

# A REVIEW ON IMPACT STUDY OF ISO/QMS ON CONSTRUCTION INDUSTRIES

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## ABSTRACT

*The post industrialization era deals with achieving the quality under the supervision and controlled environment that favours the quality work. Construction is a heterogeneous and non unique in nature. The guiding principles of quality differs for the construction industries. It differs from the manufacturing industries where the process is of repetitive in nature. Because of the present scenario of globalization, the construction industries in the developing countries are facing the stiff competition from the multinational companies. Good structure of organization , skilled manpower , sound technology and good condition of finance provides greater opportunities to multi national companies over the local construction industries. The construction industries in the developing countries like india, needs quality tag for the global competition for to achieve the better productivity and efficiency . Hence there is a great need for the construction industries to seek some kind of quality tag for their effective functioning and implication of quality work. ISO 9000 is one of the such certification to which the construction industries are opting for, despite the fact that ISO quality system does not addresses clearly the needs of construction industries. This paper aims at analysing and comparing of the conclusions that are drawn from the various researchers and to find the correct objectives or research gap for effective implementation of the ISO in the construction industries in the developing country like india.*

**Keywords:** Quality management systems, Construction industry, Globalization, ISO 9000

## 1. INTRODUCTION

In this competitive world, it is necessary to produce the quality outcome from the industries. Quality can be expressed in terms of the fulfilment of the total requirements of the internal and external customers, that leads to success or profit of an industries [60]. Sound environment, Appearance, Luxury, Safety are the requirements of the external customers like owner. While the good design and plan , Specifications, Quality drawings, Advanced technology and machineries, Quality [67]. resources are the quality requirements of the internal customers like engineers, contractors, designers [61]. There is a great need for the quality for the high investments and long term projects. The effective application of the TQM in the construction industries is still in study. There is no common or unique opinion on implication of TQM. It is highly needed to study in depth, the impact and the factors that affect the construction process. Life span of the building depends on quality of the construction. Hence it is important to study the quality of the construction [68]. The study concluded that the factors such as Quality commitment , Continual improvement, Training, Agreement with partnering parties, Clarity of the project among the employers, Good design, Specifications and Drawings are affecting the quality in general [62].

### 1.1 CONSTRUCTION INDUSTRY IN DEVELOPING COUNTRIES

Construction industry provides an good infrastructure and offers employment to the large number of skilled and unskilled manpower [64]. Developing countries are responsible for the 23% of the worlds construction. As the economic development is concern about 44% of the indias gross fixed capital formation is based on the construction industries. It adds to the 6% of the overall GDP (Gross domestic product) [64].

## 2. CONCEPT OF QUALITY

In an first phase or olden days the quality means the controlling of the processes. In the second phase of era , as the development of industries after 1920's, the product quality and the services are monitored [66]. This was done by both producers and consumers. The quality has emerged as a mantra in present era of globalization for the success of the industries [66]. Principles of quality are responsible for bringing down the cost of products. It also responsible for increasing the competitiveness [63].

## **2.1 DEFINITION OF QUALITY**

According to the dictionary, the quality means degree of goodness or worth or the degree of the excellence of a thing. It can be defined in different ways in different fields, by different experts and institutions. According to Crosby(1979), "Quality is a Conformance to requirements or specifications"[65].

## **2.2 QUALITY DEFINITIONS RELEVANT TO CONSTRUCTION INDUSTRY**

Quality definitions differ from their scope and intent. According to the American society for civil engineers (ASCE), the quality is defined as "Conformance to the predetermined requirements", and according to the Construction industry institute (CII), it can be defined as "Conformance to established requirements"[39].

## **3. FACTORS WHICH AFFECTS THE CONSTRUCTION QUALITY**

Internal factors that affects the quality are contractual provisions, structure of organization, lack of technical expertise, slow mechanization pace, lack of skills and training, limited financial capabilities[40].

The external factors that affects the quality are development of technology in allied industries, globalization, certification of quality[40].

### **3.1 LEADERSHIP AND MANAGEMENT COMMITMENT**

Culture of the construction industry mainly affects the quality. Commitment of management towards the quality work or product is the basic requirement for the industry to have success and profit. The employers should understand the importance of the leadership and commitment towards the quality work. Commitment comes only when the employers understand the importance of the project[41]. Sometimes the commitment is forcibly borne on the employers by setting targets for the specific duration of time. Another method of bringing the quality in the construction is by controlling the activities of the employers, not by their participation. The managers are given certain goals, the controlling can be done to achieve the respective goals for the allotted period. Competition among the workers leads to the internal conflicts for to achieve the short term goals. It also deals with the identification of the problem and solving it effectively. By the survey it is found that the management commitment is rated first, which affect the quality of the construction[57].

