

Assessment of Key Performance Indicators in Project Quality Plan for Construction Project

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Abstract

Construction projects are a balance between cost, time and quality. It is possible to have high quality and low cost, but at the expense of time, and conversely to have high quality and a fast project, but at a cost. If both time and money are restricted, then quality is likely to suffer. High quality is not always the primary objective for the client; time or cost may be more important. It is only realistic to specify a very high standard of quality if the budget is available to achieve that standard. The need for KPI in construction projects has increased considerably in recent times due to significant changes, advancements in technology and high expectation of the users. The KPI maintain uniformity in construction process and ensure more economical utilization of materials resulting in significant reduction in cost to the users. This type of study has become necessary when the construction industry is encountering a quality issues day by day. Critical parameters or key indicators are necessary to introduce at planning stage when PQP is preparing which divert us to concentrate for quality. This study is carried out by questionnaire and Delphi techniques on quality of certain important activities. This study leads to know critical parameters or key indicators of an activity and their contribution. These indicators can be used for internal qualitative improvement which ultimately improves business, reputation.

Keywords- Construction Projects, KPI, PQP, Quality

I. INTRODUCTION

The construction industry has been struggling with quality issues for many years, and the cost to our economy is dramatic. The cost could potentially be reduced significantly if the industry were to embrace the concept of quality assurance that has been used with great success by many other sectors of the economy. The construction industry is unique, and therefore, the application of quality assurance requires an approach that meets the needs of the industry.

Building owners also need to be educated as to what is quality assurance so that they can begin using their voice to encourage adaptation of this approach to protect their investments and reduce the cost of construction.

The quality assurance and quality control is having broad meaning as per as various sectors are concerned. In general to understand this concept of quality, we formulate four questions as follows,

- 1) What is mean by Quality?
- 2) How it is achieved?
- 3) What is Quality Assurance?
- 4) What is Quality Control?

When we are talking about quality about anything, either it is service or any product; one word should come in mind as response i.e. YES or NO. There should not be any response to differentiate quality viz; fair quality, moderate quality, quite poor or quite good quality.

Ultimately the presence of quality is important. So in general we can define the quality in different ways as follows,

- 'Quality is conformance to requirements or specifications'
- 'Quality is fitness for use'
- 'Quality is the degree to which a set of inherent characteristics fulfills requirements'

Considering the significance of construction, there are three-fold meaning in construction, which are getting job done on time, ensuring that the basic characteristics of the final product comply with the requirements and getting the job done within budget. It has been a merging dispute over clients' dissatisfaction towards Indian construction industry performance in terms of completing the project within budgeted cost and time frame given and foremost, the quality of the end product. There is an increasing demand towards high quality of construction constructed by Indian Construction Industry. The major indicator to measure and determine the quality of construction is high quality of workmanship where it determines the success of construction. In early 1980's, quality began to emerge as a key management focus in United States. Indian construction industry has realized on the aggressive competition in both regional and international industry. To ensure their position in emerging

international market, the construction industry must impose higher quality levels in trying to achieve internationally accepted quality levels.

In construction industry, quality should be implemented throughout the life cycle of the project as a preventive action. Quality issues also have to be taken into consideration in the construction project management in order to eliminate any unnecessary problems before it occurs or towards lean construction. Lean construction means to eliminate the unnecessary system or approaches and continually improvement.

II. PLAN QUALITY

The following 5C's of quality will provide an indication of the quality of the plans as follows:-

A. Complete

The plans will be an accurate and thorough representation of the existing project site and terrain features.

The plans will be an accurate and thorough representation of the proposed project features and details to be constructed. The plans will be supported by a thorough and detailed documented development process. The plans will be developed with the active involvement of all affected parties and developmental stage owners throughout all stages of development.

B. Consistent

The plans will be consistent with other plans developed and will comply with all standards and guidelines set by the design manuals.

C. Clear

The plans will not contain any design errors or omissions which will require more than one addendum during the project advertisement period.

D. Correct

The plans will not contain any design errors or omissions which will cause the delay, postponement, or cancellation of the project letting.

E. Constructible

The plans will not contain design errors or omissions that require more than two change orders throughout the construction phase which individually causes an increase or decrease of more than 3% of the original contract bid award amount or causes an increase or decrease in the contract time by more than one day.

