

REVIEW PAPER ON QUANTITATIVE APPROACH FOR IDENTIFICATION OF PROJECT SCHEDULING CONSTRAINTS IN CONSTRUCTION PROJECTMiss. Puja A. Raut*¹Asst. Prof. Gayatri A. Bahire ²

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ABSTRACT

Project planning and project performance are regarded as two complementary and inseparable issues in project management project planning and scheduling is significant in order to control the projects performance. Nevertheless, some restriction in implementing project scheduling had been reported, which include difficulty in preparing schedules and hurdles by personnel and authorities as well as high cost in preparation, lack of knowledge due to incomplete project plans, also affecting the project performance. Insufficient planning and scheduling due to poor communication between personnel will also give negative effect to the project performance. In a highly competitive environment, it is crucial for the construction industry (CI) to have a proper planning and scheduling strategy in order to improve their performance. Previous studies were only focusing on problems faced during planning and scheduling without giving much attention on how to overcome the problem. Thus, this research, study will be conducted on identifying the project planning and scheduling constraints that focus on the time and resource-driven and various factors affecting construction project scheduling

Keywords:

Construction Industry, Planning, Scheduling, Constraints, time and resource-driven

1. INTRODUCTION

India is the developing country and the construction project plays a major role in Indian Economy. The construction industry is leading as the topmost contributor to India's GDP (Gross Domestic Product). The construction industry is related to risks, just as any other global industry. Due to the complex nature and the participation of different parties in construction, an extra risk is added to construction projects. In the last few decades, construction projects have become more challenging to the contractors and clients due to tough budget and scheduling requirements. Project schedule is one of the primary components in the classic project management triple constraint of time, cost and scope. Once the elements in the work breakdown structure (WBS) are defined, creating the schedule and assigning resources to the project brings the end goal further to fruition and to reality. However, in modern business, there are many challenges and threats to the project schedule, including resource constraints, multiple projects and imperative business needs. Addressing project constraints and managing project schedules is thus a complex, multifaceted duty for the project manager.

1.1 Need of Identifying Constraints

Constraints in project management are the limits that you must work within. For project manager, being aware of what limitations and barriers they face is essential for navigating an effective project path and ultimately reaching

success. Successful scheduling is a necessity to deliver the project without any delays this causes many benefits to all participants

1.2 Project Planning and Scheduling

Project planning is defined as a process that is more than an assistance that is crucial in order to complete a project successfully. Project planning is fundamental and involve various related functions such scheduling, control of project and cost estimation. Ideally, project planning is meant to achieve several common factors, which include project resources, criteria of design, health and safety as well as to satisfy stakeholders' expectations. Scheduling in construction management means to identify the milestones, activities, and deliverables of a certain project along with the timing and dependency relationships between the different activities. So successful scheduling is a necessity to deliver the project without any delays this causes many benefits to all participants. Planning and scheduling tasks cannot be carried out simultaneously. Scheduling process can only be done after planning and it is usually were handled by different people. Project planning answers the questions of what should be done, How, Whom, When should we do it, Where to do it, While project scheduling only focuses on 'when.

2. LITERATURE REVIEW

Vishal, M. Kranti Kumar (January 2021) Most critical causes of delay are identified for three major construction project stages those are, before-construction, construction and after-construction. After that average of relative importance index (RII) value of these three constructions is taken for overall construction. The comparison of ranks of causes of delay obtaining from their RII values among before-construction stage, construction stage, after-construction stage and overall construction is performed, with the help of Spearman's rank correlation coefficient method, and as a result overall construction is highly related to other construction stages in Indian construction industry. So, the top ten most cardinal causes of delay identify in overall construction of project according to their rank obtained after analysing RII value sequentially ranked as (1) "Huge size and cost of the project", (2) "The uniqueness of the project activities requiring high technical knowledge", (3) "The reluctance in a timely decision by management", (4) "Hostile political & economic environment", (5) "Labour strikes & poor human resource management", (6) "P.M. is lacking in crisis management skills", (7)"Incomplete project planning in the beginning", (8)"Selection of less effective planning tools and techniques by P.M, (9)"The negative attitude of project key personals" (10) "Lack of timely decision by P.M"

