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A REVIEW PAPER ON STUDY ON REDUCTION OF COST OVERRUN AND TIME DELAY IN BUILDING CONSTRCTION USING SIX-SIGMA

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Abstract: There have been a lot of defects in recent years and errors may occur in a regular construction routine. In the construction of buildings, mistakes are very common. The time, complexity, budget and schedule of the proposed project can be affected by these major and some minor defects. The intent of this project is to identify and analyse the major and minor contributing problems and their corresponding defects happening in onsite construction work progress that is responsible for causing cost overrun and time delay in construction management and using the six-sigma technique named (DMAIC-Define, Measure, Analyse, Improve and Control) to minimize such defects. Identify the major contributing factors which majorly affects the cost and time it may results in construction delays. And providing the suggestions and solution to mitigate such onsite construction defects. And also through the literature review the features of the problems and defects can be analyse in this review paper.

Keywords: six- sigma, cost overrun, time delay, reducing defects, on-site activities, literature survey.

I. INTRODUCTION

To construct a building, it consists of some sequence to properly construct it. There were many issues during the construction of the building and the workers will face problems while the work is in progress, as a consequence of these issues and difficulties there were many errors that could cause and also affect the cost and time of the project. In the construction industry, operations are sequenced and tasks/events are processed in a standardized order to run the project. In an organization, respondents who are responsible for properly running the project with the main factors material quality, customer satisfaction, contractor responsibilities, labor and equipment availability, resource allocation, proper scheduling, proper estimation and planning of design and documentation and also include the external factors that all influence the project's efficiency, all of these factors must be taken into consideration when doing the work. Sometimes, these factors influencing major defects in projects that affects the projects time and cost. If in a construction industry the time and cost affected by these above factors it results in construction delays. The cost overrun and time delay affects the project's scope, quality and customer satisfaction. Since the building's problems in construction projects have increased, there is serious need to focus on the quality of building constructions industry.

Even though Six Sigma has been employed in the manufacturing and other industries, it is quite a fairly new impression in the construction project. Six Sigma's incorporation in the construction project has resulted in a gap in understanding of common problems in the construction industry that can serve as a guide for contractors and construction managers to help achieve a competitive quality level and a cost-effective project. The use of six sigma principles for the processes give a systematic approach to identify the defects, their root causes and gives a solution to improve them. Defects in construction are always the biggest priority of the construction industry. Depending on the functions, system types, and materials used, various constructed facilities generate various types of defects. Defective works can be defined as work that does not comply with the contract's express descriptions or conditions, including, most notably, any drawings or specifications, along with any implied terms regarding its quality, workmanship, performance or design. In most situations, the main major hurdle only in the nature of faulty buildings is the recovery of the costs of repairing defects found before physical harm occurs. This loss, which is the cost of repair, the loss of income or the reduction in building value, is categorized as "compensatory damages".

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II. REVIEW ON LITERATURE FOR REVIEW PAPER

Megan Florent Tchidi et.al (2012) explores that, Process and quality improvement using six sigma in construction industry**.** Practical solutions for construction process and quality improvement by using prefabricated composite structure (PCS) based on Six Sigma method. The DMAIC method of Six Sigma has been applied to conduct the analysis of the construction process, to discover essential factors to improve and thus to achieve higher customer satisfaction. These improvement measures help to overcome and reduce considerably concrete cracking and slippage in building construction.

Kuo-Liang Lee (2013) analysed that, the primary independent variable causing fractures in lightweight partition walls can be calculated and strengthened by a Six Sigma crew. They used a research report approach in this study to explain the strategies of Six Sigma by identifying problems using the scope statement.

Sneha P. Sawant et.al., (2014) analysed that, applying six sigma principles in construction industry for Quality improvement in internal finishing work by the way of framing CTQ inputs to criticize the defects and their root cause. By applying such six-sigma concept the quality of the internal finishing work can be improved.

Susmy Michael et.al., (2014) explained that, Six-sigma is used to measure the efficiency of a multistorey building. Often recommends different strategies for enhancing the building's efficiency by reducing defects. The DMAIC step of six-sigma is being used in the thesis to improve the efficiency of the buildings. The factors that influence the cause of defects are established, and data is analysed using six-sigma. Following that, the building's sigma level efficiency is measured, which aids in lowering variance costs, increasing efficiency, and optimizing labour and facility utilization.

S. Sriram et.al., (2016) explores that, in the construction industry, Six Sigma principles and an appropriate approach emphasize reducing variation and removing the root causes of problems. This project explores the general idea of Six Sigma, Six Sigma concepts, DMAIC (Define, Measure, Analyse, Improve, and Control) methodology, and methods used in each stage of DMAIC cycle. A case study was conducted in a residential building to which Six Sigma principles were applied for internal finishing work (tiling work). A defect evaluation sheet was developed, and the parameter current sigma level was calculated to be 3.37, with a yield of 95.76 percent. The DMAIC approach was used to improve the efficiency of an existing process by evaluating defects, their frequency, potential causes and effects, and suggestions on how to resolve them. The results will recommend adequate preparation, management support, and small improvements to current work practices that will help to increase quality and, eventually, consumer satisfaction, which is of paramount importance.

Shantanu Sathe et.al., (2017) analysed that, a study on a commercial building was conducted to which six sigma principles were applied for few internal finishing works: Brickwork, Plastering, flooring and Painting. A defect assessment sheet has been prepared to compute the process sigma level of the existing practice of work and after applying DMAIC (Brickwork, Flooring and Painting).

