

Review on Techniques in Cost Optimization of Construction Project

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Abstract- *The most crucial elements to take into account when planning any metro project are time and cost. The goal of a project is to complete it on schedule, on budget, and with other project goals met. Project managers must constantly monitor progress, evaluate plans, and take corrective action as needed. It is a challenging work that they must complete in practise. Optimisation is a methodical approach taken to increase profit margins and achieve the best outcomes possible under the conditions. Exists a To finish the project on time, systematic planning, programming, and good management are required. Various tools and strategies for optimisation are available. If the methods utilised are not to increase efficiency, optimising performance of the many approaches used at one stage of metro may not be advantageous. We have researched a number of variables that affect project costs in this methodology. For cost optimisation, we have once again explored a variety of methods and materials. There is also discussion about the need for optimisation.*

Keywords- time, cost, optimization.

I. INTRODUCTION

India is a developing country, and construction projects and industries play an important role in the country's economy. Time and money are two of the most important considerations in metro, and they are utilised to plan a project. The importance of time and cost optimisation in construction projects has grown as a result. To complete the planning process, it is important to estimate the cost and time of each activity, through which the overall duration and total cost of the project are calculated. Optimisation is a deliberate effort to increase profit margins and achieve the best results under given conditions or circumstances. Developing innovative technologies and procedures to boost productivity is one strategy to reduce metro costs. Cost-cutting procedures are used to manage project costs so that the contractor does not incur losses while carrying out various project operations.

1.1 Need of Optimization

"Cost optimisation can be defined as achieving a real and permanent reduction in the unit cost of services provided while maintaining their suitability for the intended use." Despite the availability of many optimisation techniques and project management tools, many construction projects fail to meet their cost and time objectives. Optimising the performance of the various approaches utilised at one stage of the construction process may not be advantageous if the methods used do not increase efficiency. As a result, it is necessary to follow and implement the techniques at each stage of the construction process based on the information given. The methodology and materials utilised in metro are also critical to the effective completion of a project.

The optimization of time and cost is necessary as it could minimize both the time and total cost of project. This optimization in time and cost helps to achieve the greatest benefit.

II. LITERATURE REVIEW

Shanmugapriya S., Dr. Subramanian K. (October 2013) [1] Overruns in both time and cost have been a serious issue in many Indian metro projects. The purpose of this research is to investigate the key elements that cause time and cost overruns in Indian metro projects. The survey results revealed that contract modification, material market rate, and high level of quality requirement are the major causes of time overruns, and change in material specification, high transportation cost, and escalation of materials price are the major causes of cost overruns.

Salunkhe. A, Patil R (January 2014) [2] Construction delays are one of the most common issues in the construction business, and they have a negative impact on project success in terms of time, cost, and quality. The time and cost for project completion are typically relevant to the employer and contractor. The writers discuss the many types of construction delays that cause project time and cost overruns. It also discusses the external and internal elements that influence the construction process, as well as the consequences of delays in large construction projects.

T.Subramani , P S Sruthi, M.Kavitha (June. 2014) [3] The primary goals of this article are to identify and analyse the reasons of metro cost overruns. The survey results revealed inadequate contract management, sluggish decision making, poor schedule management, and an increase in material/machine pricing. The key causes of cost overrun are poor design/delay in supplying design, rework due to incorrect work, a long interval between design and time of bidding/tendering, and incorrect estimation/estimation process.

Memon A.H, Rahman I.A, MohdRazaki Abdullah3, Ade Asmi Abdu Azis, (December 2010) [4] One of the most crucial success criteria for a project is its cost. The authors are concentrating on identifying major factors influencing construction costs in MARA big projects. According to the study author, the most severe factors that affect project cost are contractors' poor site management and supervision, cash flow and financial difficulties, shortage of site workers, insufficient contractor experience, and incorrect planning and scheduling by contractors. While changes in project scope and frequent design revisions have the least impact on construction costs.

BenviolentChigara,TirivaviMoyo,FungaiMudzengere re (2013) [5] They conducted study on the cost management tactics used by contractors on construction projects. Also investigated the contractor's responsibility for project cost management. They conducted surveys and interviews in Zimbabwe to obtain data. According to the findings of the study, contractors' efforts to manage project costs by focusing on project resource management. In Zimbabwe, as in other developing nations, the cost management process is still dominated by prematurely created automated technologies or traditional paper-based techniques of tracking project cost information. The author provides basic information on project cost management solutions.

