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### RESEARCH ARTICLE

#### TOP MANAGEMENT ENCOURAGEMENT IN IMPLEMENTING ISO 9001:2015 (CLAUSE 5.1).

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#### Abstract

The Quality Management System provides the environment within which related tools, techniques and procedures can be deployed effectively leading to operational success for a construction project. Top management commitment towards quality management system is generally perceived as one of the key factors in determining its success. The purpose of this research paper was to understand role of top management in connection with implementation of ISO 9001:2015. Extra high quality assurance has been followed for construction of bridge which enabled to set up third party quality assurance consultancy (Lloyd's Register Asia (LRA)). The author worked with the QA company and the state department (DTTDC) to perform various quality assurance checks and helped in implementation of quality management system ISO 9001:2015 (clause 5.1). The problem faced by the top management at was to keep track of the various activities at site for e.g. bolt testing which also includes documentation of joints of steel girder that are QA passed. Gantt charts were used to depict the data collected by performing the given set of procedure to check the quality like Bolt tightness and perform various other quality checks related to bolt that helped in successful implementation of ISO 9001:2015.

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#### Introduction:-

Historians have traced the concept of quality and quality assurance as far back as 3000 B.C. in Babylonia. Among the references to quality from the code of Hammurabi, ruler of Babylonia, is the following excerpt: "The mason who builds a house which falls down and kills the inmate shall be put to death." Later Greek architecture would surpass Egyptian architecture in the area of military applications. Centuries later, the shipbuilding operations in Venice introduced rudimentary production control and standardization.

As the market economy has developed, market competition has had an important role of the law of 'survival of the fittest' in every corner. The pressure of construction enterprises from the market and their competitors will be greater and greater. Also, there is a requirement for improving the quality assurance that requires the construction companies to improve their internal quality as well as, strengthen their internal management.

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An early definition for quality is presented by Juran (1974) who defines quality as “*fitness for use*”. Garvin (1987) sees quality as a multidimensional construct. He describes quality as having eight dimensions which include: performance, features, reliability, conformance, durability, serviceability, aesthetics, and perceived quality.

The studies covered in this paper have been performed on an iconic bridge project (under construction) over River Yamuna in which Q4 system of Quality Assurance (Extra High Quality Assurance) is mandatory as per the agreement. In order to achieve the objective, M/S LRA, an internationally renowned company in the field of Quality assurance have been deployed for an independent quality assurance. The bridge project is primarily steel dominated and most of pre fabrication has been done in a workshop located at China. Hence, it was essential that besides the quality assurance at Delhi, the fabrication works at China are also tested in accordance with the prescribed specification and quality assurance standards. Besides this there are some vital component like HFSG bolts that are being produced in a factory at Puducherry. Hence the activities pertaining to quality checks were extended to this factory also so as to ensure a complete envelope of quality assurance on each and every activity.

#### **Literature Review:-**

Top management commitment in quality management implementation has drawn much attention from researchers (such as *Ahire et al.*, 1998; *Chin et al.*, 2003; *Low et al.*, 2004).

(*Kanji & Wong, 1998*) An effective planning requires the organization to plan for the resources and the construction work by providing the work programme, project quality plan, management responsibilities, resource management, product realization, measurement analysis and improvement. Quality management has increasingly been adopted by construction companies as an initiative to solve quality problems and to meet the needs of the final customer.

According to *AbdulAziz et al. (1999)*, quality systems involve internal and external aspects. An internal quality system covers activities aimed at providing confidence to the management of an organization that the intended quality is being achieved. This is called a “*quality management system*”. Successful implementation of quality management system can contribute to an increase in product quality, improvement in workmanship and efficiency, a decrease in wastage, and increase profit. Meanwhile, an external quality system covers activities aimed at inspiring confidence in the client that the supplier’s quality system will provide a product or service that will satisfy the client’s quality requirements. This is called a “*quality assurance system*”.

*Howard et al. (1999)* mentioned having quality strategy as the construct for management commitment towards quality management. *Chan et al. (2000)* were other researchers who referred priority and resource allocation as the constructs of management commitment.

