improvement?

9. Do you provide:

A. Modern method of training to your employees?

B. Do you focus on supervision?

C. Do you institute rigorous program of education and self-improvement to your employees?

10. How do you assure quality in your organization?

A. Do you use mass inspection?

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B. Have you plan/objective of constant improvement?

11. Does your organization have purchasing policy? If your answer is yes, state your purchasing policy below.

Please write here any idea regarding the questions and the study

Thank you for your cooperation!!!

Interview question

1. What is your outlook/presumption about the three principles incorporated under strategy (i.e. creating constancy of purpose, adopting new philosophy and involving everybody in accomplishing the transformation)? And as a company representative, what is your response to the way to utilize them to improve quality management?
2. What is your outlook /presumption about Deming's principles incorporated under human resource management (i.e. drive out fear, Break down barriers and facilitate pride of workmanship.) And as a company representative, what is your response to the way to utilize them to improve quality management?
3. What are your outlook /presumption about Deming's principles incorporated under result measurement (i.e. Eliminate slogans exhortations and targets and Eliminate numerical quotas for the work force and numerical goals for management)? And as a company representative, what is your response to the way to utilize them to improve quality management?
4. What are your outlook /presumption about Deming's principles combined under training and supervision (i.e. providing modern method of training to employees, focusing on leadership and instituting rigorous program of education and self-improvement)? And as a company representative, what is your response to the way to utilize them to improve quality management?
5. What are your outlook /presumption about Deming's principles combined under quality assurance (i.e. cease dependence on mass inspection to achieve quality and constant improvement.)? And as a company representative, what is your response to the way to utilize them to improve quality management?
6. What are your outlook /presumption about Deming's principles incorporated in purchasing policy (i.e. stop awarding business on price tag alone.)? And as a company representative, what is your response to the way to utilize them to improve quality management?

APPENDIX- C

Spearman's rank table

*

Sample size (n)	p = 0.05	p = 0.025	p = 0.01
4	1.0000	-	-
5	0.9000	1.0000	1.0000
6	0.2860	0.8857	0.9429
7	0.7143	0.7857	0.8929
8	0.6429	0.7381	0.8333
9	0.6000	0.7000	0.7833
10	0.5636	0.6485	0.7455
11	0.5364	0.6182	0.7091
12	0.5035	0.5874	0.6783
13	0.4825	0.5604	0.6484
14	0.4637	0.5385	0.6264
15	0.4464	0.5214	0.6036
16	0.4294	0.5029	0.5824
17	0.4142	0.4877	0.5662
18	0.4014	0.4716	0.5501
19	0.3912	0.4596	0.5351
20	0.3805	0.4466	0.5218
21	0.3701	0.4364	0.5091
22	0.3608	0.4252	0.4975
23	0.3528	0.4160	0.4862
24	0.3443	0.4070	0.4757
25	0.3369	0.3977	0.4662
26	0.3306	0.3901	0.4571
27	0.3242	0.3828	0.4487
28	0.3180	0.3755	0.4401
29	0.3118	0.3685	0.4325
30	0.3063	0.3624	0.4251
40	0.2640	0.3128	0.3681
50	0.2353	0.2791	0.3293
60	0.2144	0.2545	0.3005
70	0.1982	0.2354	0.2782
80	0.1852	0.2201	0.2602
90	0.1745	0.2074	0.2453
100	0.1654	0.1967	0.2327

Contractor's frequency table

N O.	Factors Affecting quality management	Rate of impact					Total Weight	Mean Score (MS)
		1 Not affecting	2 Law	3 moderate	4 High	5 Very high		
1	Lack of adequate sanction by the standard assurance organization	---	7	18	7	---	96	3.00
2	Non implementation of national building code	----	14	11	7	---	89	2.78
3	Contractual Provisions	----	----	11	10	11	128	4.00
4	Lack of well-defined organizational Structure			4	13	15	139	4.34
5	Lack of Technical Expertise	----	----	1	11	20	147	4.59
6	Slow pace of Mechanization	----	---	11	17	4	121	3.78
7	Lack of Training and skills	---	---	1	16	15	142	4.44
8	Limited Financial Capabilities	---	---	4	17	11	135	4.21
9	Customer satisfaction	---	---	7	16	9	130	4.06
10	Planning and scheduling	---	---	---	22	10	138	4.31
11	Unavailability of material and equipment	---	---	5	17	10	133	4.15
12	Project management ignorance	---	1	9	19	3	120	3.75
13	Faulty project conceptualization	---	---	15	13	4	117	3.65
14	Lack of Quality management strategy	---	---	---	13	19	147	4.59
15	Technological developments in Allied Industries	---	---	17	10	5	116	3.62
16	Globalization	---	4	17	11	---	103	3.22
17	Quality Certification	2	6	9	7	8	109	3.4
18	Harsh climatic condition	---	4	17	11	---	103	3.22
19	Aggressive competition during tendering	---	8	19	5	---	93	2.90
20	Lack of knowledge regarding quality management	---	---	8	18	6	126	3.94

Consultant's frequency table

N O.	Factors Affecting quality management	Rate of impact					Total Weight	Mean Score (MS)
		1 Not affecti ng	2 Law	3 moderate	4 High	5 Very high		
1	Lack of adequate sanction by the standard assurance organization	1	4	8	2	---	41	2.73
2	Non implementation of national building code	----	3	3	9	---	51	3.4
3	Contractual Provisions	----	2	9	4	---	47	3.13
4	Lack of well-defined organizational Structure	---	2	2	5	6	60	4.00
5	Lack of Technical Expertise	----	---	4	4	7	63	4.20
6	Slow pace of Mechanization	----	1	7	6	1	52	3.46
7	Lack of Training and skills	---	---	3	8	4	61	4.06
8	Limited Financial Capabilities	---	1	2	6	6	62	4.13
9	Customer satisfaction	---	1	3	7	4	59	3.93
10	Planning and scheduling	---	---	2	9	4	62	4.13
11	Unavailability of material and equipment	---	---	9	3	3	54	3.60
12	Project management ignorance	---	---	8	3	4	56	3.73
13	Faulty project conceptualization	---	2	5	8	---	51	3.40
14	Lack of Quality management strategy	---	---	2	6	7	65	4.33
15	Technological developments in Allied Industries	---	5	3	2	5	52	3.46
16	Globalization	---	5	7	3	---	43	2.86
17	Quality Certification	---	4	5	6	---	47	3.13
18	Harsh climatic condition	1	9	5	--	--	34	2.26
19	Aggressive competition during tendering	---	---	5	10	---	55	3.66
20	Lack of knowledge regarding quality management	---	---	1	10	4	63	4.20