A Thesis on

TO STUDY THE QUALITY MANAGEMENT SYSTEM IN HIGH RISE BUILDING

Submitted for partial fulfillment of award of

MASTER OF TECHNOLOGY

Degree in

CONSTRUCTION TECHNOLOGY & MANAGEMENT

By

VAIBHAV PEGHWAL

(1801103014)

Under the Supervision of

Mr. Anwar Ahmad
Associate Professor
Integral university

Department of Civil Engineering
Integral University,
Lucknow– 226026(U.P.)
2019-20

DECLARATION

I declare that the research thesis entitled **"TO STUDY THE QUALITY MANAGEMENT SYSTEM IN HIGH RISE BUILDING"** is the bonafide research work carried out by me, under the guidance of **Mr Anwar Ahmad Associate Professor, Department of Civil Engineering, Integral University, Lucknow**. Further I declare that this has not previously formed the basis of award of any degree, diploma, associate-ship or other similar degrees or diplomas, and has not been submitted anywhere else.

Date:

Place: Lucknow

VAIBHAV PEGHWAL
1801103014
Department of Civil Engineering
Integral University

CERTIFICATE

Certified that the thesis entitled **"TO STUDY THE QUALITY MANAGEMENT SYSTEM IN HIGH RISE BUILDING"** is being submitted by **VAIBHAV PEGHWAL (1801103014)** in partial fulfillment of the requirement for the award of degree of Master of Technology (CTM) of Integral University, Lucknow, is a record of candidate's own work carried out by him/her under my supervision and guidance.

The results presented in this thesis have not been submitted to any other university or institute for the award of any other degree or diploma.

Mr. Anwar Ahmad
Associate Professor
Department of Civil Engineering
Integral University

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Vaibhav Peghwal

1801103014

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CHAPTER-1

INTRODUCTION

1.1 HISTORY OF QUALITY MANAGEMENT

The concept of a quality as we think of it now first emerged from the Industrial Revolution. Previously goods had been made from start to finish by the same person or team of people, with handcrafting and tweaking the product to meet 'quality criteria'. Mass production brought huge teams of people together to work on specific stages of production where one person would not necessarily complete a product from start to finish. In the late 19th century pioneers such as Frederick Winslow Taylor and Henry Ford recognized the limitations of the methods being used in mass production at the time and the subsequent varying quality of output. Birland established Quality Departments to oversee the quality of production and rectifying of errors, and Ford emphasized standardization of design and component standards to ensure a standard product was produced. Management of quality was the responsibility of the Quality department and was implemented by Inspection of product output to 'catch' defects.

Application of statistical control came later as a result of World War production methods, which were advanced by the work done of W. Edwards Deming, a statistician, after whom the Deming Prize for quality is named. Joseph M. Juran focused more on managing for quality. The first edition of Juran's Quality Control Handbook was published in 1951. He also developed the "Juran's trilogy", an approach to cross-functional management that is composed of three managerial processes: quality planning, quality control, and quality improvement. These functions all play a vital role when evaluating quality.

Quality, as a profession and the managerial process associated with the quality function, was introduced during the second half of the 20th century and has evolved since then. Over this period, few other disciplines have seen as many changes as the quality profession.

The quality profession grew from simple control to engineering, to systems engineering. Quality control activities were predominant in the 1940s, 1950s, and 1960s. The 1970s were an era of quality engineering and the 1990s saw quality systems as an emerging field. Like medicine, accounting, and engineering, quality has achieved status as a recognized profession.

As Lee and Dale (1998) state, there are many organizations that are striving to assess the methods and ways in which their overall productivity, the quality of their products and services and the required operations to achieve them are done.

1.2 CONCEPT OF QUALITY MANAGEMENT

The quality management system can be defined as overall activities of management that defines the quality policies, the objectives, responsibilities their implementation through quality planning, quality control, quality assurance and continuous quality improvement within the quality system. While talking about quality management system in the construction industry it is required both at the company level and at the project level. Quality in the construction industry is directly proportionate to the customer satisfaction. It is basically a tool to reliably manage the goal of client satisfaction. The quality planning involves identification of quality standards; quality assurance needs evaluation of overall performance of the project and quality control needs monitoring of specific project results.

The tools and techniques to assure the quality management of the project includes flow charting, trend analysis, experiment designs, benchmarking, Total quality management, Supply chain management, cost of quality, benefit- cost analysis, quality audits and inspections.

Project quality management has not been considered as a matter of concern rather it is the most important element towards the better results and the customer satisfaction. If the quality management techniques and procedures are not considered while construction it results wastage of considerable amount of time and the valuable resources. It is not just a single time procedure rather it is a continuous process that involves making improvements in all the aspects of business. The objective of

continuous improvement can only be achieved through commitment of efforts and the team work. This not only results in reduction of errors but reduction in the cost too. The commitment to quality management is required from the top management to the lower level of management. It can only be ensure with proper training, healthy and safe work environment and best technology based equipments.

Quality control in development regularly includes unfavorable compliance with least benchmarks of fabric and workmanship in arrange to guaranteed the execution of the office concurring to the plan. These least measures are contained within the details depicted within the past segment. For the reason of inconceivable compliance, arbitrary tests and factual strategies are commonly utilized as the premise for tolerating or dismissing work completed and clusters of materials. Developments of tall rise building provide the consolation living standard for the individuals conjointly offer assistance within the arranging of the cities. Abandons or disappointments in built offices can result in exceptionally expansive costs. Indeed with minor abandons, re-construction may be required and office operations impeded. Expanded costs and delays are the result. Within the most exceedingly bad case, disappointments may cause individual wounds or fatalities. The most reason of this paper is to display the Quality Affirmation & Quality Control in Tall Rise Buildings. With the tall showcase competition, quality has ended up the showcase differentiator for nearly all items and administrations. In this manner, all producers and benefit suppliers out there always hunt for improving their product or the benefit quality. In arrange to preserve or upgrade the quality of the offerings, producers utilize two strategies, quality control and quality confirmation. These two hones make beyond any doubt that the conclusion item or the benefit meets the quality necessities and guidelines characterized for the product or the benefit. There are numerous strategies taken after by organizations to attain and keep up required level of quality. A few organizations accept within the concepts of Add up to Quality Administration (TQM) and a few others believe in inside and outside benchmarks. The measures ordinarily characterize the forms and methods for organizational exercises and help to preserve the quality in each perspective of organizational working.

1.3 QUALITY MANAGEMENT PRINCIPLES

The ISO 9000 series are based on seven quality management principles (QMP)

The seven quality management principles are:

- QMP 1 – Customer focus
- QMP 2 – Leadership
- QMP 3 – Engagement of people
- QMP 4 – Process approach
- QMP 5 – Improvement
- QMP 6 – Evidence-based decision making
- QMP 7 – Relationship management

Principle 1 – Customer focus

Organizations depend on their customers and therefore should understand current and future customer needs, should meet customer requirements and strive to exceed customer expectations.

Principle 2 – Leadership

Leaders establish unity of purpose and direction of the organization. They should create and maintain the internal environment in which people can become fully involved in achieving the organization's objectives.

Principle 3 – Engagement of people

People at all levels are the essence of an organization and their full involvement enables their abilities to be used for the organization's benefit.

Principle 4 – Process approach

A desired result is achieved more efficiently when activities and related resources are managed as a process.

Principle 5 – Improvement

Improvement of the organization's overall performance should be a permanent objective of the organization.

Principle 6 – Evidence-based decision making

Effective decisions are based on the analysis of data and information.

Principle 7 – Relationship management

An organization and its external providers (suppliers, contractors, service providers) are interdependent and a mutually beneficial relationship enhances the ability of both to create value.

1.4 BENEFITS OF QUALITY MANAGEMENT

The potential benefits offered by QM techniques are varied and the consensus from various studies is that it has been successfully applied in other industries and can be very beneficial in the construction industry. The implementation of QM programs enables companies to improve long-term relationships, product and process improvement, create a harmonious team spirit, more customer focused, employee job satisfaction, increased revenues, reduction in quality costs, decreasing waste and rework, better coordination of activities, improved customer service and market competitiveness, enhance professionalism and skills in all spheres of the construction sector, encourage open addressing of problems, better control over the construction process, improved safety, subcontractors with proper QM systems, closer relationships with subcontractors and help to achieve the intended project objectives (Abdul-Rahman and Tan, 2005; Landin, 2000; Abu Bakar, 2011; Low and Teo., 2004; Al-Tayeb, 2008). All the above advantages cited for construction organizations are based on the lessons learned from the use of an effective QMS. An example cited in the study of Abdul-Rahman and Tan (2005) is that the majority of Malaysian constructors have been able to improve their company competitiveness by 80%, after having certified to ISO 9001. This clearly indicates that QMSs need to be developed and implemented for any construction company wishing to become a sector leader (Willar, 2012).

1.5 ABOUT HIGH RISE BUILDING

A high-rise building is a tall building, as opposed to a low-rise building and is defined differently in terms of height depending on the jurisdiction. It is used as a residential, office building, or other functions including hotel, retail, or with multiple purposes combined. Residential high-rise buildings are also known as tower blocks and may be referred to as "MDUs", standing for "multi-dwelling unit". A very tall high-rise building is referred to as a skyscraper.

High-rise buildings became possible with the invention of the elevator (lift) and less expensive, more abundant building materials. The materials used for the structural system of high-rise buildings are reinforced concrete and steel. Most North American style skyscrapers have a steel frame, while residential blocks are usually constructed of concrete. There is no clear difference between a tower block and a skyscraper, although a building with forty or more stories and taller than 150 m (490 ft) is generally considered a skyscraper.

High-rise structures pose particular design challenges for structural and geotechnical engineers, particularly if situated in a seismically active region or if the underlying soils have geotechnical risk factors such as high compressibility or bay mud. They also pose serious challenges to fire fighters during emergencies in high-rise structures. New and old building design, building systems like the building standpipe system, HVAC systems (heating, ventilation and air conditioning), fire sprinkler system and other things like stairwell and elevator evacuations pose significant problems. Studies are often required to ensure that pedestrian wind comfort and wind danger concerns are addressed. In order to allow less wind exposure, to transmit more daylight to the ground and to appear more slender, many high-rises have a design with setbacks.

Apartment buildings have technical and economic advantages in areas of high population density, and have become a distinctive feature of housing accommodation in virtually all densely populated urban areas around the world. In contrast with low-rise and single-family houses, apartment blocks accommodate more inhabitants per unit of area of land and decrease the cost of municipal infrastructure.

1.5.1 Definition

Various bodies have defined "high-rise":

- Emporis defines a high-rise as "A multi-story structure between 35–100 meters tall, or a building of unknown height from 12–39 floors."
- According to the building code of Hyderabad, a high-rise building is one with four floors or more, or 15 to 18 meters or more in height.
- The New Shorter Oxford English Dictionary defines a high-rise as "a building having many storeys".
- The International Conference on Fire Safety in High-Rise Buildings defined a high-rise as "any structure where the height can have a serious impact on evacuation"
- In the U.S., the National Fire Protection Association defines a high-rise as being higher than 75 feet (23 meters), or about 7 stories.
- Most building engineers, inspectors, architects and similar professionals define a high-rise as a building that is at least 75 feet (23 m) tall.