### **3.2 TRAINING**

Training is the important element in the TQM, which enables the employers to improve their work perfection, efficiency and to solve the internal and external problems associated with the construction activity. Training involves the analysis of cause and effect, team problem solving, interaction, interpersonal communication[58]. According to the survey it is found that the human interaction, leadership and initiative are the key success factors that are responsible for the success of the construction industry. Training is more essential for the employers those who working in an operational and maintenance phases[59].

### **3.3 TEAM WORK**

For any project to be success, there needs a proper coordination among various departmental activities and of team work[38]. Team work with proper direction and coordination leads to success of an industry in terms of profit. Joint teams are responsible for to achieve the goals jointly. They jointly plan, control and execute the work[36,55,56].

### **3.4 STATISTICAL METHODS**

They are based on the data interpretation, rather than the individual or team opinions and preferences. They provide the information on the tools with the teams in the identification of problems, and also in solving them. They communicate in the precise language that can be understood by the team members, to repeat, to verify, to reproduce measurements that are based on the past, present and future status of the work. It consist of three aspects, the cost of prevention, Appraisal and Deviation. Prevention costs are those which are due to the actions to avoid the errors and deviations. The appraisal cost is due to the confirmation of the requirements which are stated earlier. Deviation costs are due to the change in the project processes or any deviations that can be made on not reaching the requirements[37,54].

### **3.5 SUPPLIERS INVOLVEMENT**

For to achieve the best quality and economy, it is needed to have a good relationship with the suppliers. It facilitates the good quality faster construction. If the resources are supplied on time, then there is no delay, which leads to early completion of the project, that leads to the profit and success of the construction industry[15,16,35,42,53].

### **3.6 CUSTOMER SERVICE**

Customers needs are to be satisfied, whether they are internal or external customers. We have to satisfy the internal customers by providing the safety, policies, insurances, increments, hikes in the salaries, they are also provided with the good resources and environment to achieve the sound quality work. In construction industry designer is a customer of owner. Designer designs the buildings as per the requirements of the owner. Constructors are the customers of designers, because they take the designs, specifications, plans from the designers and executes them. After the completion of the construction, again the owner is a customer of constructor, here the constructor handovers the completed building to the owner as per his requirements. For work to be of quality owners, Designers, Constructors, Engineers are all to be satisfied[43,44,49,51,52].

### **3.7 CONSTRUCTION PROCESS**

Construction process is generally categorised into three main phases, Design phase, Construction phase and maintenance phase. In the design phase, the design engineers will collect the requirements from the owners and they design as per the requirements. They also consider the economy and quality. In the construction phase the drawings, designs, specifications that are provided by the engineers are executed by the constructors. Here good supervision, monitor and control of the work is needed for the quality of work. A quality building has less operational and maintenance cost. In the operational and maintenance phase, the measures are taken to prevent the building from deterioration and it adds to retain the original life of the building. A quality building has less maintenance and operation cost, and it is durable [14,45,46,47,48,50].

#### **4. PROBLEMS IN IMPLICATION OF QMS**

QMS cannot be easily implied to the construction industries as that in case of manufacturing industries. The duration of the construction process is more and it is of single order. Place of work is different for every projects. There is no standard evaluation system in the construction industries, which is in the manufacturing sector. Each project is evaluated separately. Constructor, Subcontractor, material suppliers are all different for the different projects. Because of the non uniformity in the construction, the QMS cannot be effectively applied. It is very difficult to measure the impact of QMS on the construction industry. According to the research it is found that the quality can be achieved by following the standard codes for the designs and plans. They provide the good specifications for the quality work. Quality evaluation is very difficult as there is no feedback system exists for the inspection and re-examination of quality. The faults are identified only when designer, building authority, owners point out the defects in the project. There need to changes from "controlling quality" to the "controlling the management for quality" [9,10,11,12,25]. Some policies are made to achieve the quality through proper management practices. The evaluations from the planning and designing, construction and in operation, and maintenance are referred for modification of the quality standards and are implied for the quality management. This helps to eliminate the repetition of same type of faults [13,23,29].