As for the implementation of quality management in project management, the concepts of quality planning (identification of quality standards), quality assurance (evaluation of overall project performance) and quality control (monitoring of specific project results) in the quality management processes were defined by *Project Management Institute (2000)*.

*Chin et al. (2003)* stressed that for the management to be considered as committed towards quality management, they ought to have common goals on it, review and continuous improvement, involvement and leadership, and attitude to change as far as quality management is concerned. *Low et al. (2004)* commented that top management commitment is one of the elements that would reflect QM performance measures in construction firms. It had their attention on allocation of budget, planning for change, and providing methods of monitoring process. On the same issue, *Thevnin (2004)* used willingness to change for quality improvement, and participation shown to measure management commitment.

*Haupt et al. (2004)* argued that high levels of management actions would lead to reduced prevalence of the problems as TQM is deployed on construction sites.

Role of top management commitment in quality management implementation in any organization main focus is on employee empowerment. The objective of quality can be better achieved by the top management commitment. Top management commitment empowers their employees to achieve quality (*Njie TL, Fon LT, AwomoduG (2008)*).

The purpose of the research paper was to check out Does the leadership behaviour have an impact on the success of quality management? Data was collected through questionnaire. Hypothesis of the study is that the behaviour of leadership in an organization is positively related to the success of TQM and the alternative hypothesis is supported by the results and null hypothesis was rejected. So it is proved that the leadership in any organization has a strong impact on the quality management (*Wickramaratne R (2005)*).

Analysis about the leadership issue faced by the developing countries especially in Nigeria and tried to find out the solution to social, political and economic problems. This article evaluate five factors which are more important for the quality management:-

1. leadership effectiveness,
2. leadership and Management commitment,
3. employee and individual involvement
4. general public input
5. Continuous improvement.

Employee empowerment and leadership are the two most important elements of the quality management in an organizations (*Oriaku N and Oriaku E (2008)*).

### **Material and methods:-**

The project in the instant case i.e. India's first iconic Bridge being constructed by Delhi Tourism and Transport Development Corporation, (DTTDC), across the Yamuna at Wazirabad is a cable-stayed bridge which would link National Highway No. 1 near existing T-point at Wazirabad on the western bank and marginal Bund Road at Khajuri Khas on the eastern bank of river Yamuna, thereby connecting North Delhi with East Delhi making it easier to travel to Ghaziabad (U.P). The main bridge (cable stayed) is designed for the length of 675m, 35.2 dual carriageways of 14m each and inclined bow shaped special steel pylon with a height of 154 m above ground level and having the facility of panoramic view of Delhi through a Glass Façade (viewing gallery) on the top.

### **Scope of LRA:-**

As an independent third party consultant, various quality assurance checks were performed to maintain the high quality of the prefabricated products that were shipped in by China. Some of the quality checks that were included in the scope were as follows:

1. Inspection during fabrication at the prescribed stages to ensure compliance with project specification.
2. Complete dimensional verification after machining to verify the "critical to quality" parameters.
3. Verify surface preparation before painting.
4. Witness paint thickness after application of primer, intermediate coat and final painting.
5. Witness torque testing of the bolt after assembly of parts, girder joints and pylon at the site.

Amongst the various activities as listed above on site as well as off site that required independent quality checks, this paper has a focus on the testing of Steel Girders and 154m high bow shaped steel Pylon.

### **Systematic Approach in solving problem:-**

Since this is an innovative bridge, various codes and manuals are being followed for the construction of bridge such as NHA quality manual, Indian Roads Congress publications SP: 47-1998 and SP: 57-2001.