It is recognized that good communication and significant effort by all "stakeholders" is necessary to meet the 5 C's and achieve the desired result of a quality set of plans.

III. QUALITY MANAGEMENT GURUS

A. W. Edwards Deming

W. Edwards Deming played an important roles and responsibilities on management at both the individual and company level, which he believed 94% of quality problems are management responsibility. He has pointed out fourteen point plans which is a complete philosophy of management that can be applied to any scale of organizations in the public, private or service sectors.

The Deming's cycle is a universal improvement methodology where the whole idea is to constantly improve and thereby reduce the difference between the requirements of the customers and the performance of the process. As an explanation, the cycle is about learning and ongoing improvement, learning what works and what does not in a systematic way; and the cycle repeats; after one cycle is complete, another cycle is started.

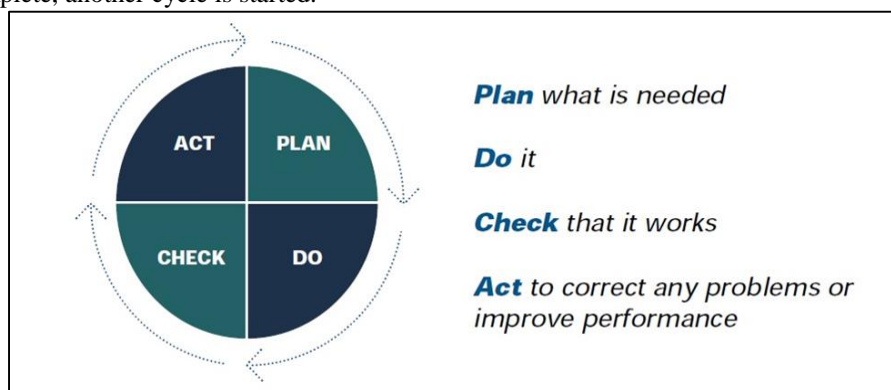


Fig. 1: PDCA Cycle

B. Dr. Joseph M. Juran

Dr. Joseph M. Juran developed the quality trilogy namely quality planning, quality control and quality improvement. A good quality management requires proper quality actions to be planned out, improved the quality and controlled using tools. The trilogy works by achieving the process control at one level of quality performance, then plans are made to improve the performance on a project based on project basis, using tools and techniques such as Pareto analysis.

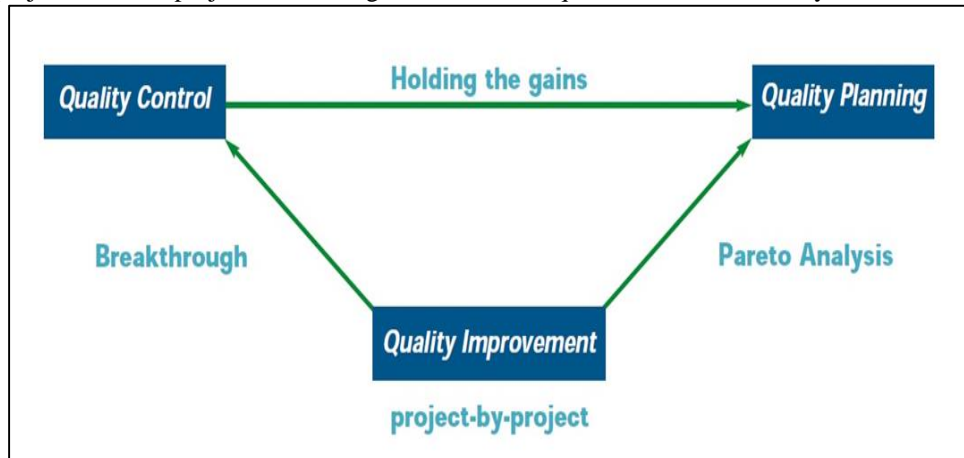


Fig. 2: Quality Trilogy

He not only concentrates on the end customer, but on other external and internal customers. Each person along the chain, from product designer to final user, is a supplier and a customer. In addition, the person will be a process, carrying out some transformation or activity.