1.5.2 History

High-rise apartment buildings had already appeared in antiquity: the insulae in ancient Rome and several other cities in the Roman Empire, some of which might have reached up to ten or more stories, one reportedly having 200 stairs. Because of the destruction caused by poorly built high-rise insulae collapsing, several Roman emperors, beginning with Augustus (r. 30 BC – 14 AD), set limits of 20–25 meters for multi-story buildings, but met with limited success, as these limits were often ignored despite the likelihood of taller insulae collapsing.[The lower floors were typically occupied by either shops or wealthy families, while the upper stories were rented out to the lower classes. Surviving Oxyrhynchus Papyri indicate that seven-story buildings even existed in provincial towns, such as in third century AD Hermopolis in Roman Egypt.

In Arab Egypt, the initial capital city of Fustat housed many high-rise residential buildings, some seven stories tall that could reportedly accommodate hundreds of people. Al-Muqaddasi, in the 10th century, described them as resembling minarets, while Nasir Khusraw, in the early 11th century, described some of them rising up to 14 stories, with roof gardens on the top story complete with ox-drawn water wheels for irrigating them. By the 16th century, Cairo also had high-rise apartment buildings where the two lower floors were for commercial and storage purposes and the multiple stories above them were rented out to tenants.

The skyline of many important medieval cities was dominated by large numbers of high-rising urban towers, which fulfilled defensive but also representative purposes. The residential Towers of Bologna numbered between 80 and 100 at a time, the largest of which still rise to 97.2 m. In Florence, a law of 1251 decreed that all urban buildings should be reduced to a height of less than 26 m, the regulation immediately put into effect.] Even medium-sized towns such as San Gimignano are known to have featured 72 towers up to 51 m in height.

The Hakka people in southern China have adopted communal living structures designed to be easily defensible in the forms of Weilongwu and Tulou , the latter are large, enclosed and fortified earth building, between three and five stories high and housing up to 80 families. The oldest still standing tulou dates back from the 14th century.

High rises were built in the Yemeni city of Shibam in the 16th century. The houses of Shibam are all made out of mud bricks, but about five hundred of them are tower houses, which rise five to sixteen stories high, with each floor having one or two apartments. This technique of building was implemented to protect residents from Bedouin attacks. While Shibam has existed for around two thousand years, most of the city's houses date from the 16th century. The city has the tallest mud buildings in the world, some more than 30 meters (100 feet) high. Shibam has been called "one of the oldest and best examples of urban planning based on the principle of vertical construction" or "Manhattan of the desert".

The engineer's definition of high-rise buildings comes from the development of fire trucks in the late 19th century. Magirus had shown the first cogwheel sliding ladder in 1864. The first turntable ladder drawn by horses was developed in 1892 which had a length of 25 meters. The extension ladder was motorized by Magirus in 1904. The definition of a maximum of 22 meters for the highest floor was common in the building regulations at the time and it is still so today in Germany. The common height for turntable ladders did later go to 32 meters (100 feet), so that 30 meter is a common limit in some building regulations today, for example in Switzerland. Any building that exceeds the height of the usual turntable ladders in a city must install additional fire safety equipment, so that these high-rise buildings have a different section in the building regulations in the world.

Currently, the tallest high-rise apartment building in the world is Chicago's John Hancock Center, constructed under the supervision of Skidmore, Owings & Merrill and completed in 1969. The building has 100 stories and stands 344 meters tall.

List of some tallest building in lucknow

S.No	Name	Location	Height	Floors	Building Type	Year
1.	Paarth Aadyant Tower 1	Gomti Nagar Extension	80m	24	Residential	2017
2.	Paarth Aadyant Tower 2	Gomti Nagar Extension	80 m	24	Residential	2017
3	Paarth Aadyant Tower 3	Gomti Nagar Extension	80m	24	Residential	2017
4.	Paarth Aadyant Tower 4	Gomti Nagar Extension	80m	24	Residential	2017

5.	Paarth Aadyant Tower 5	Gomti Nagar Extension	80m	24	Residential	2017
6.	Paarth Aadyant Tower 6	Gomti Nagar Extension	80m	24	Residential	2017
7.	The Golf Gateway Tower 1	Golf City	77 m	23	Residential	2016
8.	The Golf Gateway Tower 2	Golf City	77 m	23	Residential	2016
9.	The Golf Gateway Tower 3	Golf City	77 m	23	Residential	2016
10.	The Golf Gateway Tower 4	Golf City	77 m	23	Residential	2016

1.6 OBJECTIVE OF THE STUDY

- To assess current practices of QM in construction Industry from the perceptions of the main actors of the construction industry in Lucknow.
- To identify any present quality problems and obstacles that exist in this sector.

1.7 SCOPE OF THE STUDY

- The scope of this study to find the implementation of quality management system in high rise building in Lucknow.
- This study is to find the challenges faced by construction companies in and around Lucknow to implement quality management system.

CHAPTER-2

LITERATURE REVIEW

N.S Azman et.al(2018),this paper aim to determine the various success factors affecting the quality management of construction project that using IBS and ranked the success factors .They found that 87factors from review papers and two most significant factors affecting quality management in IBS are high ranked which is appointment of high experience technical team, using high quality componenets and materials with overall percentage 2.48% and 1.86%.

Cuigang Song, Yang Liu et.al(2018),this paper describes about problems and countermeasures in construction quality management of house building engineering. As one of the main types of construction projects in China, the goal of the construction of buildings is providing people with a good and safe living and working space. The significance of construction quality management is also self-evident. At the same time, the effective implementation of construction quality management of housing construction projects has a very realistic impact on the construction enterprises themselves.

Japhary Juma Shengeza(2017),this study has evaluated the application of Project Quality Plan(PQP) as one of the implementation strategies of QMS in construction projects. The data was collected by use of questionnaire; interview and document review. Primary data from 32 mediun and large scale high rise building construction project were sampled through non-probability sampling. The study also evaluated the existence of application of constituents of PQP and identified dominant obstacles in application of PQP for building construction projects.

P Siva Sankar et.al(2017), The main purpose of this paper is to present the Quality Assurance & Quality Control in High Rise Buildings. Specifications of work quality are an important feature of facility designs. Also for the high rise building the requirements and laboratory tests that are essential for it are mentioned. This chapter also shows the importance of analytical quality assurance during the construction process and presents an introduction to successful and economic method development. After doing some methodology and research they conclude that lack of professionalism leading to lack of detail when meticulous

planning and decision making as per site management is concerned leading to under utilization of resources to a great extend. Still now project resources planning is only limited to planning and scheduling with time but resources mobilization and usages planning according to their capacity and availability ahead of timing the planning stage is still now nobody concern.

Fei Cheng(2017), He describe analysis of the connotation of the assembly structure and analyzes the quality problems in the construction process of the construction projects and puts forward the improvement measures to promote the improvement of the building quality and the construction of the building Construction speed. Based on this, this paper analyzes the structural system and design of prefabricated building. Based on this, this paper focuses on the analysis of the advantages and disadvantages of the construction of the assembly and analyzes the quality problems of the assembly quality (The quality problems of bed mortar, the problem of the installation size deviation, the quality of the concrete after the pouring, the protection of the finished product) Construction of construction quality measures (the rational use of high technology, to strengthen the construction workers training, establish the retrofit mechanism of assembly quality, the establishment of quality management platform, optimize the design of assembly-style buildings) to discuss.

Reshma S. Fegade (2016), This paper is first identify the factors which affect the quality of different items of work for High Rise Building. Then find out the factors which are responsible to affect the quality of work by visiting site of High rise building. By observing on the site of high rise building, main factors responsible to affect quality and photographs of quality problems are collected. From this collected data, analysis is made by ranking method to find out each factors to what amount (in%) responsible to affect Quality for high rise building.

Tiong Kung Leong et.al(2016), This paper explores the role of quality management system (QMS),such as ISO 9000, and total quality management, and their approaches in construction industry. The aim is to determine if these systems have the potential to generate new knowledge for improving quality management practices and outcomes in construction projects. This paper reviews all the prior literatures relevant to QMS in construction industry. It also provides useful

implications for industry practitioners to determine their strengths and weaknesses and the area of improvement in their current system or practices.

Anup W S et.al(2015), this research is done to give insight about practices, tools, techniques, management, commitement towards quality implementation in construction projects. It also explores the issue forced during the implementation of quality management system. The research uses questionnaire approach to gather data. A case study whivh substantiates the questionnaire is conducted using content analysis method. According to the result obtained from the research most of the employees believe that implementation of QMS increases paper work and thus unwillingness to implement it has increased. Competence, training and awareness has to be developed in the organization and should be given importance.

Pravin P. Mane and Dr. Jalindar R.Patil (2015),this research based on the QMS recommended that construction companies should create a flexible and conductive organizational atmosphere which encourages the development of quality management system in all aspects of their work. The paper includes the outcomes of the research methodology decided by authors based on the interview of project participants and analysis of scrutinized interview data. After scrutinizing the data it conclude that the quality control measures used on construction site is the quality of workmanship in all construction activities followed by site review meeting with staff, set procedure to control quality, do proper sampling and testing, observe regular schedule, follow the prescribed curing and deshuttering schedule.

Nursyamimi Shaaria et.all(2015), the current study was conducted to identify the set of Project Quality Management System (PQMS) practices for its successful implementation in construction field through a systematic review of literature. Critical success factor (CSF) to implement PQMS in construction project were stated as ‘Client Commitment’, Measurement and Improvement’, ‘Integration of quality Plan’, ‘Education and Training’, Teamwork and Communication’ and ‘Use of ICT’.

D.Ashokkumar(2014),this research mainly focus the importance and factors that affect the quality management in the execution phase. It also includes visiting of

some construction companies and conducts the questionnaire survey, then analyse the difficulties and the cost varience due to quality management. This thesis is useful for minimizing the material wastage, workmanship wastage, time wastage and indirect cost.

Abdul Hakim Mohammeda et.al(2014), This paper describes the implementation of Project Quality Management System and identify critical success factors of project quality management system associated with the indicators for each critical success factor identified. Hundreds of articles searched using keyword of "success factor", "quality" and "construction" were gathered and analyzed using content analysis method. This research provides a comprehensive compilation of all previous study on the Critical Success Factors for Project Quality Management System implementation, through a clearly structured methodological approach. A total of six critical success factors for project quality management system in construction industry were identified. Each of the critical success factors is associated with three indicators that present evidences of implementation.

Tiong Kung Leong(2014), This paper proposed seven existing and new performance indicators to measure the effectiveness of quality management system(QMS) maintenance and practices in construction industry. This research is carried out with a questionnaire based on QMS variables which are extracted from literature review and project performance indicators which are established from project management's theory. Data collected was analyzed using correlation and regression analysis. The findings indicate that client satisfaction and time variance have positive and significant relationship with QMS while other project performance indicators do not show significant results. Further studies can use the same project performance indicators to study the effectiveness of QMS in different sampling area to improve the generalizability of the findings.

Ivan W. H Fung et.al(2012), This paper examines quality performance of clients and consultant services in implementing QMS and its impacts on contractors and project management. Questionnaire survey and structured interview discussions were conducted to achieve the objective in this paper. The results show that quality performance of clients and consultant services in implementing QMS are

generally high except the aspects of "less revisions of working drawings" and "high buildability and constructability of the design". It is also found that the implementation of ISO 9000 QMS will result in increase of the overall construction cost up to 25% and increase of workload in dealing with the required paperwork; however, no significant improvement is found on the construction progress.