Depending upon the levels of checking/cross-checking and controls, required to provide adequate confidence, four classes of quality assurance are mentioned below in Table – 1:

**Table-1:-**

<b>Classes of Quality Assurance</b>	<b>Class Nomenclature</b>
1. Nominal QA	Q-1
2. Normal QA	Q-2
3. High QA	Q-3
4. Extra High QA	Q-4

Since, all the highway projects are on National Highways qualifying Class Q3 (High QA) of the publication, and the fact that level of supervision has to be uniform over the entire project, the Manual has been based on Class Q3 of the

publication. In case of superior facilities like Expressways and Innovation bridges requiring Extra High QA (Class Q4) the additional provisions, in terms of additional and increased frequency of testing etc. have been indicated in the Manual. Sometimes, specific components of Class Q3 projects may be required to be updated to Class Q4. A concept of Levels of testing has been introduced in order to cover up elaborate planning of testing of materials and products depending upon various factors related to each material/product.

Since the degree of requirement of confidence for bridge construction is very high, nominal QA i.e. Class Q-1 shall not be permitted in bridge construction. Thus there will be only three class of QA for bridge construction, namely Q-2, Q-3, and Q-4.

Hence, for construction of this high precision structure, **extra high quality assurance i.e. Q-4** has been followed.

Apart from having a quality management plan from the construction agency, a third party Quality Assurance i.e. Lloyd's register Asia has been designated to carry out quality checks and assurance for construction which includes Welding, Bolt Fabrication, corrosion treatment etc. which is important to be checked and rechecked for this asymmetrical cable-stayed bridge.

Documentation of large number of girder joints resulted in losing the track of the tested joints. One of the efficient way to document the data was to plot in MS- Project with Gantt chart which enabled the top management to keep check and knowledge about the quality checks of girder joints completed.

A Gantt chart is a type of **bar chart**, adapted by Karol Adamiecki in 1896, and independently by Henry Gantt in the 1910s, that illustrates a project schedule. Gantt charts illustrate the start and finish dates of the terminal elements and summary elements of a project. Microsoft Project is a project management software product, developed and sold by Microsoft. It is designed to assist a project manager in developing a plan, assigning resources to tasks, tracking progress, managing the budget, and analyzing workloads.

**ISO 9001:2015(clause 5.1):-** *Top management shall provide evidence of its commitment to the development and implementation of the quality management system and continually improving its effectiveness by*

- a. *communicating to the organization the importance of meeting customer as well as statutory and regulatory requirements,*
- b. *establishing the quality policy,*
- c. *ensuring that quality objectives are established,*
- d. *conducting management reviews, and*
- e. *Ensuring the availability of resources.*

Quality Management System (QMS) have many applications in the construction industry. QMS could be implemented either at the company level or at the project level. From the perspective of a construction company, quality management in construction projects should mean maintaining the quality of construction works at the required standard so as to obtain customer's satisfaction that would bring long term competitiveness and business survival for the companies.

#### **Corrosion Treatment: Proper Fabrication and Corrosive Coatings:-**

This iconic bridge is made of steel that are pre-fabricated and shipped to Delhi. The pylon of the bridge mainly comprises of steel, which calls for proper fabrication and coatings. The corrosion resistant coat is necessary for maintaining the durability and reliability of the steel which has to carry large amounts of load.

Both sulphates and chlorides increase corrosion rates. They react with the surface of the steel to produce soluble salts of iron, which can concentrate in pits and are themselves corrosive.

The air and water quality where this steel structure is to be erected has high amounts of sulphates and chlorides which are highly corrosive. Hence anti-corrosive coatings are necessary followed by paint coats (ISO 12944).

Before installation of the pre-fabricated parts, Dry Film Thickness test is performed on the parts to check out the thickness of the coating so as to prevent from corrosion.

**Dry Film Thickness:-**

Dry Film Thickness is probably the most critical measurement in the coatings industry. It provides vital information as to the expected life of the substrate, the product's fitness for purpose, its appearance and ensures compliance with a host of International Standard (ASTM D1005- 95(2013)).

The dry film thickness of the pre-fabricated parts were inspected at the site and standard of 240 micron was taken into account to re-check quality as the parts were shipped.

**Bolt Testing at Girder joints:-**

As per rule mentioned in IS 1376:8, the pre load should be sufficient to maintain the joint members in contact and in compression. Loosening will cause the loss of bolt tension and shall reduce the fastener fatigue life.

