A review paper on the Quality Audit of Public Building Project by Using Six Sigma Technique

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Abstract: Six Sigma is a Quality improvement technique that has being implemented in manufacturing and other industries. The critical objective of construction industries nowadays is to complete a project within a stipulated time and cost through process standardization, minimize of waste, and organizational potential and efficient use of resources by using recent techniques such as Lean Six sigma.

Most of the construction companies face poor client satisfaction due to non completion of the work as per the required standards and specifications. Six sigma refers to the minimization of variation through proper work flow maintenance and it leads to performance improvement of contractors in terms of cost and quality.

The combination of Lean tools and Six Sigma methodology is used on projects to improve the process by eliminating the variations and creating workflow in a process. This system has already been implemented in different fields such as service, hospitality, technology, manufacturing and in its first implementation in the year 1987, in the information technology industry by the company “Motorola” It is to be considered though that early delivery is not always profitable, owing to the possibility of a quality reduction in the final product of the project. For this reason, an equivalence must exist between time and quality. On the other hand, in the construction industry, every building is like a prototype for the automotive or information technology industry, and that means that improving time and quality in the Research Building Construction Industry can be quite difficult. However, this is not entirely the case, because the research of the Six Sigma implementation in that field demonstrates that it is able to optimise and improve those common and specific projects in time and quality.

1. Introduction

Six Sigma is a system which primarily can improve the quality and consequently the time management of projects. The Six Sigma technique has already been implemented in different industry sectors, and fortunately it has brought about more benefits. It has improved the time, quality and cost management in the projects. Six Sigma technique, consists of the process called DMAIC (Define, Measure, Analyse, Improve and Control). However, Six Sigma focuses on detecting the errors in the process of project completion, with which it then can create a database to improve the process of the projects.

However, construction work is fragmented and project-oriented work processes compared to the manufacturing industry. So, the evaluation of Six Sigma within construction context becomes an interesting research question considering quality, performance and management aspects.

Nowadays, every industry sector needs more specific controls. Six Sigma is able to take control of the projects. Furthermore, it is also able to improve the quality and use of time. The building construction industry is currently in development stage, and with the Six Sigma implementation in this industry sector, it will be able to improve the quality and time management of its projects. Six Sigma is a quality improvement technique based on statistics, was used firstly by Motorola in the 1980’s. It helps to decrease costs, increase quality by improving process and reduce the production time. Six Sigma has statistical and business perspectives and its applications are improved by Six Sigma Academy.

Quality Management is defined as any approach used to achieve and sustain a high quality output by conforming to requirements and meeting customer satisfaction. Six sigma is a quantitative approach for improvement with the goal of eliminating defects from any process, specifically a numerical goal of 3.4 defects per million opportunities (DPMO). Six sigma is reportedly easier to apply than many other quality management programs because it provides information about the change needed and the programs to execute the change.

The strategy it uses is a five-step improvement process: define, measure, analyse, improve and control (DMAIC). This process is deeply integrated with the overall goals of the organization and, as such, requires top down implementation. Six sigma
is more intense, focused and detailed than any other quality improvement techniques. Six Sigma was first used in 1985 by Bill Smith of Motorola to decrease cost, increase quality by improving process and reduce the production time.

Research building construction projects are estimated to specific costs, determined quality and expected delivery times for the final products. However, while projects are carrying on their processes, many times the project-errors are not considered and not taken into account. This is the case despite the fact that Six Sigma is able to benefit the projects and consequently, is able to improve them in terms of quality and time management.

2. Literature Review

Title - A Review of Six Sigma Approach: Methodology, Implementation and Future

Author - Meena Ahirwar

This paper states that DMAIC is a closed-loop process that eliminates unproductive steps, often focuses on new measurements, and applies technology for continuous improvement. Some papers focus on explaining the DMAIC contents, with some authors discussing each phase of DMAIC in detail. For example, raises teals present self-learning training material for DMAIC, using a fictitious application. This paper helps the readers to learn how to carry out a small-scale Six Sigma project, including guidance on the application of tools. It indicates a perceived need for training material and suggests that an avenue for further research is to develop training material to cover a wider range of applications and larger scale projects. Other papers concentrate on specific aspects of DMAIC, such as the project selection process in the Define phase or process control in the Control phase, explaining some key measures in Six Sigma, such as project metrics and Roll Throughput Yield (RTY). For example, Sneer emphasizes the importance of the project selection.