C. Armand V. Feigenbaum

Armand V. Feigenbaum was the originator of "total quality control" or often referred to as total quality. He has defined total quality as "An effective system for integrating quality development, quality maintenance and quality improvement efforts of the various groups within an organization, so as to enable production and service at the most economical levels that allow full customer satisfaction".

D. Dr. Kaoru Ishikawa

Dr Kaoru Ishikawa has made many contributions to the development of quality and his total quality viewpoint, companywide quality control, his emphasis on the human side of quality, the Ishikawa diagram and the assembly and use of the "seven basic tools of quality" are the most noteworthy. The "seven basic tools of quality"

Table 1: Basic tools of Quality

Tools of Quality	Problems
Pareto Analysis	Which are the big problems?
Cause and Effect Diagrams	What causes the problems?
Stratification	How is the data made up?
Check Sheets	How often it occurs or is done?
Histograms	What do overall variations look like?
Scatter Charts	What are the relationships between factors?
Process Control Charts	Which variations to control and how?

E. Dr. Genichi Taguchi

As for Dr Genichi Taguchi, he believed that to design product that is robust or insensitive to variation in the manufacturing process is more preferable, contradict to Dr. Ishikawa believed, which is to control all the many variations during actual manufacture.

F. Philip B. Crosby

Philip B. Crosby is well known in Quality Gurus for the concepts of "Quality is Free" and "Zero Defects". His quality improvement process is based on four absolutes of quality which are:

- 1) Quality is conformance to requirements
- 2) The system of quality is prevention
- 3) The performance standard is zero defects.
- 4) The measurement of quality is the price of non-Conformance

IV. PROJECT QUALITY PLAN

‘Project Quality Plan’ can be defined as a set of activities planned at the beginning of the project that helps achieve quality objectives. It is a live document that is used and updated regularly throughout the project life or contract period. It must comply with ISO 9001 standards and specifications of the project.

- The PQP clearly defines
- Project or contract objectives.
- Resources to be used i.e. organizational structure.
- Personnel responsibilities and authorities

Process controls to be used to deal with work and risks involved, including quality procedures, and ITP’s and associated checklists, with method statement. Methods to be used to monitor and audit implementation. Methods to be used to identify non-conformities, and implement corrective and preventive actions. Methods to be used for document control and records management including maintaining, securing/protecting/storing, identifying, retrieving and otherwise controlling records for the periods required and then their disposal.

V. QUALITY DIMENSIONS

Table 2: Dimensions of Quality

<i>Dimension</i>	<i>Terms</i>
<i>Performance</i>	<i>Primary product/service characteristic. Such as time, cost and workmanship Aspect</i>
<i>Features</i>	<i>Secondary characteristics, added consideration, such as creativity in design, Attractiveness</i>
<i>Conformance</i>	<i>Meeting specification or industry standards, workmanship and client requirement in contract</i>
<i>Reliability</i>	<i>Consistency of performance over time, average time for the unit to fail</i>
<i>Durability</i>	<i>Useful life period, less maintenance or repair</i>
<i>Service</i>	<i>Resolutions of problems and complaints, ease of repair</i>
<i>Aesthetic</i>	<i>Sensory characteristics in design, such as exterior finishes</i>
<i>Perceived Quality</i>	<i>Past performance and other intangibles, such as being ranked first in the tendering process</i>

VI. TYPICAL CONTENTS OF PQP

- 1) Introduction to the ISO 9001 : 2008 Standard
- 2) Project Quality Management System of the company
- 3) Project Title, Scope of Work & Principal Parties
- 4) Project Organization:
- 5) Site Organization Chart
- 6) Key staff at site
- 7) Specific allocation of duties and responsibilities
- 8) Job Description of Key Staff at Site
- 9) Project Administration:
- 10) Authorized Signatories List
- 11) Correspondence
- 12) Meeting Schedule
- 13) List of Method Statements
- 14) List of ITP (Inspection & Test Plan)
- 15) List of Project Standard Forms & Checklists
- 16) List of Client/ Consultant Supplied Forms/ Checklists

VII. OBJECTIVES OF STUDY

- 1) To understand the general process of performance related specifications and testing procedures for construction materials.
- 2) To develop checklist for onsite inspection for appraising the QA and QC data periodically.
- 3) To provide ‘Project Quality Plan’ is to define activities / tasks that focus on achieving customer's quality expectations. These activities / tasks are defined on the basis of the quality standards set by the organization delivering the product.
- 4) To identify various factors based on activities affecting the quality performance of construction projects. (Key Performance Indicators, say: KPI)

VIII. RESEARCH GAP

- 1) Critical activities are identified in the project. Necessary actions are defined.

