

# Use of Six Sigma in Construction Industry to Increase Quality

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**Abstract** –This is a review paper for understanding the role of Six Sigma as a discipline of reducing the deviations and variations and hence eliminating the activities or wastes within the construction processes. Six sigma identifies and reduces the amount of waste creation on sites. The researchers have done quantitative study approach to identify the factors contributing a number of quality problems. Thus wastes within the construction project, were reduced by driving the suitable methods of Six Sigma and Lean tools. Industry In manufacturing sector worldwide, six sigma is becoming very popular and its advantage is being taken for improving productivity and quality performance and also to make the process robust to quality variations. Hence Benchmarking with manufacturing industry, six sigma can be effectively used in construction. Efficient material management is essential in managing a productive and cost-effective site. Primary objective of the study is to derive the reasons contributing to the amount of material wasted on residential building sites and find the remedy. The researchers note that Six sigma will play a very vital role in construction industry

**Key Words:** Six Sigma, quality, road construction, waste material, DMAIC and Benchmarking

## 1. INTRODUCTION

The roads form major infrastructure of a country which describes the condition of a country and plays a substantial role in economy. In the quest for productivity improvement, curtailing waste and optimizing profitability, it is vital to ensure the quality of project work processes. Thus eliminate the non-value adding activities in order to elevate predominantly the reliability and stability of construction operations. Furthermore, many other factors that influence the waste include; insufficient store size, improper material handling, lack of inspection on inventory and climatic conditions. These sources need to be reduced or eliminated to enhance the performance of road construction processes. By eliminating the root cause of variability, improved productivity and reduced cycle time is achieved.

Six Sigma focuses on reducing the deviation and improving the first-time yield of the process, Lean is primarily concerned with the waste elimination. The combination of Lean tools and Six Sigma methodology together improves

construction quality, shortens cycle time, and reduces wastage and overall cost. This is achieved by improving the process control to maintain the reliability and perceptibility processes.

## 2. LITERATURE REVIEW

**Mr. Ganesh and et all [2015]**.in their paper presents a review of the six sigma case studies implemented in the Automobile Industries, small Scale Industries, Service Industries and also the Product Manufacturing Industries. The major problems highlighted are declining profit margins, customer demand for high quality product and variety. The authors have analyzed the impact of Six Sigma on developing economy like India. The study provides an insight into what kind of benefits Indian industries are gaining from Six Sigma as a whole. The study further highlights similarity and differences of benefit gained by different scales and sectors of Indian industries through Six Sigma.

**2)M. Subburaj et al [2010]** in their paper carried out the study to identify the different reasons for idle time (traffic jam) and road accidents in Chennai, India through DMAIC principle -six sigma technique and suggest a possible solution for this problem. According to author road transport plays an important role for economic development. At the same time every day we are facing human loss, social and economic loss due to road accident. The implementation of DMAIC principle on road safety will reduces road accidents and traffic problem by 50%.

**3) Muharrem Firat Yilmaz [2012]**. The author has discussed process improvement methods used in construction industry and analyzed the basic features and principles of Six Sigma. This study defends that there is no doubt about the positive effects of Six Sigma on construction projects. Six Sigma can provide a broader quality concept, detailed performance measurement, coordinated and repeatable process/performance improvement. It has increased quality directly/indirectly and has positive effects on production efficiency. The author has mentioned that six sigma is too new within construction context and construction professionals are not ready to implement it to the whole project phases. The author has emphasized the importance of project control and site engineer's collaborations. Also, he thinks that the

proper adoption of Six Sigma is not total in construction industry and it should be implemented and adjusted to considering typical characteristics of construction industry

**4) Rodney A. Stewart et al [2006]** have attempted to improve their market competitiveness, by limiting the extent of non-value-adding activities. They have observed that some organizations are beginning to monitor the performance of internal and external engineering and construction processes. To achieve these bold aims, these organizations are looking to other industries such as manufacturing to examine the effectiveness of measuring and monitoring tools such as six-sigma techniques. The authors summarize that the six-sigma approach provided the PIP team with a structured process improvement strategy to reduce waste and other non-value adding activities from the construction process.

**5) Seung Heon Han et al** in their research explores practical solutions for construction performance improvement by applying the six-sigma principle. This principle provides the metrics required to establish performance improvement goals and a methodology for measuring and evaluating improvement. The proposed approach is expected to achieve more reliable workflows by reducing process variability to fit in a desirable range—thereby improving the overall performance through the evaluation of the quality level in current construction operations. To achieve this purpose, this paper explored the feasible strategies for the improvement of the construction processes and operation by combining the six-sigma principle with the idea of lean construction.