Abdul-Rahman and Hamza(2011),this research explores preliminarily the practices of quality management, management commitement in quality management, and quality management implementations problems in construction projects. The research applies semi-structural interview approach with twelve project management practitioners. After finding of the preliminary study on yhe implementation of quality management in construction project it concludes several points which are as follows:-

- Total quality management is not a common practice
- ISO registration is mainly for marketin purpose
- Implementation of quality management is greatly perceived as a mean to fulfil contractual obligations instead of satisfying the needs of clients

Monica Santos Salgado(2011),this paper is to analyse the relation between the existence of an implemented quality management system on design offices and its influence on the design management process for sustainable building. Constructors and architects have been interviewed in order to get their opinion about this subject. After observation it has been consider the first step not ony for the certification ISO 9000 but also for helping to accomplish the requirements of HQE methodology- particularly on registering the QBE(Quality Environment of the Building) goals and the design decisions to achieve the desired results.

Thomas Mills (2010), he describes about the achieving BIM and CIM implementation through quality management. The proposition is approached from a through review of BIM/CIM/FIM capabilities, the operation actualization in design and construction, the individual value added and extracted throughout the workflow process, and the value added to owner in delivering an accurate model.

Kaziliunas (2010), The investigation has shown that very important for ISO 9000 financial benefits is a well-developed ISO 9000 implementation strategy. Strategic orientation is a moderating factor influencing the relationship between ISO 9000 certification benefits and the firm's financial performance. In the present study, a strong interdependence between the companies' certification motivation factors and the results obtained was determined. From the overall findings of the investigation, it can be concluded that strong internal motivation or willingness to improve a company's quality helps establish a quality management system that leads to external benefits (such as the improvement of the company's position in the market) as well as to internal benefits. Continuous improvement of processes, people and system, the reward system, team work, the measurement of performance and communication during the post-certification period are all critical success factors for the sustainable quality management system and for successful results of ISO 9000 certification.

K. N. Jha & K. C. Iyer(2006), They discuss the Critical Factors Affecting Quality Performance in Construction Projects. A preliminary survey identified 55 attributes responsible to impact quality performance of the projects. Statistical analysis of questionnaire responses on the attributes resulted into two distinct sets of success and failure attributes. Further analyses of individual sets of success attributes and failure attributes separately grouped them into fewer critical success and failure factors. The critical success factors obtained were: project manager's competence; top management's support; monitoring and feedback by project participants; interaction among project participants; and owners' competence. The factors that adversely affected the quality performances of projects were: conflict among project participants; hostile socio-economic environment; harsh climatic condition; PM's ignorance & lack of knowledge; faulty project conceptualization; and aggressive competition during tendering.

Adriano Vivancos and Francisco Cardoso(2000) This paper discuss about the impacts of the implementation of quality management systems in the organizational struructure of Brazilian building firms. They discuss some expressive organizational transformations observed in the case studies. In

methodology it involved visits to the central office and to at least one construction site of each company. Using standard questionnaires, three interviews with engineers were made in each case. Finally , it was also observed thar during implementation of quality programs building firms become conscious of the importance of having strong partnership relationship. Although most of the companies studied were still far from having a real partner suppliers, it can be said that the spread of the quality movement might strongly contribute for the progress of the local building productive chain.

Albert P.C. Chan(2000), This paper aims to identify factors that showed a strong correlation to good quality performance. The ultimate goal is to provide clients, project managers, designers and contractors with information that can help them become more efficient with their limited resources and, as a result, achieve better quality outcomes. A total of 110 recently-completed building projects in Hong Kong were examined and analysed. Using factor analysis and stepwise multiple regression analysis, factors affecting the quality of the building project were identified. It was shown that project management action by the project team was the most powerful predictor of client's satisfaction with quality. Other factors included effectiveness of the construction team leader, the client's emphasis on quality, and the client's emphasis on time.

Refaat H. Abdel-Razek(1998),This paper describes a method of obtaining construction managers' consensus opinion on factorsto improve quality on their projects. It also explains the details and results of the application that was carried out in one of the largest contracting companies in the Middle East. A consensus of opinion of 90 construction project managers was obtained on 16 factors required to improve quality on their projects, together with the relative importance of each factor. For example, improvement of employees' financial standard contributed more than 13% of all the factors. A Pareto analysis shows that the first eight factors contribute 78% of the weight of all the factors. The factors that have the same source of problems were also combined and categorized into fourareas. Improvement of employees' satisfaction, for example, is one area and contributed more than 33% of all the factors. Making improvements in these factors should make it possible for contracting companies to achieve progressively better quality.

Al-Musleh (2012) discussed the implementation of TQM in construction firms, and concluded in his study that TQM has been recognized as a successful management philosophy in the manufacturing and surface industreies , so can like by embraced in the construction industry to help quality and productivity.

Talha(2004) TQM provides an effective approach to prevent or reduce these problems and provide higher quality services and products. Its management are designed to focus on the entire organization and all of the employees in providing products or services that satisfy the customers.

Chase et al(2001) TQM is a QMS which pursues excellence in customer satisfaction through continuous improvements of products and process by the total involvement and dedication of everyone involved in the process or the products.

Bryde and Robinson (2005) most contractors have failed in meeting stakeholders' needs on cost, quality and time objectives. The failure of these objectives are caused by design deficiencies, products failure and poor workmanship and these problems are common and faced by most countries irrespective of the differences in their economies.. Many researchers have written papers regarding the implementation of TQM in different industries while few have focused on the construction industry.

Metri (2005) attributes it to the fact that construction industry has generally lagged behind other industries in implementing reform through TQM principles.

Low and Peh (1996) said that fifteen percent (15%) savings on total cost of construction can be achieved through eliminating re-work and wasted work with the introduction of QM and it should form the preliminary focus in rectifying the ills of the construction industry.

Yusoff et al (2006) enumerated obstacles to QM: High cost especially initial cost, resistance to change, loss of productivity of the workforce due to the effort exerted in learning the new system, management interference, limited ability of personnel, remote job sites making it hard to control, communication problems between personnel within the workforce.

Abdul-Rahman and Tan (2005) noticed several obstacles for implementing TQM on construction sites such as: too much paperwork, transient nature of workforce, field employees regard TQM as irrelevant, difficulty in measuring results, low bid, and subcontractors and suppliers not interested.

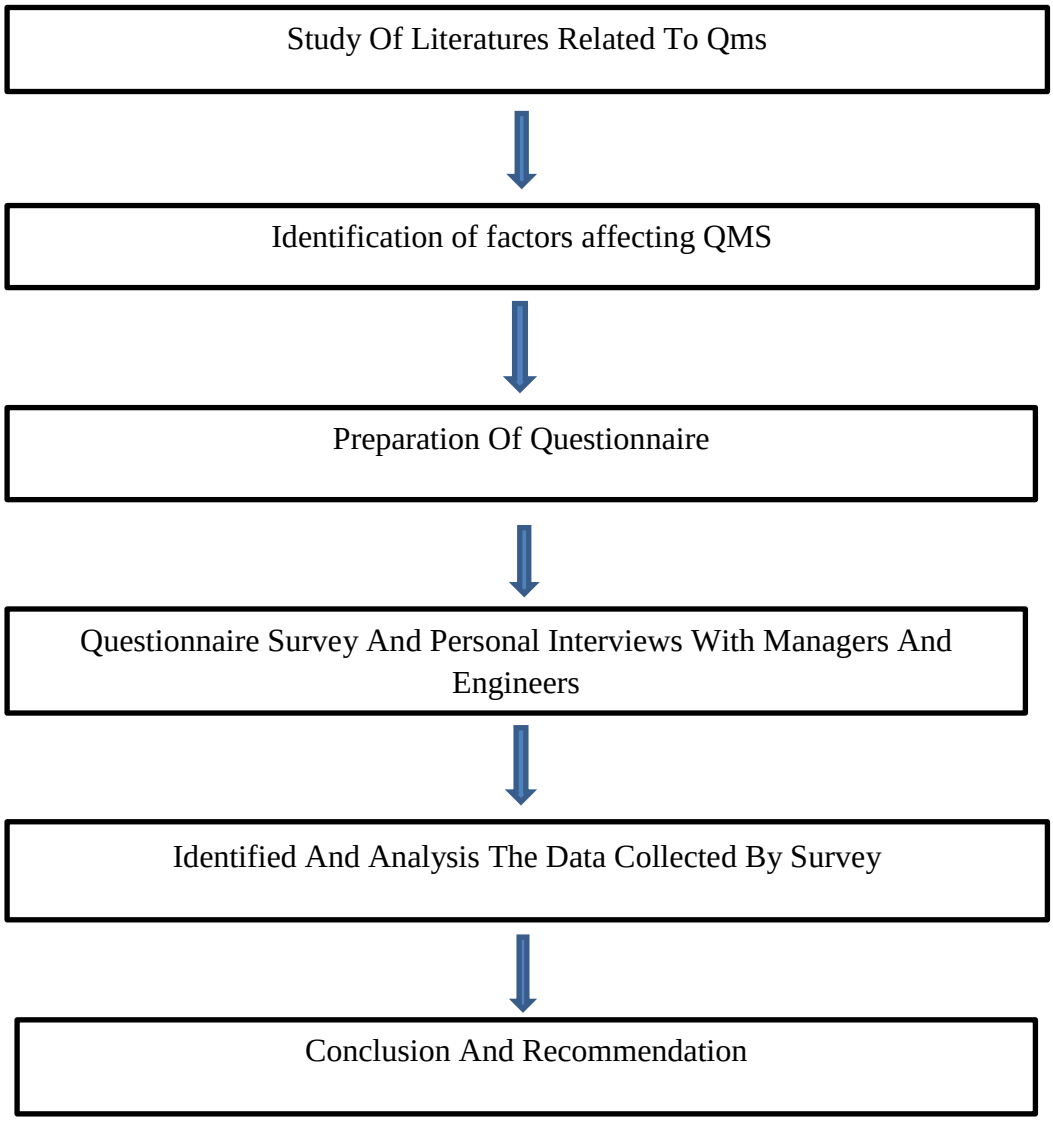
CHAPTER-3

METHODOLOGY

3.1 General

This paper aims to investigate the potential benefits derived from implementing QMS and barriers to the extensive implementation of QMS in high rise building. It has been planned to carry out the work by zero study claims study through questionnaire and after collecting the data are analysed by two different methods. First is Relative Importance Index and second one is SPSS software.

3.2 Research Methodology Flow Chart



Questionnaires Format

Dear Respondent,

This questionnaire has been designed to study the quality management system in high rise building. The study is being conducted by the student pursuing an M.Tech program at Integral University. This study is done only for academic purposes and your response will not be used for any other purpose. Participation in the survey is voluntary. Each question is having choices and you have to tick only one choice. There is no right or wrong answer; you have to pick the choice you agree the most with. Kindly ensure that none of the questions is missed and you answer them to the best of your knowledge.

Your participation is highly appreciated.

Thanks and Regards

VAIBHAV PEGHWAL

Q-1: Type of Organization?

1) Consulting office
2) Contracting company

Q-2: What is your Designation?

1) Company manager
2) Supervision engineer
3) Site Engineer
4) Project Manager

Q-3: Would you mention age group (in yrs)

1) Less than 35
2) 35-45
3) 45 or above

Q-4: Would you mention your years of experience in construction industry/business?

1) Less than 5
2) 5 to 10

3) 10 or above

Q-5: May I know your education status?

1) Less than diploma certificate level
2) Diploma certificate level
3) Bachelor level
4) Master level
5) Ph. D level

Q-6: What is your perception of quality?

1) Inspection and Corrective Actions
2) Elimination of Defects
3) Continuous Improvement
4) A Tool to Increase Profits
5) Increase Productivity
6) A Competitive Advantage
7) Customer Satisfaction

Q-7: Does your Company have Quality Policies, Manuals or Documents?