#### **5. OBJECTIVES OF RESEARCH AND METHODOLOGY FOLLOWED**

The review research is conducted in three stages. In the first stage, the QMS that are applied and which are following in the various construction industries are studied by the literature review. They are studied in the view point of framework in quality improvement in the construction industries. In the second stage the similarities in the literature review are separated and are sorted to compare and to determine the effective role of that theories on the construction implication in the industries. In the third stage the QMS in Indian construction industries are reviewed and compared to the current theories and practices around the globe [8,23,26]. The main objective of this literature review research is that to determine the research gap in the current practices and theories. Then to find the importance of generating new ideas and knowledge to improve the quality management practices and final outcome of the construction industries. Findings from this literature review research will contribute to find the new area of research for the QMS studies in India especially in construction industries in southern Karnataka.

#### **6. IMPORTENCE OF QUALITY OF CODES AND STANDARDS**

Design professionals should have the knowledge of codes and standards. They gives the minimum quality requirements for the buildings and also plays the vital role in the quality of the building. According to the research it is concluded that the quality designs starts with the sound engineering and scientific principles. The codes and standards gives only the minimum criteria of requirement of quality [6,7,22,24].

##### **6.1 IMPORTENCE OF SPECIFICATIONS AND DRAWINGS**

Drawings and Specifications are the two important documents that are given to the constructors. They gives the information on the materials, size and shape, the scope of the project, they are the key documents for the quality construction [3,17,18]. They gives the information on the items, the assembly methods for to reach the final projects. Quality in the Drawings and Specifications influence or affects the design and construction phases, and finally affects the life span of constructed building. Hence the drawings and specifications should be precise, clear, uniform, easily understandable, and it should be free from complexities [4,5,21,30,34].

##### **6.2 IMPORTENCE OF ISO STANDARDS**

The series of standards for quality management was first published in 1987 by Geneva based international organisation. ISO explains the international standard series which are dealt with the testing and service, Delivery, Quality product design and quality production. The ISO 9000 series consists of two basic types of standards, one deals with the quality assurance and another with the quality management.

The ISO 9001, ISO 9002 and ISO 9003, they are related with the quality assurance standards, that deals with the contractual and assessment purposes. ISO 9004 series related to the quality management standards, they are designed for to give guidance to the companies that are implementing and developing the quality systems. The company which is registered under ISO are always monitored by the third party (Approved outside auditor). The processes of the company are documented and are systematically audited. The third party were continuously auditing the processes and are documented for to inspect wheather the company running on the policies and procedures that are required to produce high quality construction (Product).

TQM deals with the internal and external customers satisfaction , and with the quality of the activities conducted by the industries.ISO also comes under the TQM program and it is highly related with the process quality. The ISO provides an excellent beginning point for the industries to imply the TQM[19,20,31,33].

## **7. REVIEW DISCUSSIONS**

The literature review undertaken for this study has given different views on the usefulness and drawbacks of implementation of ISO 9001 : 2000. The discussions are as below.

Quality can be expressed in terms of process and product quality.The product quality refers to achieving the the quality in the Technology,Equipment and Materials.Process quality refers to the quality in organizing,managing in all the phases ,in planning and design, in construction, and in operation and maintenance.After the Globalization,all the construction industries are giving the first priority to have a quality tag to their industries, to compete globally [24].More attention has to be given for to get certified by the ISO and to impliment the QMS in the construction industries [15,31]. QMS helps in getting the ideas related to the process, technology adoption, quality of raw materials in executing the quality work [11]. ISO9000 certification is considered as a best QMS that has been adopted by the majority of the countries [9]. At the end of the year 2005,the companies that are certified by ISO are 2425, out of this around 532 are the construction companies [6]. Malasian government has directed to grade 7 contractors to have ISO certification at the end of 2008 [17]. Because of this rule the number of ISO certified companies are increased rapidly to about 4573 at the end of 2011 [17].The QMS becomes ineffective when the certification just becomes the paper or ticket to enter the competition world. Even after the implication of TQM,the employers participation is found to be minimum[1,32]. So it is needed to investigate the QMS implementation level in the construction industries.