A practical starting point for all threaded fasteners tightening analysis is to use basic elastic torque-tension equation, to estimate the relative magnitudes of torque and clamp force, with this equation, we can define linear relationship between torque and tension.

$$T = K D F$$

T=Torque, K=Nut Factor, D=Nominal Diameter, F=Force

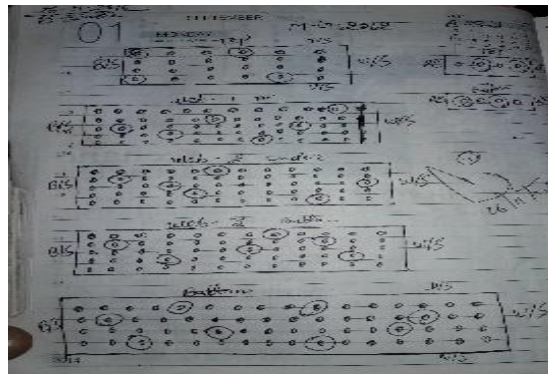
S.no	Bolt Size (mm)	Torque Required (psi)
1.	10.9 mm X 27 mm	200 psi
2.	10.9 mm X 35 mm	370 psi

**Table -2** Bolt size and required Torque

Torque is applied to the threaded fastener in order to stretch the bolt while compressing the clamped parts. When applying torque to a fastener there will obviously be some resistance due to the friction effects in the bearing and threaded regions. If the resistance is great enough the bolt (or nut) will not turn and either the proper preload will not be attained or a joint failure will occur (due to torsional stresses or a cross-threading situation). To ensure that fasteners movement will occurs both the input torque, an angular displacement of the fasteners are monitored.

**Data Collection:-**

The readings taken after testing a girder joint is roughly documented (shown below Image-1) so as to keep track of the tested joints. The readings were then taken to plot on MS- project with the help of Gantt chart. Various other data related to quality assurance was documented.



**Image - 1**

10% of total Bolts in one joint (random) are selected to check their torque with Hydra. The test for bolt tightness is performed on the basis of IS 1367:8. After selecting 10% of the total bolts in a girder joint, hydra is clamped to selected bolts one by one and checked for torque. If the torque comes out to be less than the above given values, the torque is maintained until the bolt gets tightened as shown below (Image 2)-



Image – 2

**Results and discussions:-**

The data was represented on MS-Project with the help of Gantt chart to show the progress and the number of joints that have been checked. A sample of Gantt chart is shown below:

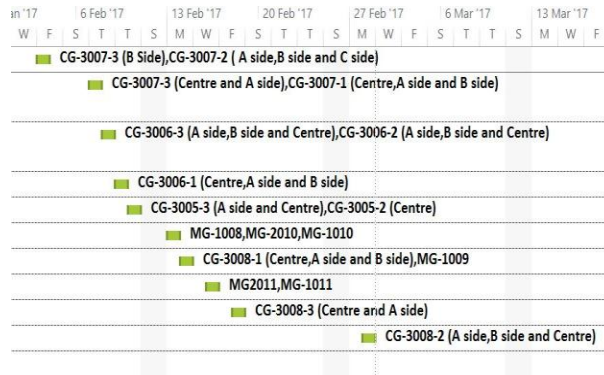


Image-3

The scrutinizing the data helped the top management to participate in quality management, thus helping in implementation of ISO 9001 (clause 5.1). The participation of top management in keeping the check for the tested girder joints helped in scheduling the quality plan and future planning of the remaining unchecked girder joints. Further the top management kept track of the various activities at the bridge which helped to reframe the future quality plan of the bridge.

**Conclusions:-**

As far as the role of quality management is concerned, every manager is responsible for quality; especially senior management. Senior management has numerous responsibilities. They must practice the philosophy of management by wondering around. Management should get out of the office and visit the customers, suppliers and departments within the organization, so that managers can find out what is happening with a particular customer, supplier or project. The top management is also responsible for smooth execution of work at the site and make an efficient quality schedule that corresponds with the work done at the site. This enables the top management to schedule both the work and its quality plan.

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