1) Yes
2) No
3) Partially existing

Q-8: When your Company Check for Design Drawing Conformance to Standards?

1) Do not Check it out
2) After Every Design
3) Before Commencement of projects
4) During construction

Q-9: How do your company train the employee for quality?

1) No training id given

2) On-site
3) Workshops on quality improvement
4) Short courses

Q-10: Has your company got the ISO certificate?

1) Yes
2) No
3) Maybe

Q-11: How is the process of selection the contractor?

1) Based on the minimum price
2) Based on the technical evaluation
3) Bases on technical and financial evaluation

Q-12: Is the supervisor's control comprehensive and ensure the right of the work?

1) Yes
2) No
3) Sometimes

Q-13: Does the contractor's engineer exist at the site permanently?

1) Yes
2) No
3) Don't know

Q-14: Does the contactor's engineer do his role in achieving quality at the site?

1) Yes
2) No
3) Don't know

Q-15: Are materials stored in places suitable for its safety?

1) Yes
2) No

3) Don’t know

Q-16: In your view, What are the most partly commitment to achieve quality in construction projects?

1) Government institutions
2) Donor institutions
3) Engineering offices
4) Contracting companies

Table no. 1

No	Obstacle in QMS	Practically ignored(1)	Seldom used(2)	Moderately used(3)	Highly used(4)	Extensively used(5)
1	Lack of top-management commitment/understanding of quality issues					
2	Absence of a clear strategy for quality management in the company					
3	Lack of employees’ and workers' commitment/understanding, and resistance to quality programs					
4	Lack of communication between project's parties (contractor and consultant)					
5	Firms emphasis on short-term objectives/gains					
6	Lack of education and training to drive the improvement process					
7	Loss of part of the productivity of workers as a result of the effort in					

	training					
8	Too much documents are required which lead to difficulty on documentation ability					
9	Lack of expertise/resources in Quality Management System					
10	A lack of codes and specifications					
11	Insufficient attention to achieve quality by workers in projects					
12	Instability of the volume of work and the instability of the national economy.					
13	Absence of rewards and appreciation of the achievement of employees and workers					
14	Awarded the tender on the basis of lower prices and not efficiency					
15	Lack of feedback from previous projects and take advantage of them.					
16	Absence of advance planning for the project					
17	Lack of top-management commitment/understanding of quality issues					
18	Lack of owner awareness					

CHAPTER-4

DATA ANALYSIS

4.1 INTRODUCTION

In this thesis work the excel software was used to calculate and analyze the statistical data which was collected by the questionnaire survey other than that complete statistical tests can also perform in that software. The collected data from the questionnaire survey will be analyzed by using excel software so as to carry out the data analysis in this research.

4.2 RII INDEX METHOD-

Data of all these tables were analyzed by a RII Index was calculated for each type of claims as follows;

RII Index = $\sum$ W / (A X N)

Where, W = weight given to each factor by the respondents, ranges from 1 to 5,

A = highest weight (i.e. 5 in this case) and

N = total number of respondents.

Ranking formulation using RII method

Obstacle in QMS	Practically Ignored	Seldom Used	Moderately Used	Highely Used	Extensively used	weighting	Rank
Lack of top-management commitment/understanding of quality issues	11	8	4	10	3	94	0.52
Absence of a clear strategy for quality management in the	8	10	7	7	4	97	0.53

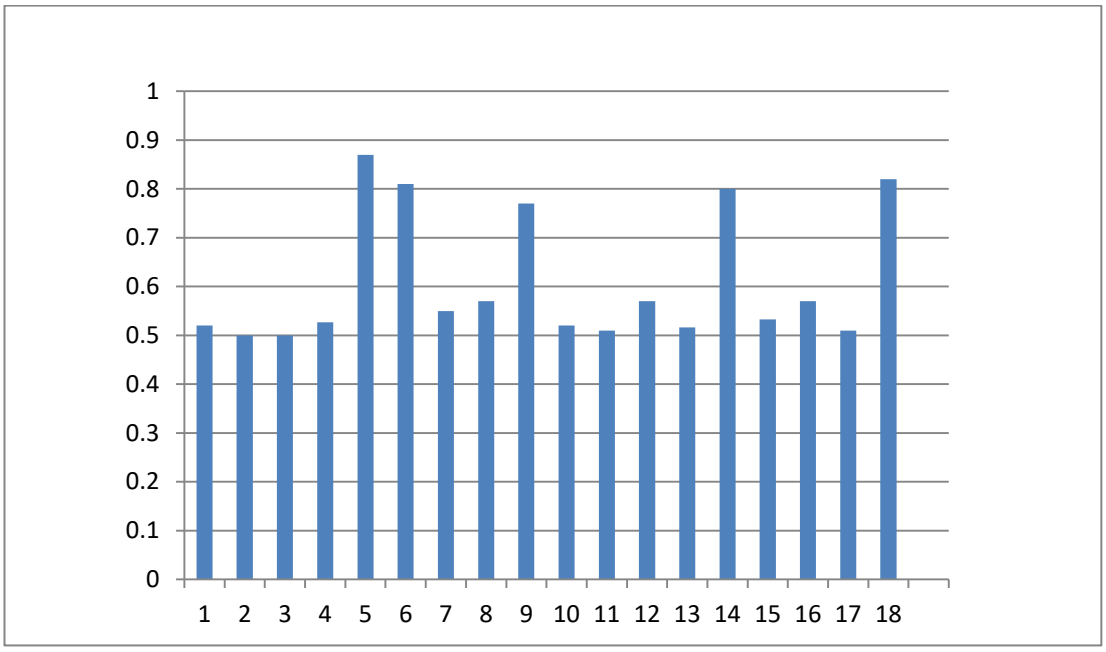
company							
Lack of employees' and workers' commitment/understanding, and resistance to quality programs	9	8	9	7	2	90	0.5
Lack of communication between project's parties (contractor and consultant)	4	12	10	8	1	95	0.52
Firms emphasis on short-term objectives/gains	0	1	7	5	23	158	0.87
Lack of education and training to drive the improvement process	1	4	6	5	20	147	0.81
Loss of part of the productivity of workers as a result of the effort in training	7	8	11	6	4	100	0.55
Too much documents are required which lead to difficulty on documentation ability	7	10	5	9	5	103	0.57
Lack of expertise/resources in Quality Management System	0	3	6	9	16	140	0.77
A lack of codes and specifications	10	8	7	8	3	94	0.52
Insufficient attention to achieve quality by workers in projects	9	6	10	8	2	93	051
Instability of the volume of work and the instability of the national Economy	4	11	10	8	3	103	0.57

Absence of rewards and appreciation of the achievement of employees and workers	5	14	7	6	3	93	0.51
Awarded the tender on the basis of lower prices and not efficiency	2	2	8	6	18	152	0.84
Lack of feedback from previous projects and take advantage of them.	7	9	8	8	3	96	053
Absence of advance planning for the project	5	12	6	8	5	104	0.57
Not used computer software to manage projects effectively	10	9	7	7	3	92	0.51
Lack of owner awareness	0	3	6	10	17	149	0.82

Answer is the most factors effecting in supply chain management from RII-

Factors	Rank
Firms emphasis on short-term objectives/gains	1
Awarded the tender on the basis of lower prices and not efficiency	2
Lack of owner awareness	3
Lack of education and training to drive the improvement process	4
Lack of expertise/resources in Quality Management System	5
Too much documents are required which lead to difficulty on documentation ability	6
Absence of advance planning for the project	7
Instability of the volume of work and the instability of the national Economy	8

Loss of part of the productivity of workers as a result of the effort in training	9
Lack of feedback from previous projects and take advantage of them	10
A lack of codes and specifications	11
Lack of communication between project's parties (contractor and consultant	12
Lack of top-management commitment/understanding of quality issues	13
Lack of top-management commitment/understanding of quality issues	14
Absence of rewards and appreciation of the achievement of employees and workers	15
Insufficient attention to achieve quality by workers in projects	16
Absence of a clear strategy for quality management in the company	17
Lack of employees' and workers' commitment/understanding, and resistance to quality programs	18



Factors affected in QMS

4.3 SPSS Analysis

SPSS Statistics are software system package used for statistics analysis. SPSS is among the foremost wide used programs for statistics analysis in scientific discipline. it's additionally employed by market researchers, health researchers, survey firms, government, education researchers, selling organizations, and others. the initial SPSS manual has been represented in concert of "sociology's most influential books" for permitting normal researchers to try and do their own statistical analysis .In addition to statistical analysis, knowledge management

4.3.1 Frequency Statistics :-

The Frequencies procedure provides statistics and graphical displays that are helpful for describing many sorts of variables. to make a table of frequencies (number of occurrences of given categories), by analyzing by suggests that of descriptive Statistics, the frequency within the needed variables would be calculated. Figure shows concerning choose the variables to be pictured within the frequency table by moving them from the left- to the right- hand box. SPSS provides the user further choices, as well as statistics, charts, and format

Statistics

		Firms	Tender	Owner	Education	Expertise
N	Valid	36	36	36	36	36
	Missing	0	0	0	0	0

Table 4.2 Frequency table of factors affecting QMS

Frequency Table

Firms

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Practically ignored	1	2.8	2.8	2.8
	Seldom Used	1	2.8	2.8	5.6
	Moderately used	6	16.7	16.7	22.2
	Highly Used	5	13.9	13.9	36.1
	Extremely used	23	63.9	63.9	100.0
	Total	36	100.0	100.0	

Table 4.3 Frequency table of firms emphasis on short- term objectives/gains affecting QMS

Tender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Practically ignored	2	5.6	5.6	5.6
	Seldom Used	2	5.6	5.6	11.1
	Moderately used	8	22.2	22.2	33.3
	Highly Used	6	16.7	16.7	50.0
	Extremely used	18	50.0	50.0	100.0
	Total	36	100.0	100.0	

Table 4.4 Frequency table of award tender on the basis of lower prices not efficiency affecting QMS

Owner

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Practically Ignored	1	2.8	2.8	2.8
	Seldom used	2	5.6	5.6	8.3
	Moderately used	6	16.7	16.7	25.0
	Highly used	10	27.8	27.8	52.8
	Extremely used	17	47.2	47.2	100.0

	Total	36	100.0	100.0	

Table 4.5 Frequency table of lack of owner awareness affecting QMS

Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Practically ignored	1	2.8	2.8	2.8
	Seldom Used	4	11.1	11.1	13.9
	Moderately used	6	16.7	16.7	30.6
	Highly Used	5	13.9	13.9	44.4
	Extremely used	20	55.6	55.6	100.0
	Total	36	100.0	100.0	

Table 4.6 Frequency table of lack of education and training to drive the improvement process affecting QMS

Expertise

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Practically ignored	2	5.6	5.6	5.6
	Seldom Used	3	8.3	8.3	13.9
	Moderately used	6	16.7	16.7	30.6
	Highly Used	9	25.0	25.0	55.6
	Extremely used	16	44.4	44.4	100.0
	Total	36	100.0	100.0	

Table 4.7 Frequency table of lack of expertise/resources affecting QMS

4.3.2 Pie chart

A Pie Chart is a type of graph that displays data in a circular graph. The pieces of the graph are proportional to the fraction of the whole in each category. In other words, each slice of the pie is relative to the size of that category in the group as a whole. The entire "pie" represents 100 percent of a whole; while the pie "slices" represent portions of the whole. Pie charts are generally used to show percentage or proportional data and usually the percentage represented by each category is

provided next to the corresponding slice of pie. Pie charts are good for displaying data for around 6 categories or fewer.

