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Implementation of Six Sigma Method for Quality Improvement

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Abstract – *construction sector is a topmost sector in India. . Construction management and technology are the two key factors which affects the development of the construction sector. The main of the project is to study the quality of building work. Study the various factors that affect the quality and customers need are main aim of this work. For that quality terms are studied. DMAIC methodology is helpful to this work. The result of six sigma is based on the quality factors. The purpose of this study is to identify the factors of G+4 building. The comparative studies are done and it shows the exact quality of work. This study will help us for future work.*

Key words: *Six sigma, DMAIC, Construction Industry, Quality, Customer Satisfaction.*

1. INTRODUCTION

Construction industry plays a major role in economic growth of nation. It is the most booming industry in the whole world. Construction sector is viewed as a service industry which generates substantial employment and provides growth afflatus to other manufacturing sectors. Construction management and technology are the two key factors which affects the development of the construction sector. These days the critical objective of construction industry is to complete the project in specific time and within the scheduled costs and budget. Along with this need for improving quality and customer satisfaction has received significant attention in recent years, so the one approach which can fulfil all the requirements of construction sector is using six sigma concepts in construction industry. The six sigma is a quality improvement technique to ensure customer satisfaction. The result of six sigma will be an increased efficiency, improvement in performance and control the problems to minimizing defects, risks and deviation. Six sigma is a quantitative and qualitative approach for improvement with the goal of limiting defects from any process, specially a numerical goal of 3.4 defects per million opportunities (DPMO). Six sigma is easier to apply than many other quality management techniques because it is provide information about what change needed and the programs to execute the change.

Table -1: sigma level

Defects per million	Sigma level	Yield
6,97,672	1	30.23%
3,08,537	2	69.41%
66,807	3	93.31%
6,210	4	99.37%
233	5	99.97%
3.4	6	99.99%

Source: www.irjmets.com, volume 2/ issue 3/ March 2020

The six sigma is a statistics based methodology and depends on the scientific method to make significant reductions in customer defined defect rates in an effort to eliminate defects from every product, process and transaction. A normally distributed product quality distribution curve can be used to illustrate the six sigma principle. The lower and upper limit defects is +/- six sigma from the mean. Quality control is very important technique to build durable and efficient structure in the construction industry. The strength of the structure is a random variable, it is necessary to excise good quality control to minimize its variability. Quality means, the construction it is providing a building which provides an appropriate quality for the purpose for which it is intended.

1.1 Need of study:

The construction industry is largest industry in India. It produces the large quantity of waste and consumes more resources. So, for reducing these new methodology can apply. It can reduce various problem related to construction sector. The comparative study of six sigma methodology in two building can give overview about its quality, and production cost of building. And help to minimize the defects. It results in the affection of project objectives like time, cost, quality, scope.

Specifically, it helps to identify and eliminate sources of variation in process, sustain success, enhance value to customers. DMAIC is six sigma improvement model and it help to improve the current capabilities of an existing process.

1.2 Scope of work:

Six sigma provide structural methods of improvement to reduce waste, reduce cost, reduce lead times and improve planning.

DMAIC - the six sigma concept can be used as an improvement process to address the individual problems that have occurred or can be used for preventative actions.

2. METHODOLOGY:

In these studies the data is collected from various sources to study the six sigma principles, concepts of DMAIC and DMADV. The concept of six sigma which measure a process in terms of the defects. The main motto of using this concept in construction process is to reduce the variation in every process. The acceptable range of lower and upper control limit as +/- 6 sigma from mean. The DMAIC is the data driven quality improvement process. It is used to redesign the existing process by analysing the defects in process. So, the comparative analysis of both the building can be easy to study. The sigma level is determined using DPMO, and problems are identified using the DMAIC principle of the six sigma approach, which increases the sigma level and eliminates defects. For implementing six sigma methods, the quality of product and process base tool is DMAIC.