Barbole A.N., Yuvraj D. Nalwade, Santosh D. Parakh(June. 2013) [6] The survival today for any company is how to manage its service Cost, quality, and performance. Now a days the customers are continuously demanding high quality and better performance of services and at the same time they want the prices to fall. For this author focus on impact of cost control and cost reduction techniques in present scenario. An objective of this paper is to understand the basic concept of Cost, Cost Control, and Cost Reduction and to study various Tool and Techniques available for Cost Control and Cost Reduction. The Cost Control and Cost Reduction techniques used in manufacturing sector like Value Engineering, Quality Control, and Budgetary Control are

specified by the author also cost, cost reduction, cost control etc. Various terms are specified by the author.

C.I. Anyanwu (December 2013) [7] The author discusses numerous cost aspects such as budgeting, cost monitoring, and control methods. He discusses cost control and cost control parameters in material, labour, and equipment, among other things. According to the author, a budget is the translation of an organisational strategy into actual shape through resource allocation in the form of cash. He discusses the numerous tools used by management and cost supervisors for project planning, control, and monitoring, such as the Gantt chart, network analysis, CPM, and PERT. The author's primary goal is to research manufacturing philosophy and inputs that contribute to analysing and sustaining construction costs in order to avoid project abandonment due to cost overruns.

AkintolaOmigbodun (June 2001) [8] According to the author, "engineering is the conceptualization, design, construction, and administration of projects and products regardless of field or application, the engineer solves problems with imagination, creativity, and synthesis of various sources of knowledge." The four strategies presented to acquire the best answer for any engineering design are design for production and assembly, concurrent engineering, complete quality management, and value engineering. A comparison of different optimal design methodologies is made with value engineering. Cost reduction in metro construction is examined with examples from West Africa and the Middle East.

Georgekutty C.K, Dr. George Mathew (August - 2012) [9]The author concluded from the study that by applying value engineering to metro projects, the management team achieves a solution that emphasises the functions of the project, allowing the team to make a final decision and resulting in a cost effective design for the project. Value engineering is effective because its techniques allow for the discussion of design challenges related to the latter group of factors as well as design.

J Zhou, Ped Love, X Wang, Kl TeoAnd Z (Irani 2013) [10] New technology innovation in the construction field is not being incorporated in project implementation. As a result, the construction industry's expansion is moderate. The fundamental issue is that construction will not be completed within the planned cost and time frame, resulting in project failure. In construction, material has a dominant role. The whole project cost would be decreased if the material was carefully regulated. To accomplish this goal, the author created a study approach to control material procurement and carrying costs. The methodology used has been validated by a

computer programme and is determined to be correct and beneficial for project analysis and control.

Khyomesh V. Patel, Prof. Chetna M. Vyas(May 2011) [11] The primary goal of this research is to optimise construction schedule. This author used a variety of methodologies, including the Mathematical Method, the Heuristic Method, and the Metaheuristic Method. According to the author, the methods and algorithms used to optimise construction schedule are efficient and effective.

Hisham Said, Khaled El-Rayes, (June 2011) [12] According to the author, material management is more important for managing productivity and cost efficiency. The primary goals of material management include purchasing, storing, and inventory control, as well as quality assurance. Material management is required to attain these goals. The author conducted a survey in Ahmadabad to assess material management. They discover that materials and equipment account for 70% of total cost. As a result, material management is critical for improving product and cost efficiency. Proper tracking and controlling are also necessary; bad management may result in project delays.

Andrew N Baldwin, Simon A Austin, Chi-Sun Poon, Li-Yin Shen, Irene Wong (June 2007) [13] The authors proposed a new model of construction logistics planning to enable the optimisation and integration of crucial material procurement and material storage choices on the construction site. To test the capacity of the CLP model, one case was examined. The investigation revealed that the criticality of metro operations using the material, site space available, material procurement, and site layout constraints all influence material purchase decisions.