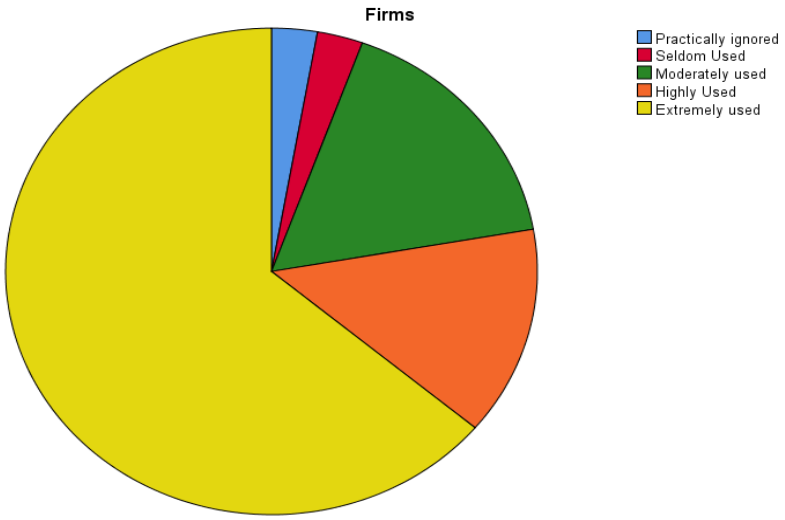


Fig 4.1 Pie chart of firms emphasis on short term objectives/gains affecting QMS

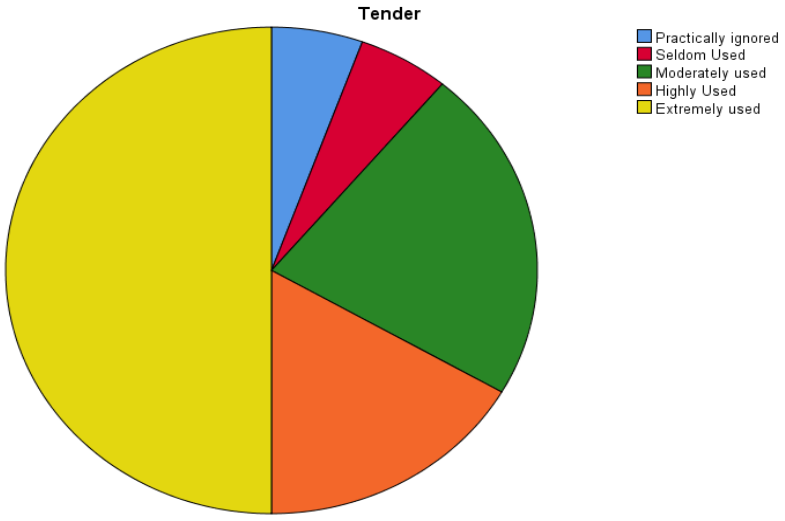


Fig 4.2 Pie chart of awarded tender on the basis of lower prices and not efficiency affecting QMS

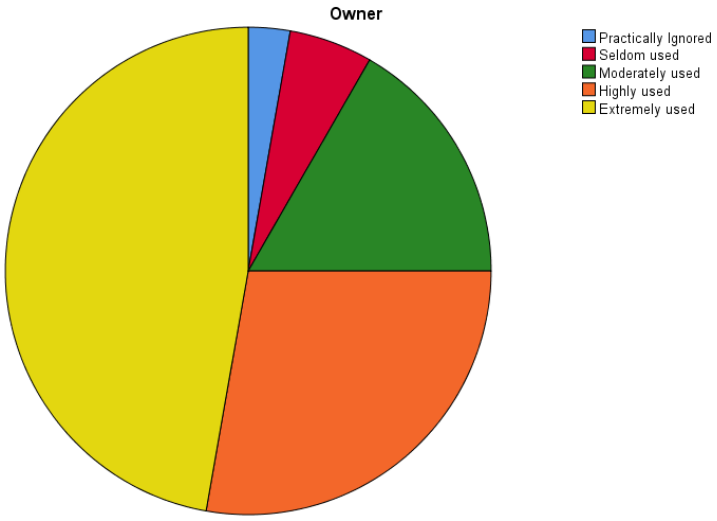


Fig 4.3 Pie chart of lack of owner awareness affecting QMS

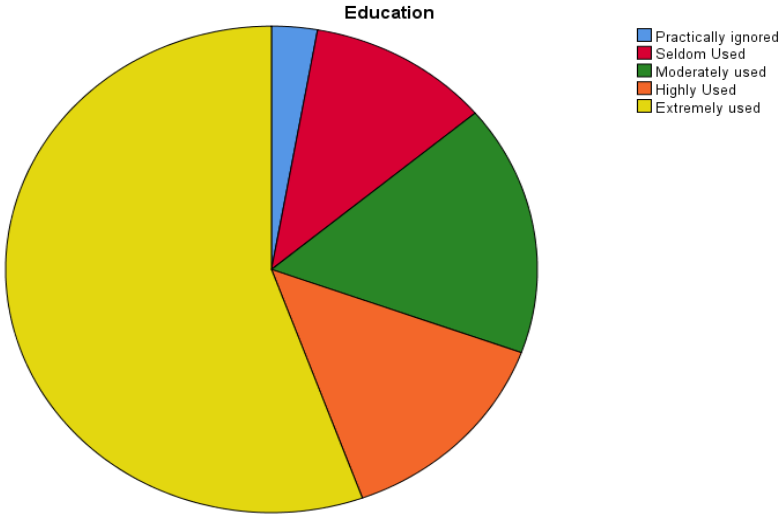


Fig 4.4 Pie chart of lack of education and training to drive the improvement process affecting QMS

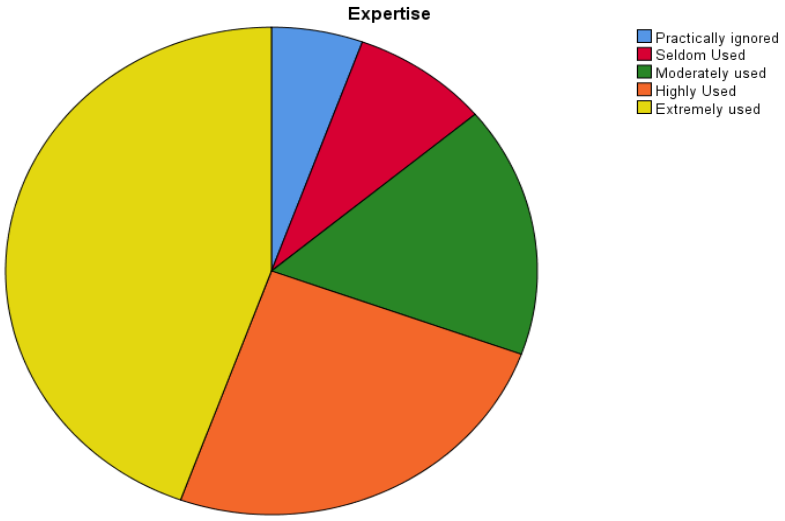


Fig 4.5 Pie chart of lack of expertise/resources affecting QMS

4.3.3 Histogram

It was introduced by Karl Pearson. A histogram is an appropriate representation of distribution of numerical data. A frequency distribution shows how often each different value in a set of data occurs. A histogram is the most commonly used graph to show the frequency distributions. It looks very much like a bar chart, but there are important difference between them

- On the vertical axis, place frequencies. Label this axis " Frequency"
- On the horizontal axis, place the lower value of each interval.
- Draw a bar extending from the lower value of each interval to the lower value of the next interval

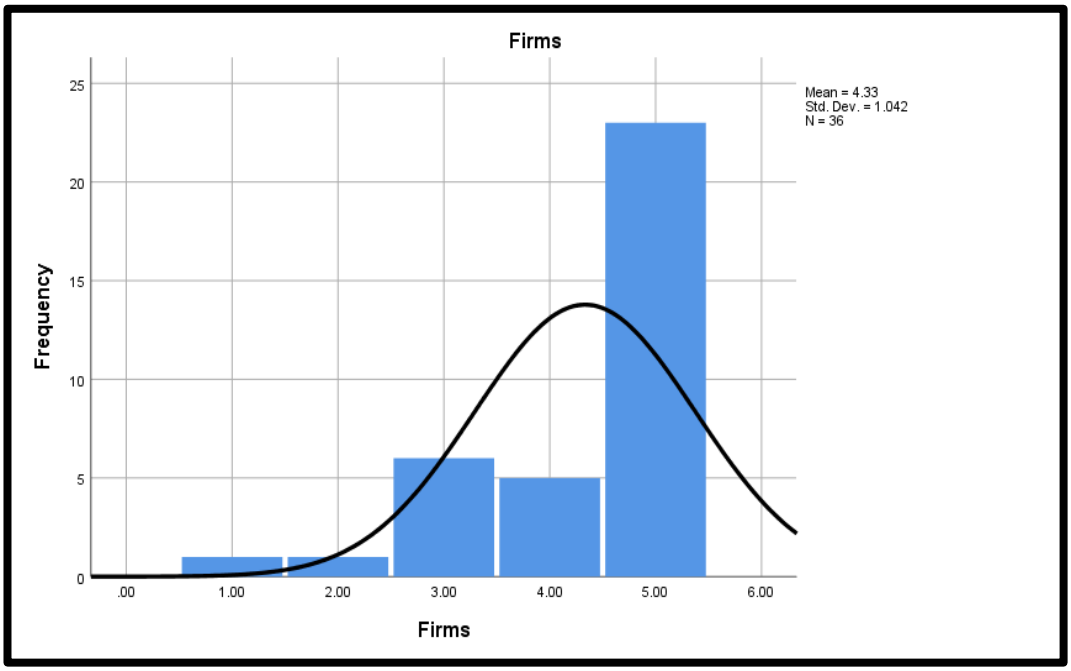


Fig 4.6 Histogram of Firms emphasis on short-term objectives/gains

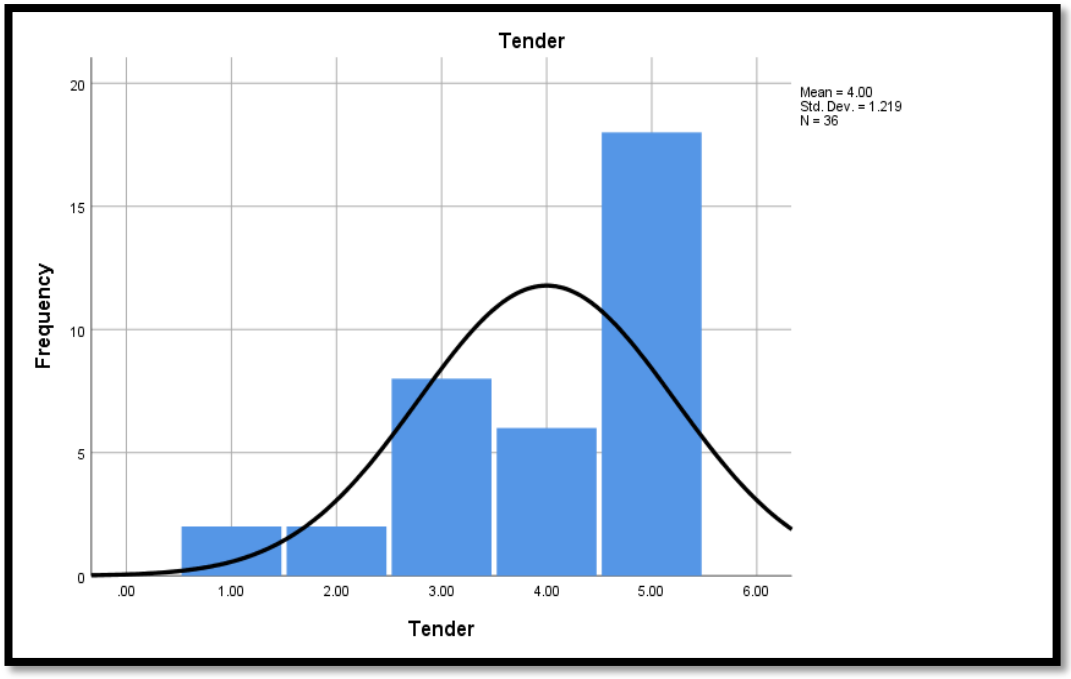


Fig 4.7 Histogram of awarded the tender on the basis of lower prices and not efficiency affecting QMS