Maha Alkasisbeh (2018) discussed that, a comparative analysis on where and how Six Sigma was applied in the construction industry in Amman to recognize issues with construction projects. The main objectives of this project to investigate the implementation of Six Sigma tools to investigate the main building's problems and the root causes of these problems. Also, the study intends to implement these tools to improve the performance and the efficiency of construction projects. To accomplish this aim, information is collected from government institutions in order to classify the most significant building issues, and then a questionnaire approach is used to evaluate the underlying problems of these issues. The key problems in building projects in Amman, according to the results of six sigma techniques, are excavation breakdown, faulty sealing system on roof, bad water distribution system, and inadequate ventilation, which account for 52.2 percent of total problems in building projects. Despite the fact that the idea of using Pareto analysis and cause and effect diagrams has been out for a long time, the project has effectively shown to use these basic Six Sigma methods to define the areas of weakness and assign resources to solve them.

Shaikh Mohammed Ayyaz et.al., (2018) suggested that, for construction projects to be completed successfully, three critical requirements must be met: time, expense, and quality. The real parameter that defines the protection and overall health of construction projects is efficiency. Only non-compliance with desired requirements produces the most defects during the execution process. It has been found that many site executors are unaware of the value of a quality assurance checklist. This is why even newly designed structures can develop flaws. To fix this, a Software program for Quality Control Measure was built then using Six-Sigma technique. Six Sigma technologies are widely used in manufacturing plants, but their application in the building industry has begun. A quality management

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guideline prepared by a construction firm was used as a guide in the Android application. If a defect occurs during the work and the site supervisor does not mitigate it, the higher authority may take necessary remedial action. Quality Control Predictor Implementation time needed for a lengthy traditional quality control process can be greatly reduced by using this approach. Through this application, six sigma levels for particular performance are obtained immediately as well as cause s and effects of particular defect is also recorded in the application.

Akshata P Momaya et.al., (2020) analysed that, an application of six-sigma is a quality improvement process in building construction to improve the quality of the process of the work done on the field of ongoing work activities. In this study particularly, they undertaken their analysis on row housing construction (residential building) to improve the quality of internal finishes (such as plastering, painting, flooring, painting and false ceiling. They used DMAIC methodology to improve the quality of the internal finishing work.

Funke F. Fakunle et.al., (2020) they analysed the major causes of construction delays such as cost overrun and time delay could be identified and gives the suggestions to eliminate them all. The primary objective of this project is to present an overview of the major delays in construction projects and their causes across the globe with emphasis on the significance research studies conducted in selected countries. The project is therefore, based on a literature review investigating the major delays in construction projects in selected construction industry globally. The project could assist impending construction practitioners that may want to enter into the construction market anywhere in the world and upcoming researchers who may want to further explore construction-related projects delay to get an improved fundamental understanding of the major project delays encountered in the construction industry.

Meor Ibrahim et.al., (2015) suggested that, the building sector's biggest worry is still construction defects. Depending on the features, device types, and resources used, various built facilities produce different types of defects and require different standards and types of quality. As a result, this research was conducted to examine the defects that occur in construction projects and to establish methods for reducing defects in construction project. The questionnaire survey that were given to the contractors were used to perform the analyses. Finally, based on the research findings, a conceptual framework is proposed. This research will help Malaysian contractors become more informed of how to handle and mitigate defect jobs.

Deepanjali Patil et.al., (2015) suggested that, using the six-sigma on construction activity of internal finishing the defects can be found out by the DMAIC method and calculated it by DPMO and gives their suggestions to improve and control the defects occurring in the internal finishing work.

Sandeep Bodke et.al., (2017) suggested that, A variety of factors influence product quality, work time, expense, and material waste, among other items. The aim of the construction sector is to finish a project within a given time period, at a cost that is within the necessary standards and specifications, with minimal waste and efficient resource usage. The analysis of Six Sigma in building construction using the Six Sigma theory is defined in this study. Use Six Sigma's DMAIC approach, which helps to define the consistency of existing systems by evaluating defects and suggesting improvements in DFSS for ongoing project.

Sukumar. S et.al., (2017) explained that, an analysis of introducing Lean Six Sigma in the building industry with the Six Sigma DMAIC approach to enhance the entire project development. The stakeholders' data is obtained, and the information is analysed using SPSS software. The study's projected outcomes are a drop in flaws and a reduction in waste through the introduction of Lean principles in the building sector.

Ar. Priya Swami et.al., (2020) discussed that, implementation of Six Sigma methodology in construction industry for quality process improvement, in a residential complex. And so finding the defects in a plastering work using the six-sigma methodology called DMAIC method.

Kapre Varad. B et.al., (2020) suggested that, Six-sigma is a quality-improvement method that is used in a number of industries. It is now being used in the building industry as well. It is new to the construction industry, and it assists in the identification and correction of defects and problems that arise in the field. In this study suggests that, quality analysis and quality control in building construction using six-sigma approach can be analysed in the residential building construction. They based their investigation on the concreting process by cube checking and measuring its intensity with Minitab software, and they also found defects in the plastering process by making a checklist. The six-sigma method, by the way, can be used to analyse and monitor efficiency.

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III. CONCLUSION

According to this previous studies, the cost and time was affected mainly by the construction defects. This can affects also the customer satisfaction and quality of the project. From the literature review, analysed that there were need some more improvements to mitigate such defects from the preliminary stage of the work. The main intension of this review paper is studying the main reason for the construction defects and reducing them by the six sigma approach. Six sigma technique is used as one of the quality improvement method in manufacturing and production sector. Recent years it is also used in construction sector too to reducing the defects and sequencing the process of the work in the beginning stag. This review paper explores that better idea for implementing six sigma technique in building construction to mitigate the construction problems as well. And also trying to improving the quality of the projects.

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