Title - Six Sigma Implementation within the Building Construction Industry”- A Case Study of the Research Building Construction

Author - Francisco Ribes

This paper is on the implementation of Six Sigma within the Research Building Construction Industry. The case studies presented have been researched in Germany. Six Sigma consists in improving the projects mainly in terms of quality and also in terms of time management. According to the Six Sigma system, the goal is to detect the errors in those fields. This can consequently improve and optimise the projects, which have been already implemented with Six Sigma. Moreover, this system can also reduce the errors, and that means less work accidents and less extra money waste, by means of focusing on quality and time management. This system has already been implemented in different fields such as service, hospitalization, finance, retail, automotive, media, manufacturing and in its first implementation in the year 1987, in the information technology industry by the company “Motorola”. It is to be considered though that early delivery is not always profitable, owing to the possibility of a quality reduction in the final product of the project. For this reason, an equivalence must exist between time and quality. On the other hand, in the construction industry, every building is like a prototype for the automotive or information technology industry, and that means that improving time and quality in the Research Building Construction Industry can be quite difficult. However, this is not entirely the case, because the research of the Six Sigma implementation in that field demonstrates that Six Sigma is able to optimise and improve those common and specific projects in time and quality.

Title - Six Sigma within Construction Context as a Quality Initiative, Performance Indicator/Improver, Management Strategy

Author – Muharrem Firat

The aim of this study is to evaluate Six Sigma as a process improvement method within construction context. Literature Review had discussed process improvement methods used in construction industry and analyzed the basic features and principles of Six Sigma. Three interviews were conducted about the basic principles of Six Sigma and Quality Concept. Interviewers are a Project Manager, Field and Cost Engineer. The approach of the interview to Six Sigma is based on quality, performance and management aspects. This study defends that there is no doubt about the positive effects of Six Sigma on construction projects. Particularly, 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. As a management approach, Six Sigma is discussable within construction context due to differences of manufacturing and construction industry. Since construction industry includes lots of unrepeatable tasks and different process design techniques, Six Sigma does not seem applicable as a whole management approach in construction industry.
Title - Implementing and Applying Six Sigma in Construction  
Author - Low Sui Pheng  
This paper states that Six Sigma is a statistical measure used to measure the performance of processes or products against customer requirements. This paper described the Six Sigma concept as a quality initiative that may be applied in the building industry. The principles, methodology, and metrics of Six Sigma are first discussed. The implementation phases as well as the training programs required are explained. A case study of how Six Sigma was pioneered in an organization in the building industry is presented. The findings suggest that management initiative and support, relevant training, appropriate selection of pilot projects, and commitment by team members are crucial for the successful implementation of Six Sigma in the organization. The application of Six Sigma for improving the quality of internal finishes during construction is also explained. Improvement measures taken by a contractor helped to raise the sigma from 2.66s to 3.95s for quality of internal finishes.

Title - Applying Six Sigma Principles in Construction Industry for Quality Improvement  
Author - Sneha P. Sawant  
This paper describes the basic theory of Six Sigma, principles, methodology, and various tools used. A case study of a residential building is taken in which the Six Sigma principles are applied for internal finishing work, the Six Sigma methodology has been adopted to improve the quality and is checked against the sigma level. The findings suggest that proper training and management support and minor changes in current work procedure can help improve the quality and ultimately customer satisfaction which is of prime importance.

3. Scope, Methodology and Purpose  
3.1 Scope:-
Following are the objectives of the proposed dissertation work.

a) To understand the needs of six sigma in construction industry from process improvement perspectives and matches these needs with the expected outcomes of Six Sigma.

b) To find out six sigma levels of various construction activities related to public buildings.

c) To create useful and scientific knowledge about Process Improvement and Six Sigma for Public construction building.

d) A Case Study on the Implementation process of a Six Sigma Program.

3.2 Methodology:-
Six Sigma has two key methodologies:

1. DMAIC: It refers to a data-driven quality strategy for improving processes. This methodology is used to improve an existing business process.

2. DMADV: It refers to a data-driven quality strategy for designing products & processes. This methodology is used to create new product designs or process designs in such a way that it results in a more predictable, mature and defect free performance.

There is one more methodology called DFSS - Design For Six Sigma. DFSS is a data-driven quality strategy for designing or redesigning a product or service from the ground up. Sometimes a DMAIC project may turn into a DFSS project because the process in question requires complete redesign to bring about the desired degree of improvement. There are several methods that can be used in the implementation of Six Sigma in an organization, for example, the five-phase improvement cycle that has become increasingly common in Six Sigma organizations: define, measure, analyze, improve, and control :DMAIC. The steps involved are:

1. Define. Define the customers, their requirements, the team charter, and the key processes that affect the customers. Goals and/or objectives of a certain process are then set based on the customer’s requirements.

2. Measure. Identify the key measures, the data collection plan or the plan for measurement for the process in question, and execute the plan for data collection.

3. Analyze. Analyze the data collected as well as the process to determine the root causes of the problem that need improvement.

4. Improve. Generate and determine the potential solutions and plot them on a small scale to determine if they positively improve the process performance. Successful improvement methods are then implemented on a wider scale.

5. Control. Develop, document, and implement a plan to ensure that performance improvement remains at the desired level.

3.3 Purpose of Dissertation:-
The purpose of this study is to apply Six Sigma technique within construction context and evaluate its features, understanding the needs of construction industry from process improvement perspectives and match these needs with the expected outcomes of
Six Sigma technique. The objective of this study is to create awareness and provide scientific technique about process improvement and implementation of Six Sigma technique for construction industry.

References