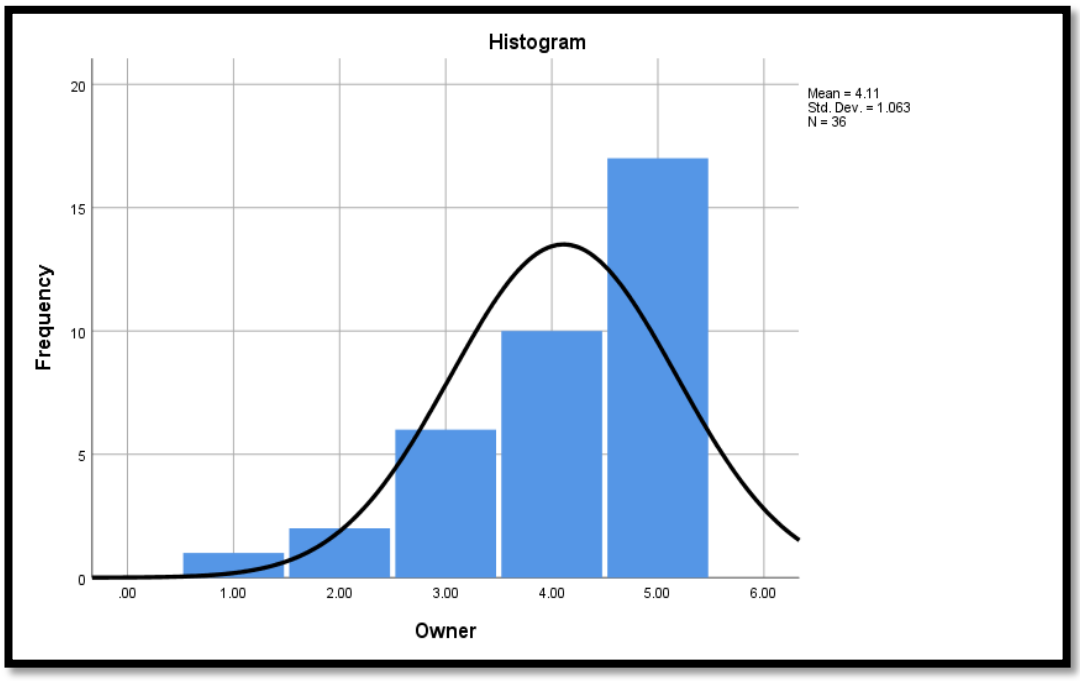


Fig 4.8 Histogram of lack of owner awareness affecting QMS

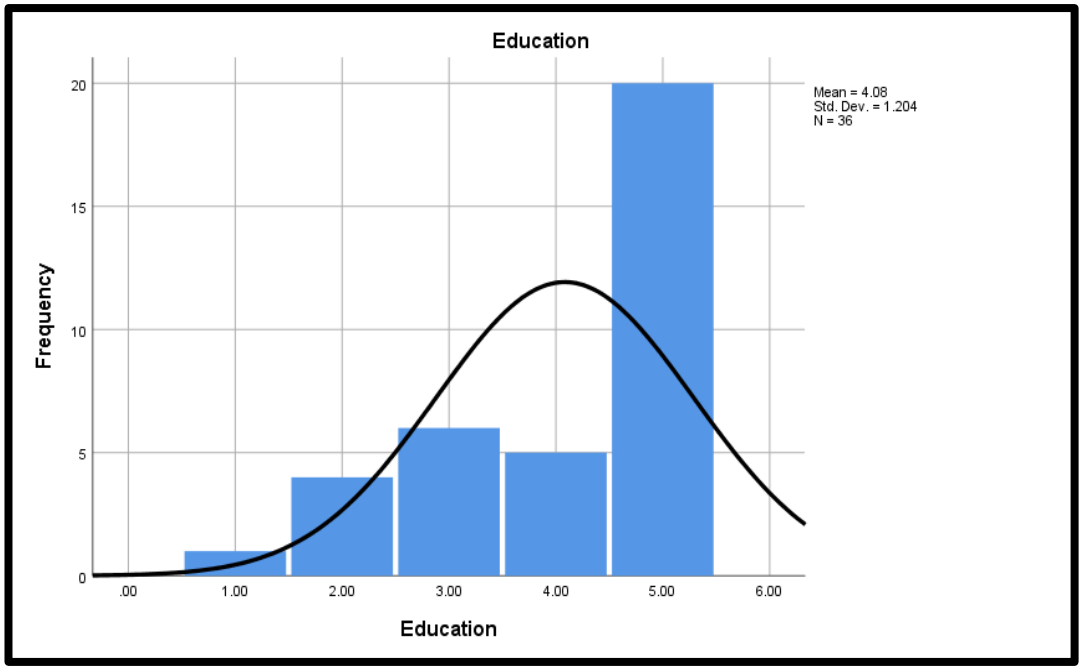


Fig 4.9 Histogram of lack of education and training to drive the improvement process affecting QMS

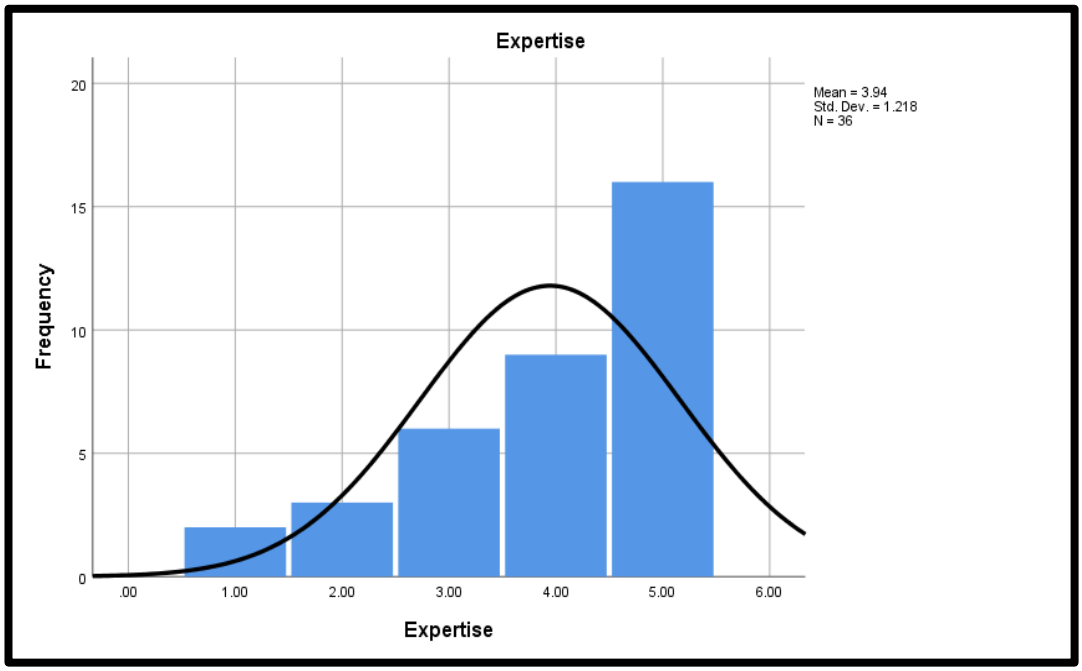


Fig 4.10 Histogram of lack of expertise/resources affecting QMS

CHAPTER-5

CONCLUSION

Based on finding several points were concluded:-

- According to majority of respondents, their perception of quality is by the continuous improvement, then inspection and corrective actions, then elimination of defects. This means that the concept of quality is a well-understood terminology by the employees within the company.
- Most companies do not have quality documents, and the existing of quality policies, manuals or documents in respondent's companies is not sufficient and they do not follow any laid down policy. This indicates the lack of commitment of top management towards the implementation of QM in construction projects.
- Majority of companies check for design conformance to standard before commencement of project and during construction. This means that this companies need more efforts to improve the quality.
- Training is an integral part of QM program. The majority of employees in construction companies lack adequate training, lack of courses and lack of workshops on quality improvement which points to the need for more participation in training and workshops sessions.
- A large part of the existing construction projects in Lucknow are given to contractor whose price is the lowest. According to interviewers "Financial situation is the basis of quality, there is no one working for the quality at the expense of losing his money".
- There is lack of commitment by the contracting companies and governmental institutions to achieve quality, so they should work hard and hard in this field in order to improve quality systems in their companies.

CHAPTER-6

RECOMMENDATION

5.1 Introduction

From the previous chapter, it was found that many significant and important problems and factors require effective actions to be avoided, solved and applied, so as to enhance the performance of this effective construction sector. Thus, searching for some important highlights to be adopted in this sector is useful in solving or avoiding most important problems and trying to improve this sector performance.

Thus, in this chapter proposed problems solutions, obstacles avoiding procedures and model development will be presented. Then, a solution listing and a model will be performed to represent and summarize.

5.2 Proposed solutions for the top five rated problems and obstacles related to QM implementation

The resulted top ten most important problems and obstacles that affecting the implementation of QM were discussed in the previous chapter. Set of proposed solutions were conducted, trying to solve such related problems and obstacles. The top ten most important problems associated with the related conducted solutions are discussed below:

5.2.1 Firms' emphasis on short-term objectives/gains

The researcher suggests the need to recognize the impact of good quality on the overall value of the business, value in financial terms and also value in reputation, these values appears as long term objectives of the companies. Also, conducting discussions about quality in the companies is important issue to recognize the impact of high quality. The managers suppose that the focus on quality is something that increases costs, while literatures proves that it reduce costs specially cost of reworks

and cost of rejected works. In this regard, giving special training courses and workshops for these firms, focusing on COQ and how to reduce reworks if doing the right things right at the first time is essential. However, the lessons learnt during the implementation of projects with regard to quality need to be fully documented and evaluated systematically.

5.2.2 Awarding the tender on the basis of lower prices

For overcoming this problem, there must be a complete and accurate study for prices by the owner representative, determining properly the tender price before tendering and awarding the tender to the nearest price of the real estimated one. Moreover, tenders' commissions may condition prequalification of contractors, for assessing the suitability of contractors on a basis of factors such as: firm's experience, equipment's' availability, financial and managerial ability, reputation and work history. So as develop a list of qualified bidders before inviting them to bid. Also, tenders' commissions are recommended to condition receiving of all tenders' offers during bidding in two envelopes; technical proposal envelope and bill of quantity envelope, so as to assure offers technically responding first, then those best technical's offers can be competed according to their offered prices. Adopting the application of this procedure will assure awarding the lowest price and technically the best. Where, the technical proposal contains projects' related technical aspects including: time schedule, safety plan, cash flow, method of statement, similar projects, concerned institutions and the bidder company history.