In order to check the degree of implementation level , QMS has divided into 14 priciples, as per the researchers. These 14 principles are known as Deming's principles [1, 33]. For effective implementation of QMS, the majority of the researchers concludes that the critical factors that affects the QMS are training to employers,involvement of employers, top management leadership and commitment for quality, management of quality suppliers, employers involvement in training are useful in maintaining the good environment in construction industries [18,19,23,25,27,32]. Training to the employers results in the better productivity in the construction industry [26]. For successful implementation of TQM , the employers involvement plays a vital role [13,26,29,33]. It is found that there is a lack of co ordination among the various departments in the industry [2].Employers involvement comes only when they are inspired and by giving the targets of work to be completed within specific time to them [4]. One of the key factors to have success is that to manage the human behaviouralaspects[5]. Communication among the various departments is needed to solve the problems [16]. For to share information and knowledge, there needs to have a good communication among the different departments [21].Organization culture is one of the critical factor observed in the implication of the TQM [12]. There is a perception that the culture and organizational outcomes depends upon the quality management practices of the industry [22].Technical and non technical systems of framework are merged for the organizational arrangements to achieve the goals and objectives of the company [5].Feedback from the maintenance stages are helpful in modification of the QMS principles that are taken as a benchmark for achievement [30]. Most of the constructional industries concentrates more to the non technical factors. This is the major drawback of the construction industries [5].The reason for the failure of the ISO certified companies in Spain are weak in human aspects such are scheme of suggestions and team work, improper using of quality tools and techniques.Most of the construction industries are good in maintaining the records and documents after the implementation of the ISO standards[2,27,28]. It is also found that there is a improvement in the leadership,training and commitment of top management [5,7,10].Employee involvement is the major factor affecting the TQM implementation [5,10,30].Organizational culture is in positive correlation with the degree of implementation of TQM [12]. By meeting the crateria of safety, time,cost,the degree of project success can be measured [44].Scheduling,planning,implementation,organizing,controlling the projects are the major tasks of construction industries in the management field [53].The various capabilities of management and strategies are responsible for the effective completion of the construction projects [42]. Therefore it is very difficult to understand the reality of the demand in the controlling and planning of the construction industries by the construction managers [47]. Construction,procurement of construction, construction documentation, design of building are all associated with the services of the construction management [36].According to [55], project management includes identification of the requirements,achieving and establishing the clear objectives, balancing of cost, time, scope and quality with the competing demands.Behaviour of the contractors, subcontractors, suppliers are all depends upon the culture of the industries [54].There should be a good team of management for the success of the construction industries [37,54]. Failure in the management team leads to the failure of the projects [38,56].Lack of management commitment leads to the failure of the project [38,58,59].The demand for the highly innovative construction is increasing day by day and also there is a increase in the problems in the field of management [40,44,45,47,51,57]. Most of the construction companies are suffering from the delay in the construction due to various factors, conflicts and complications among the employers, more waste and less productivity[39,43,51]. The challenging factors for the construction industries that are faced by the managers are cost,quality and implementation of the new technology[44].Environment

conditions, laws, rules and regulations of the government, workforce management, time constraints, safety are the factors which affect the construction quality in the construction industries [45].

## 8. RESEARCH GAP

ISO 9000:2000 refers to the ISO 9000 update released in the year 2000. The ISO 9000:2000 was again updated in 2008 and in 2015. ISO 9000:2015 is the most current version. The new series are more compatible than the old ones. There is a lack of research on the implication of new version of ISO 9000:2015. Most of the QMS in the industries are still follows and based on the ISO 9000:2000. Many of the constructors in India are not changed to new series. Some of the companies are not certified by the ISO also. Hence it is needed to draw the conclusion from the comparison of implication and impact of quality standards on the companies that are certified and not certified by the ISO series. It is also needed to check the compatibility of new series as the many companies are following the older series. In general the higher version series are more compatible than the older ones.

## 9. CONCLUSIONS

This review research finds the gap for the future researches to be carried out to contribute new ideas or knowledge. There are lack of research on the management of quality in the construction industries. There is a great scope for the research in the implication of QMS and to study the impact of QMS in different countries. The better conclusions can be drawn by comparing the results from the studies conducted at different countries. Especially for the large scale construction projects, it is much essential to implement the QMS. From the review it can be concluded that the application or adoption of QMS in the construction industries increase the productivity and efficiency. Some of the papers conclude that, the ISO adoption is needed to improve the quality, but some of the papers concludes that, it increases the paper work, leads to wastage of time and money. The study focuses on to interpret these findings and finally to arrive with correct result of adopting ISO standards. It is needed to study the relationship between different practices of quality and performance of project to investigate the impact or effectiveness of quality approaches. The study focuses mainly to study the main impact of ISO standards on the private construction sector in Karnataka.

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