- 2) But, the key factors which are affecting to quality of activity is not identified
- 3) This may lead to the achieving less quality and time spent, resources require for correction. Key performance indicators are necessary to know for any activity before it starts.

IX. SCOPE OF WORK

- 1) Setting out objectives
- 2) Literature survey
- 3) Site Visits
- 4) Identification of critical activities and factors affecting to it
- 5) Finding importance of factor in terms of grade
- 6) Corrective actions for respective key factor

X. METHODOLOGY

Following activities are selected for this study:

A. *Excavation*

The terms 'excavation', 'excavation work' and 'competent person' are used extensively in this code of practice. 'excavation' means a hole in the earth, or a face of earth, formed after rock, sand, soil or other material is removed (such as a trench, ditch, shaft, well, tunnel, pier hole, cutting or caisson or a hole drilled in the earth). 'Excavation work' means work to make, fill or partly fill an excavation.

B. *Plinth Filling*

Plinth filling shall be carried out with approved Plinth material in layers not exceeding 45 cm, watered and compacted with mechanical compaction machines. Engineer May however permit manual compaction by hand tampers in case he is satisfied that mechanical compaction is not possible. When filling reaches the finished level, the surface shall be flooded with water, unless otherwise directed, for at least 24 hours, allowed to dry and then the surface again compacted as specified above to avoid settlements at a later stage. The finished level of the filling shall be trimmed to the level/slope specified.

C. *Reinforcement Works*

This procedure is prepared for cutting, bending of reinforcement as per relevant standards, Drawings and specification. Procedure shall be adopted for all the works for the building works.

D. *RCC Work*

The concrete of the mixture of cement, sand, water and aggregate in a certain proportion with steel bar by a known method is termed as reinforcement cement concrete.

RCC is a construction technology which evolved with the evolution of different structural material in the 18th century during the industrial revolution.

Industrial revolution brought in new technology which helped in the manufacture of various material. The architect Le Corbusier, He believed that any shape and form was possible, if RCC is to be used. Components structure of RCC are beam, column, staircase, slab etc.

E. *Brick Masonry*

Brick masonry is widely used in many forms of construction, landscaping and hard industries. Ever since the days of Mesopotamians brick masonry has been used to build houses and other form of shelter, as well as pathway, decks, steps and wall. Amongst all the different types of building material available, brick masonry is most popular.

Brick masonry has several advantages over other types of building materials. Brick masonry does not warp, bend, dent, rot, rust, burn. Even the colors of brick masonry will not fade since the bricks are fired at extremely high temperature, locking the colors in.

F. *Form Work*

The formwork or shuttering is a temporary ancillary construction used as a mound for the structure, in which concrete is placed and in which it hardens and matures. The cost of formwork may be up to 20 to 25% of the cost of structure in building work, and even higher in bridges.

G. *Painting*

Paints are liquid composition of pigments and binders which when applied to the surface in thin coats dry to form a solid film to impart the surface a decorative finish, apart from giving protection to the best material from weathering, corrosion and other

chemical and biological attacks. Paints preserves timber structure against warping and decay. Most of the metals corrode if not painted at suitable interval. Painting on surfaces imparts decoration, sanitation and improved illumination.

H. Plastering

Plastering is the process of covering rough surfaces of walls, columns, ceilings and other building components with thin coat of plastic mortars to form a smooth durable surface. The coating of plastic material is termed as plaster. Plastering on external exposed surfaces is known as rendering.

XI. CONCLUSION

This study indicates the correct testing procedure to maintain the quality for an activity. This gives related checks for overall quality.

This study gives an integrated checklist for an activity which is used at different site by different organization. This may leads to easiness in external quality audit.

PQP is most important document is rearranged with contents & key indicators for an activity & their importance.

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