Furthermore, offers examination commissions should be instructed to Comply with bid referring to the best evaluated offers that having the most appropriate prices. Taking into account the bidder ability to confirm the required quality degree, execute the project within the specified period, and perform the required work according to the conditions and specifications. Also, the commission has to make sure of price moderation of "the lowest price offer" which corresponding to the conditions and specifications. In addition, the commission must be guided by the latest prices used in former deals, market prices and the competition guiding estimated prices.On the

other hand, legislation should be enacted that obligate tenders opening committees rejecting any tender offer reduced by more than 25% from the estimations.

5.2.3 Lack of owner's awareness about the importance of quality

The exaggerated owner interference in the details of the project is at the expense of quality, the owner wants to reduce the costs of project while he drawn image of excellent output before starting the work. This leads to the restriction of the supervisor engineer and prevent him from performing his role properly.

In this regard, financial planning before starting the implementation of the project is required to prevent any change during the works, and it should be on the top of the owner's priorities due to the negative impact of the absence of it on many aspects including; the construction process and the quality. Here, it can be said that project's owner is the main responsible for quality problems and hence, they are recommended not to start any activity of project before ensuring its required budget and not to impose their opinions on projects without conscious study.

On the other hand, spreading the awareness of quality in every work is very essential, especially for all society members, starting from homes and schools, and making it as a culture in the society.

5.2.4 Lack of education and training for the improvement process

It is important to conduct training courses by engineering association and contractors union for the contract parties "mainly consultants and contractors" to increase their qualifications and knowledge in the different QM related matters.

Also, raising awareness among the contract parties about QMS is required to ensure the quality of works. This can be gained by giving special workshops focusing on QMSs and how to use these systems. Also, issuing regular publications and distributing them to contractors, engineers and consulting offices.

5.2.5 Lack of expertise/ resources in QMS

Renowned experts from academia should be hired to train the managers on the concepts of TQM operations. The experts will help in drafting the critical parameters to quality features that are specific to the need of company, hence, defining a system that is fit for purpose and addresses the quality at all levels. It is extremely important that top managers should be put through a rigorous training program at different quality levels. On the other hand, experts from academia should give special courses for students in the faculty of engineering before graduation, focusing on QMS.

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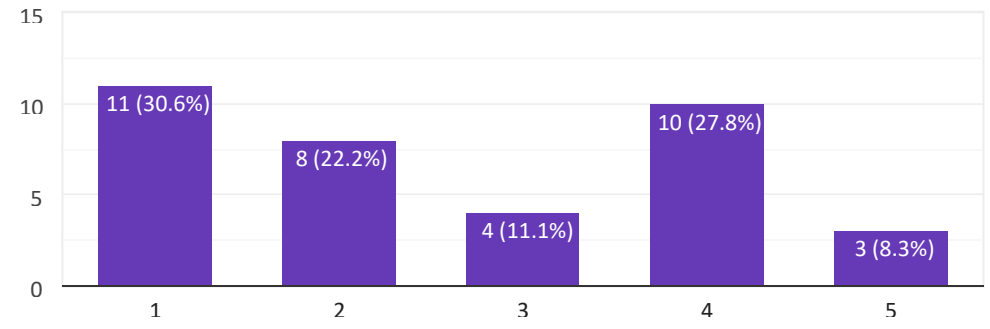
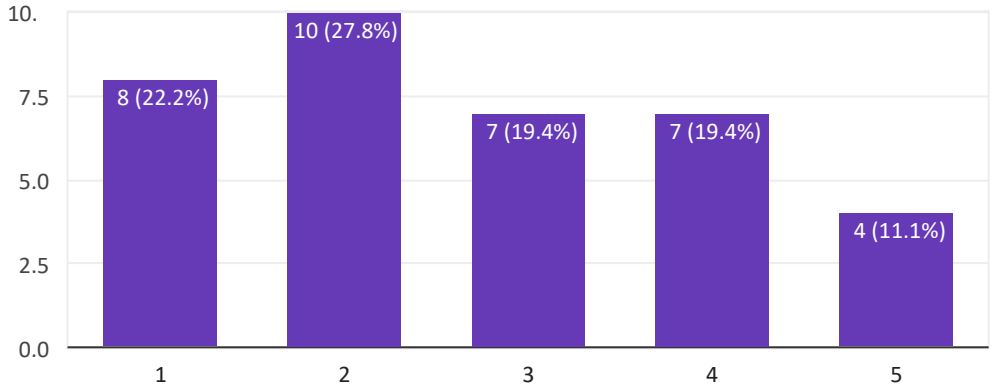
APPENDIX

In your view, what are the problems affecting Quality Management (QM) implementation in your company - 36 responses

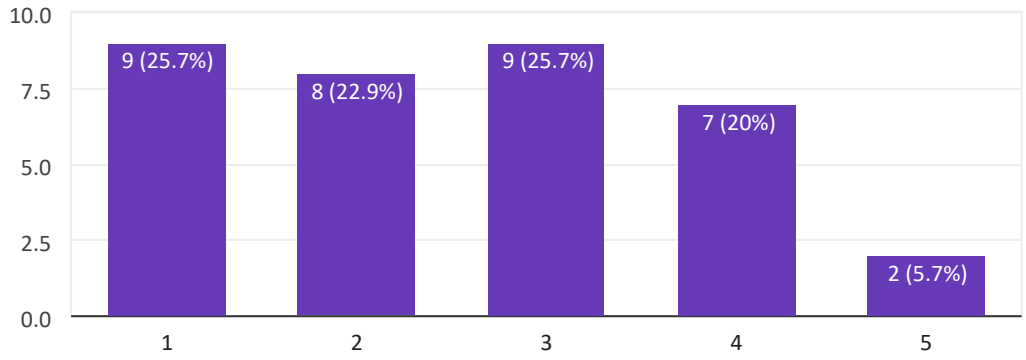
1. Lack of top-management commitment/understanding of quality issues.



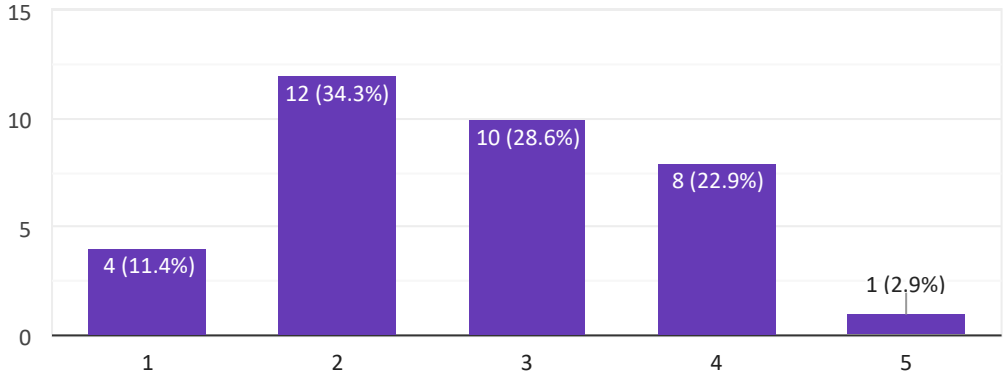
2. Absence of a clear strategy for quality management in the company.



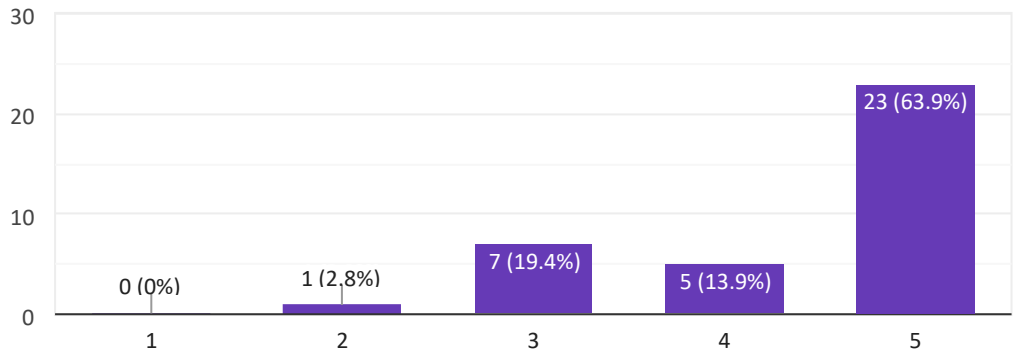
3. Lack of employees' and workers' commitment/understanding, and resistance to quality programs.



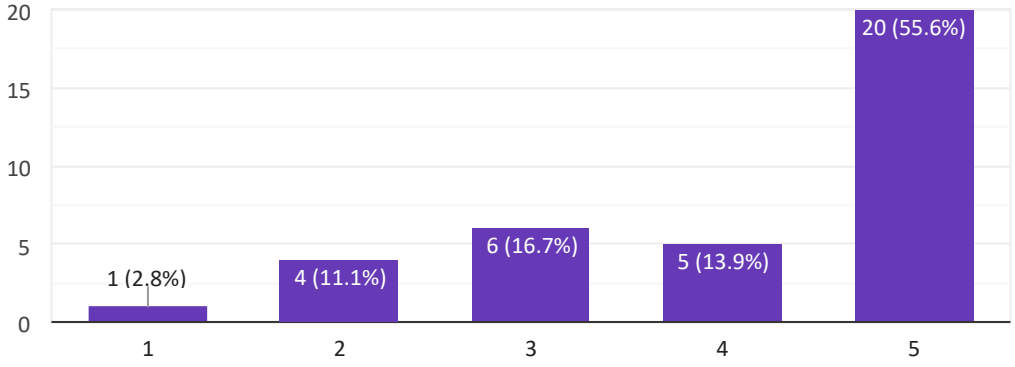
4. Lack of communication between project's parties (contractor and consultant).



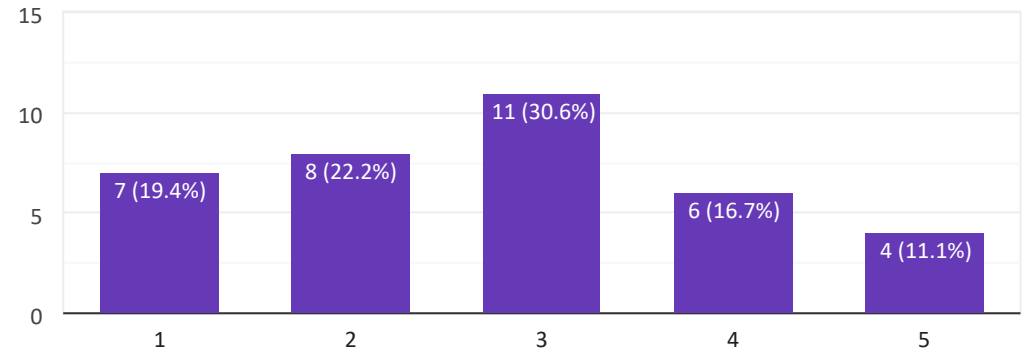
5. Firms' emphasis on short-term objectives/gains.