P. Tiwari, K. Parikh, J. Parikh (September 1999) [14] the design of high rise metro I different from the different of residential and other forms of metros because of the repetition of the construction and time for the completion of each floor. The main objective of the authors is to develop the model or tools and techniques for analyzing the information for the high rise metro. Also, to investigate the difference in the various models for the private residential metros. Authors discuss about the optimization techniques such as design structural matrix. From study author conclude that there is need to develop the new tools and techniques which can help to designer to analyze the information and to make the improvement in the design management which helps for optimization.

Kale R, Gore G. N, Salunke J. P, (January 2014) [15] The authors addressed the theoretical foundations of the hope

model. Create a novel model of multi-criteria optimisation for metros. Also suggested is the development of a multi-criteria optimisation model to handle the problem of road, bridge, and tunnel construction.

C. Sarma, HoiyatAdeli (1998) [16] the The primary goal of this article is to optimise the cost of the bridge, including the material. According to the authors, the optimisation is done for different grades of steel and concrete. They used the direct design method to analyse the construction. They used Nonlinear Programming Problem (NLPP) with SUMT (Sequential Unconstrained Minimization Technique) as their methodology. The authors discovered a considerable savings in cost overrun.

Gopal M. Naik , M. Kumar (September 2013) [17] The goal of this study is to reduce the cost of concrete structures such as beams, slabs, columns, bridges, water tanks, frame structures, tensile members, folding plates, shear walls, and pipelines. It is explained how to use Reliability Theory to optimise costs. The authors concluded from the study that there is a need to conduct research on cost optimisation of realistic three-dimensional structures, particularly for big structures with a large number of members, where optimisation can result in significant savings.

Shrivastava R, Singh S. ,Dubey C. G. (2012) [18] The major goal of the paper is to boost productivity and forecast the costs incurred by resources so that the total cost of the project can be lowered. Artificial Neural Networks have proved themselves as practical, multifunctional, robust computational techniques with solid theoretic foundation and a high potential for effectiveness in any subject, particularly metro. According to the survey results, the Neural Networks technique lowered the total project cost by 3.91% and shortened the project length by roughly 5%.

Seyed Ali MousaviDehmourdi (2014) [19] The most crucial things to consider in any metro project are time and money. In the early 1990s, ant colony optimisation was introduced as a unique technique for solving hard combinational optimisation problems. On the basis of that, the author created a new multi-colony ant algorithm for optimising three objectives: time-cost quality-quantity. The model is also applied to a time - cost trade off dilemma with two objectives. The results that are being produced in comparison to the present approaches. According to the authors, the model is capable of balancing crucial aspects of construction projects.

Daisy X.M. Zheng, S. Thomas Ng , Mohan M. Kumaraswamy (September 2002) [20] The purpose of this article is to apply engineering economics principles, basic

economic ideas, finance, and quantitative methodologies to the modelling and analysis of civil engineering projects. A practical application of linear programming in a real-world project problem with two objectives: optimisation of equipment carrying expenses and identifying the optimum method for minimising equipment functioning costs. A structured linear programming methodology is primarily used to optimise equipment transportation costs. Applications of this approach aid in assessing the need for replacement and maintenance analysis are based on an econometric approach to practical situations, and the results reveal that optimisation with sophisticated approaches aids in project cost minimization.

S. Thomas Ng And Yanshuai Zhang (September 2008) [21] Completing a construction project in the shortest amount of time and at the lowest possible cost is a significant factor that usually necessitates the hiring of additional labour and equipment or the use of alternative metro techniques, both of which add extra cost liabilities to the contractor. Several analytical models for time-cost optimisation have been developed. Genetic Algorithms (GA) could be used to determine the fitness of solutions based on the objective function and its restrictions. The goal of this paper is to evaluate the analytical power of the GA with other TCO approaches provided. The results show that the GA approaches can produce the best possible outcome for metro. When the project is huge and/or complex, time-cost optimisation is more helpful.

Daisy X.M. Zheng, S. Thomas Ng, Mohan M. Kumaraswamy (2002) [22] The primary goal of this article is to optimise project construction time and cost. They used the Ant Colony Method of optimisation for this. The main focus is on optimising time, cost, and quality. They compared it to the other optimisation approaches. The ant colony method is a technique for multi-objective optimisation.