1. Define: to define customer requirements that do not meet those requirement are defects. Identify the problems which affect the quality of product. SIPOC tool is used.
2. Measure: identify the performance requirement of process with respect to its defects characteristics. For that, Pareto chart is used.
3. Analyze: analysis the data collected from previous steps and find out the root cause of defects. For that, the cause and effect diagram are used.
4. Improve: identify the ways to destroy the existing defects and adopt new solution. Remedies for the corrective action are given
5. Control: measure the performance of new process under a control plan to control all the activity related to quality level of process to increase the six sigma level. Control plan are established.

2.1 Problem identification:

A challenge is a distinction between the desired and the actual situation. It is related to an expected outcome or standard of behaviour, either directly or indirectly. Identification of exact problem is the main step to implement the problem solving process successfully. The problem identification in research is:

1. lack of knowledge
2. Material waste.
3. Improper scheduling
4. Poor work planning.
5. Customer dissatisfaction.
6. Maintain less quality.

2.2 Questionnaire survey:

A sample questionnaire is prepared and is distributed to customers which are live in these building. A rating system is adopted for identification of factors affecting the quality of projects. The questionnaire covers the building's quality as well as the numerous issues they find in these projects. The second questionnaire survey is sent to a variety of people involved in building construction, such as site engineers, owners, contractors, and architects. Construction elements such as labours, measures, materials, procedures, equipment unassignable events, scheduling, contract procedure, and site management safety precautions are included in these questionnaires. These surveys are helpful at the time of construction of new building.

1) Questionnaire survey for building members.

1. What is the definition quality according to your construction requirement?
2. What type of problem is common in all flats?
3. Which type of problem you face in daily routine?
4. How those places where the problems occurs more unusual?
5. Which type of problem is greater?
6. Rate the quality of building?
7. How much money will you spend on maintenance?
8. Any specific types of problem are you face?

2) Questionnaire survey for distributors

1. Which qualities of material were used in construction work?
2. Any scrap materials are needed or helpful to any work?
3. Proper testing of material should be done?
4. Is all the work is done on specific time?
5. Which safety norms should follow the workers?
6. Has the shuttering material been properly aligned using appropriate equipment?
7. Are all workers give proper training?
8. Which type of problems you face in day to day life?
9. Any other problem regarding the construction.

3. DATA ANALYSIS:

The relative importance index analysis aids in identifying the aspects that have the greatest impact on building construction quality. To estimate the relative importance of the many causes and effects of delays, utilise the Relative Importance Index method. In this project, the same procedure will be used in different groups (i.e. clients, consultants or contractors). For each factor, a four-point scale numbered from 1 (not important) to 4 (very important) will be used and converted to relative importance indices (RII) as follows:

RII = Sum of weights / A*N

Where,
W = weight of scale
A = highest weight
N = total number of respondent

Table -2: Ranking by RII

Sr. No	Factors	Rank
1	Design	III
2	Material	VI
3	Contract	V
4	Labour	VII
5	Equipment	IX
6	Site staff	V
7	Contractors	IV
8	Environment	I
9	Political	XIII
10	Owner	VI
11	Site layout	XI
12	Financial	X
13	Execution	VI
14	System	IX

3.1 Applying six sigma in building:

The checklist is prepared for various components of building. The one which meets standard requirement is marked as "0" otherwise who does not fulfil standard requirement mark as "1" and NA shows that item is not applicable. The total number of defects and total number of opportunities for defects in each checklist is calculated as following formula:

$$DPMO = \frac{\text{no. of defects X } 1000000}{\text{No. of opportunities X no. of units.}}$$

4. RESULT:

Table -3: sigma level of building

Sr. No.	Work name	Sigma level
1	Brickwork	3.81
2	Concreting	3.90
3	Plastering	3.99
4	Flooring	3.96
5	Painting	3.85
6	Formwork	3.96

From above table, it is clearly seen that the quality of building is not good. The customer was not satisfied because they do continuously maintaince in building. The DMAIC methodology is used for the study, it helps to improve and control the quality of new building construction with help of these parameters.

5. CONCLUSION:

The quality is directly affecting the building maintaince. While using this method in building work, the defects are minimized due to DMAIC method. The six sigma value does not reach the exact value. i.e. 3.4. This method is help to reduce the future work.

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