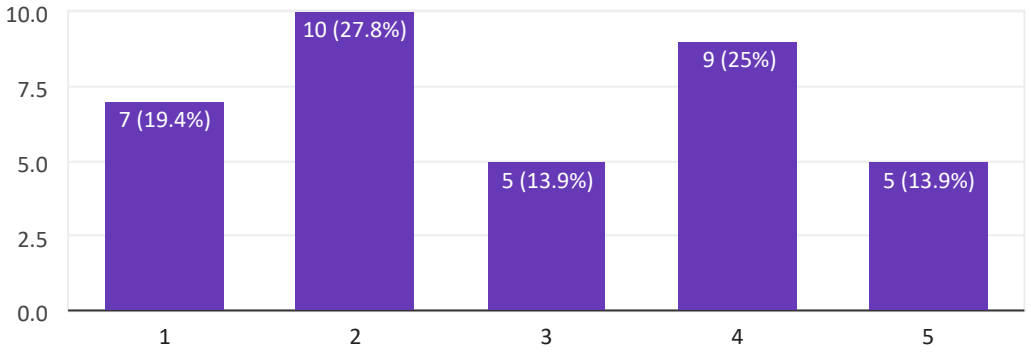
6. Lack of education and training to drive the improvement process.



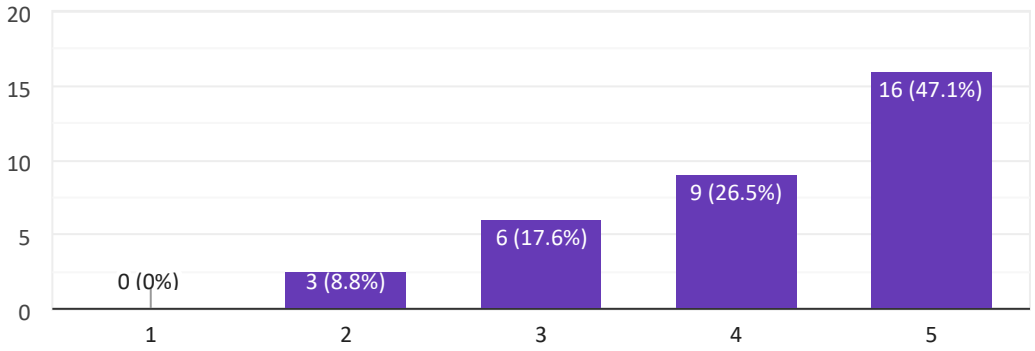
7. Loss of part of the productivity of workers as a result of the effort in training.



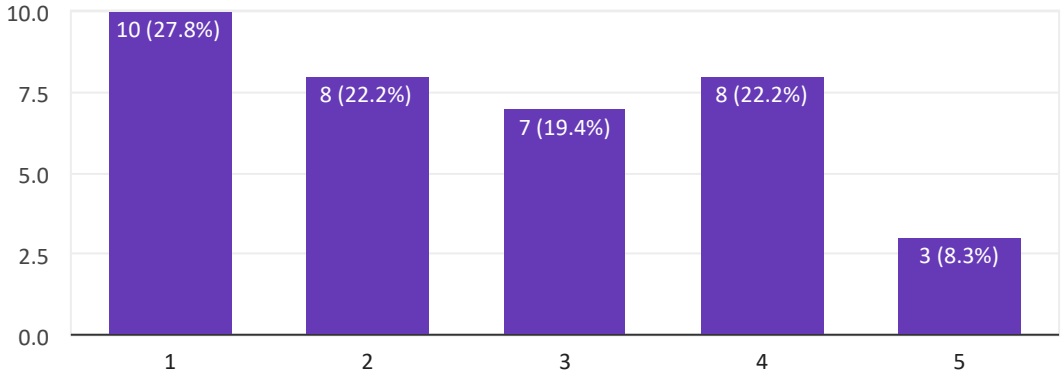
8. Too much documents are required which lead to difficulty on documentation ability.



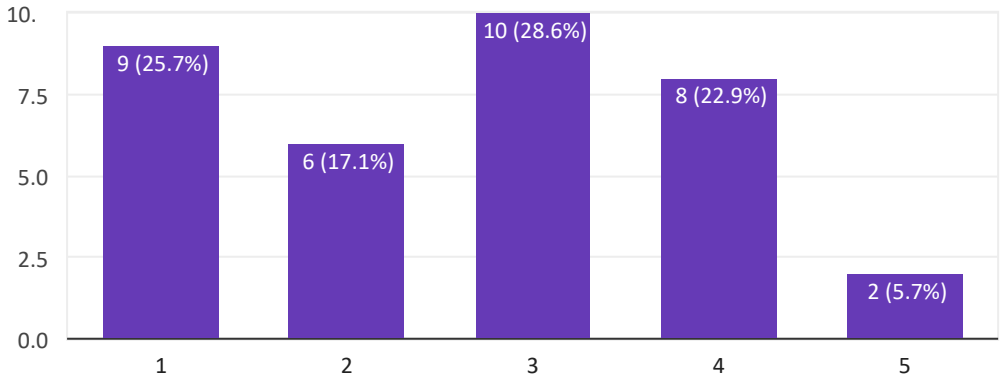
9. Lack of expertise/resources in Quality Management System.



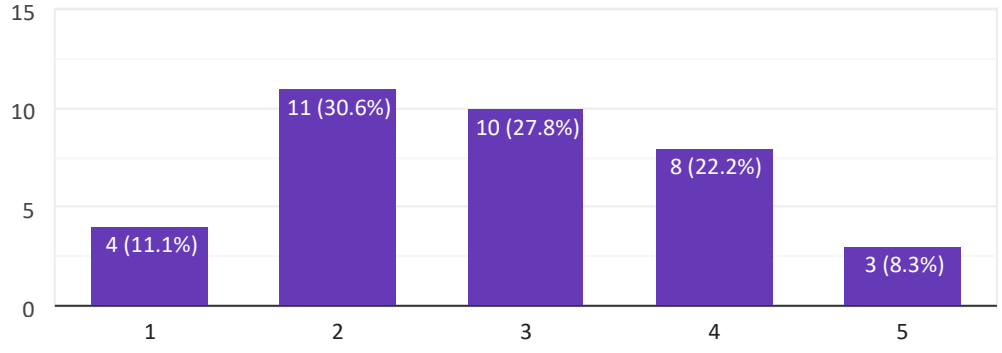
10. A lack of codes and specifications.



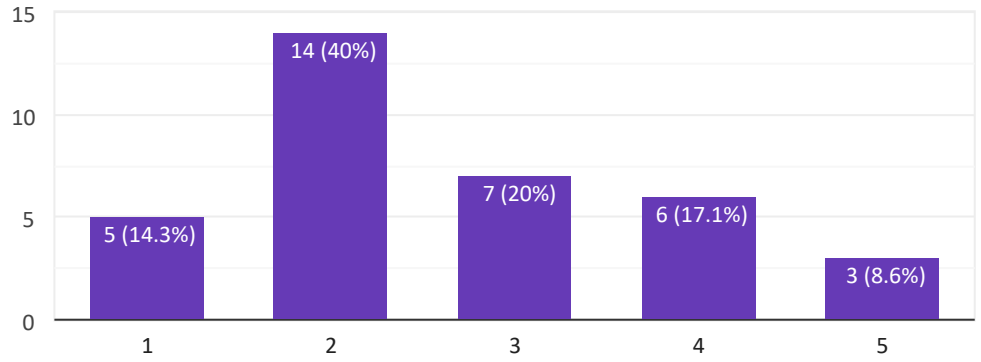
11. Insufficient attention to achieve quality by workers in projects.



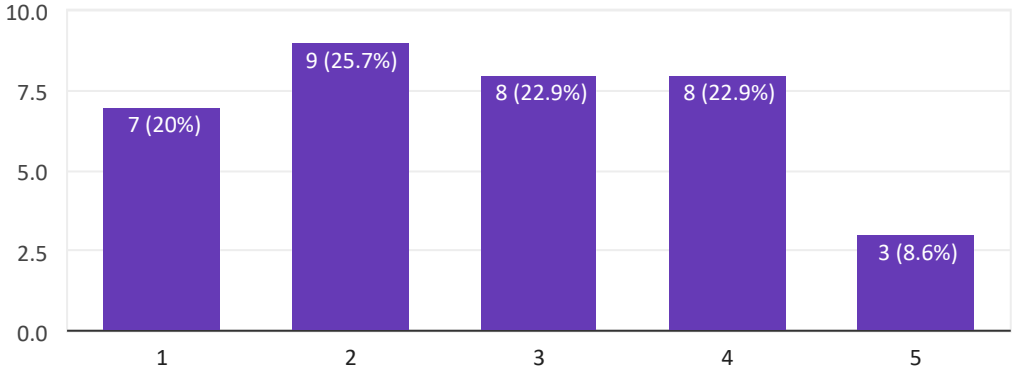
12. Instability of the volume of work and the instability of the national economy.



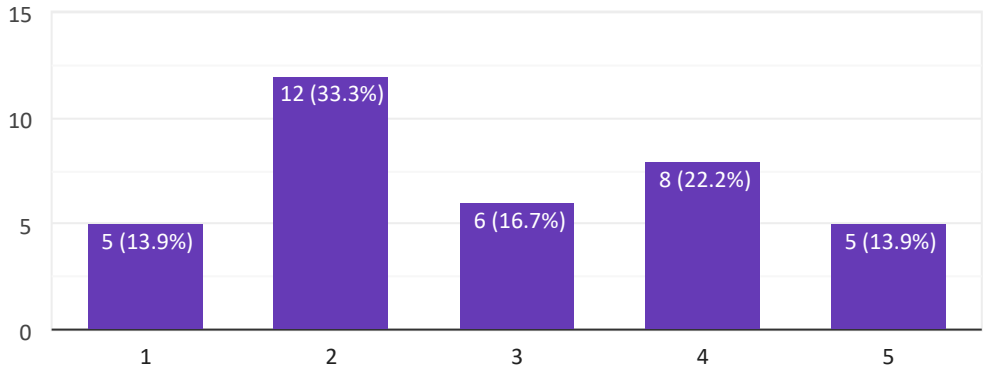
13. Absence of rewards and appreciation of the achievement of employees and workers.



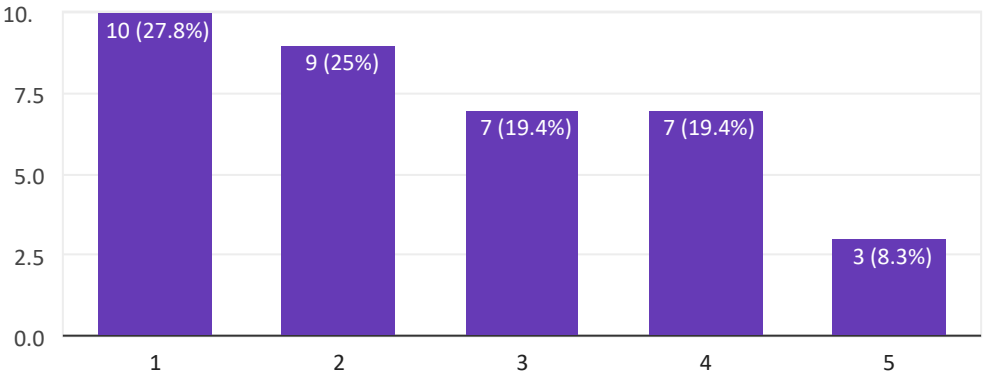
15. Lack of feedback from previous projects and take advantage of them.



16. Absence of advance planning for the project.



17. Not use computer software to manage projects effectively.



18. Lack of owner's awareness