Daisy X.M. Zheng, S. Thomas Ng, Mohan M. Kumaraswamy (2002) [22] They used a Genetic Algorithm to optimise the project for many objectives. According to the author, a genetic algorithm can optimise time, cost, and quality. GA approaches could also produce the best results for metro time cost optimisation.

A.S. Ali, S.N. Kamaruzzaman (2010) [23] According to the author, the four most significant characteristics for construction management are scope, cost, time, and quality. The author's primary goal is to identify the problem or parameters that lead to the cost overrun. They carried out a quaternary survey on active projects to accomplish this. The method employed for data analysis is quantitative, i.e.

descriptive statistics and ranking analysis. According to the findings of the inquiry, the elements that lead to cost overruns include erroneous or inadequate assessment of the initial cost, and the component that does not effect is design error. To control the construction cost, the author suggests proper costing and financing.

Ming Li ,GuangdongWurobust, (2014) [24] The goal of this research is to optimise a time-cost tradeoff problem. A time-cost tradeoff optimisation model is built using a multi-objective robust optimisation method. The results show that by modifying the time and cost robust coefficients, the robust Pareto sets for time-cost tradeoff can be created based on various acceptable risk levels, from which the decision maker can select the preferred construction alternative.

Pathak.U.J, Chavan.C.S, Rathode.L.V, Nachare.V.L, Suryawanshi.A.B, (Apr 2014) [25] Low-cost housing technologies seek to reduce construction costs by employing alternatives to traditional methods and input. The authors compared the cost efficacy of low-cost housing technologies to standard construction methods. Two case studies in India discovered that employing low cost housing technologies instead of standard construction methods for walling and roofing can save between 22 and 26% of the construction cost, including material and labour costs.

Tam W. Y, (2011) [26] It is vital to implement cost-effective, innovative, and environmentally friendly housing technologies for the construction of houses and metros in order to allow ordinary people to build dwellings at a reasonable cost. The author's methodology compares construction costs for standard and low-cost housing technologies. Which case studies in India are being used in the investigation? During cost reduction, construction methods, structure strength and durability, stability, and safety of various elements are compared. The study discovered that employing low-cost housing technologies can save between 26.11% and 22.68% of construction costs when compared to standard construction methods. This demonstrates that the sector can save money by employing low-cost housing technology.

NilanjanSengupta (January 2008) [27] According to the author, cost-effective construction methods are useful and advantageous in terms of both cost and environment. The author discusses various effective technologies in India, as well as their features and benefits. In India, the following technologies are used:

1) Rat trap bond wall: this bond saves money and material while increasing strength.

- 2) Brick arch: it is included in the construction. It is advantageous in terms of looks.
- 3) Filler slab: the slab structure of this slab is also explained. It is advantageous in terms of economy, appearance, strength, material utilisation and reduction, less weight, and material savings.
- 4) Compressed earth block: This is advantageous since it absorbs less water after rains.

According to the study's author, if we pay attention to phrases like sanitization of people, manpower development, material devolvement, and technical advice, then cost efficient techniques will be widely adopted in the context of sustainable development and environmental protection.

R. Taur, V. Devi (Oct 2009) [28]The primary goal of this study is to highlight the many aspects of prefabricated metro methodology for low-income homes. Authors discuss several prefabrication techniques and their benefits and importance.

The most significant components of a structure are the foundation, walls, doors and windows, floors and roofs, which can be analysed individually based on the demands. There is a need to improve metro pace and reduce construction costs. The authors' suggested metro systems include prefabricated roofing components such as precast RC boards, structural block walls, precast hollow concrete panels, precast concrete/Ferro cement panels, and mortar less block walls.

III. CONCLUSION

In this work, we reviewed various optimisation approaches. It is critical to reduce metro costs and time at each stage. It is necessary to meet current requirements while also completing the project within the expected time, cost, and available resources. The main aspect influencing project cost is project and material delay. Several methods for analysing time-cost problems have been devised and implemented, however they can only optimise one parameter. Various low-cost materials are also proposed to reduce project costs while retaining project quality and robustness. For optimisation, numerous mathematical methods and software-based models were investigated.

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