**6) Sunil V Desale and Sharad V Deodhar[2014]** have observed that inefficient labour productivity practices, results from poor site material management, and handling. In this paper, therefore an attempt has been made by authors to rectify these activities and construction organization. The authors have derived the reasons contributing to the amount of material wasted on residential building sites, which needs to be brought down substantially by devising suitable method. The authors have concluded from these findings that the prevalent conventional methods and thumb rules used in the companies contribute to material wastage on site. Their study distinctly reveals that each aspect of working needs to integrate to reduce the amount of waste material on site. Some suggestions are made by the authors to cut down the quantum of waste generated on sites. These are improvements in Construction organization and its management, Project management, Material Management and Method of Execution of Works.

**7) Nilesh V Fursule et al [2012].** In this the author signifies the fact that six sigma is a long-term commitment. It won't work well without full commitment from upper

management. Six Sigma changes the way a company thinks by teaching fact-based decision making to all levels. The Six Sigma programme changes the 'DNA' of the company by changing the way the leaders think and by improving the management pipeline by developing management and communication skills in people. According to the author, the important reason behind the failure of six sigma is because of the ignorance on implementation model.

### 3. METHODOLOGY

The researchers have described about the use of six sigma DMAIC in automobile, small scale industries and service industries. The author is showing the wide application of six sigma in various industries. Thus concept of benchmarking is used for improving construction industry

They have found out the actual time taken to reach a particular location from 5 different starting points (during two different times in day). This experiment was performed for 10 days and average travelling time and ideal time is recorded. After getting the required data, the DMAIC approach is used.

Another researchers have prepared a set of questions and then interviews were conducted with deputy project manager, a lead field and a lead cost engineer. Then the data was collected and analyzed by DMAIC some of researchers have done a case study to find out the effective application of six sigma in construction industry. The case study was based on a PIP for a contract in the United Kingdom. Case study methods are approached to find out the means of preventing the wastages at site. The case study demonstrates, how lean thinking and six sigma principles, tools and techniques can be applied. One of the method used was by comparing two models and sensitivity analysis then benefit of the six sigma principle in conjunction with lean construction was quantified. First, observed data were compared with the outputs of modeling to verify the simulation model. Another method used by researchers was comparing the results from before and after the process modification. The number of process time variations that exceeds 2 min were reduced through the process stabilization and subsequently a higher sigma level was obtained. The authors has performed in-depth comparative analyses on the existing methods for performance improvement and identified the advantages of the six-sigma principle over the traditional techniques.

### 4. RESULTS AND DISCUSSIONS

1. Six Sigma as a quality initiative is useful in order to extend quality concept to more efficient form and create a new quality framework which includes financial

parameters of construction industry. Use of DMAIC methodology is helpful to increase quality and productivity at the same time and it has affected the technical and financial success of project considerably. In order to obtain better results, DMAIC must be properly adapted and successfully implemented in the construction industry which in turn will act as a process improvement tool

2. By use of six sigma, various industries will be benefiting in terms of energy, time, money, man power and wastage of resources The adoption of Six Sigma to the construction industry requires the integration of Six Sigma to the existing quality management strategy of the companies. Six Sigma has provided an exact methodology, continuous data collection system and measurement techniques for performance/process efficiency measurement as a prerequisite. Additionally, the integration of Six Sigma approach to the existing procedures of project control department makes the collaboration of Site and Office department more efficient

3. Wastage in the construction industry in India is quite high and process improvement will help it to become cost effective and competitive. The study shows that there is always delay in material procurement from client. It also shows that there is lack of proper monitoring system on site to keep a check on the quantity of material when purchased and actual quantity received on site. Lean Six Sigma methodology aids in improving the construction quality, process reduction, waste reduction, and construction cost.

## 5. CONCLUSION

Six sigma is not only used in service and manufacturing industries but also it can be used effectively in the construction industry. Six sigma is also used in enhancing the safety level. By detecting the defects in the process, the energy is saved in terms of resources. (Man, Material and Money) By benchmarking with other industries, construction industries can achieve the goals with the help of six sigma and also achieve the required quality of work. Six Sigma has provided an exact methodology, continuous data collection system and measurement techniques for performance/process efficiency measurement as a prerequisite. With proper execution six sigma can eliminate waste, prevent accidents ensure safety and quality work. It can help the organization to be productive and manage all the problems easily

## 6. REFERENCES

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