Engr Sameer Ahmed, Dr. Sayed Fayaz Ahmed (December 2020): All projects run under three constraints: time, cost, and scope. Constraints are called triple constraints. Challenges faced by Triple Constraints are major reason for the lag in the Construction Projects. This research study aims at exploring reasons for the challenges Triple Constraints are facing in the construction Industry. Construction (Building) projects at Karachi, Pakistan were initiated by the Government in 2016 and still they are facing problems to complete the Projects according to the Actual Project Duration and the Originally Estimated Cost for the Projects. The data was collected of two types; Primary data and Secondary data, Primary data from the Ongoing Construction Projects in Karachi and Secondary data is collected from the Research papers. Study of research papers highlighted reasons for the Triple Constraint delays/overruns. These reasons were input into NVivo software to determine the frequency of each cause. The reasons were ranked on the basis of Relative Frequency Index (RFI), Relative Severity Index (RSI) and Independent Relative Importance Index (IRII) through research papers. Some of the causes which were identified were —Underestimating effects of Inflation and Escalation, Poor Planning and Scheduling, Clients-Slow

decisions, Design changes, Poor Financial Management and etc. are the top reasons behind delays and project failure of Construction projects.

Anjay Kumar Mishra 1, Kailash Kumar Muktan (February 2019): Theory of Constraints (TOC) is new concept of project management. Every project has some constraints. This study explores the constraints to improve the project performance dealing with time constraint with a case of Sankosh-Tipling Road project and Bhimdhunga-Lamidanda Road Project of Dhading District. The overall objective of this study is to identify the constraints in the specified road construction project working environment and review the possibility of Critical Chain Project Management (CCPM) approach for effective scheduling. TOC has been applied to project management in order to address the typical issues experienced by project managers that led to project delays and failures. The resulting approach, described by (Goldratt, 1997) as the 'Critical Chain' method for the project management, challenges the flawed assumption that the only way to achieve better performance is through good local performance throughout the system. Thus, he proposed CCPM as a systematic approach which advocated focusing on the longest chain activities.

Nur Mardhiyah Aziz, Faizul Azli Mohd-Rahim, Loo Siaw Chuing, Ee Wen Le (May 2019): To deal with the issue of planning and scheduling, this study aims to identify the constraints of project planning and scheduling in Malaysian construction projects. An initial list of 43 constraints is identified from the literature review. This is followed by a main study comprising a questionnaire survey of 205 construction industry practitioners including a diverse range of construction consultancy practice that include Project Managers, Architects, Civil Engineers, Quantity Surveyors as well as contractors. Data obtained were analysed using Relative Important Index (RII) and the Spearman Correlation Coefficient. Findings from this study shows the most important human factors are perceived to be motivation, training/skills, top management support, willingness to process change, IT staff roles and responsibilities, user involvement and management style. The findings can also serve as a guideline for the organizations and form the basis for their future planning. Furthermore, human factors framework or model can be developed which can be used by specific system such as for Enterprise Resource Planning (ERP), Database Management System (DBMS), Building Information Modelling (BIM) and others.

Md Bytullah Emon(2018): This author has identified the main factor working behind the construction delay of Khulna city. After reviewing different study on this subject 42 factors are selected for this study. The factors are examined by the most experienced people on this subject of Khulna city. Depending on their judgment the rank on the factor has been sorted on the basis of their impact level on construction delay. According to the investigations and analysis of survey data the top five reasons are: (1) Number of construction training centre is very little; (2) Lack of skilled labourer; (3) If the budget crossed; (4) Lack of planning; (5) Not practicing the construction law.

R.Vidhyasri, R.Sivagamasundari (2018): Factors are identified by consultations with experts and practicing engineers apart from reviewing literatures and carrying out a pilot study. Questionnaire is designed for the experiment and administered on selected construction professionals of varying capacities. The obtained responses are factored. Using the data, statistical model has been constructed. The model is analysed using SPSS and the outcome such as frequency, mean variations and deviations and other statistical parameters are obtained. The variations mean and deviations are considered and represented in the bar chart and pie charts for the possible interpretation of the results quantitatively. A questionnaire survey comprising 53 identified critical factors is conducted with field experts. 210 responses were collected from professionals employed at various projects. The most important factor is lack of Inspection of major activities at the time of execution with highest mean value of 3.80.

Marimuthu Kannimuthu, Palaneeswaran Ekambaram, Benny Raphael, and Ananthanarayanan Kuppaswamy(2018): The Author identified top challenging issues are (a) real-time monitoring and proactive

decision making, (b) division and assignment of resources/resource allocation, (c) project management processes (information sharing), (d) coordination, (e) communication, and (f) competencies of project manager. Factor analysis identifies the following factors to improve the Multiproject environment capabilities (a) decision-related, (b) project environment-related, (c) project management-related, and (d) organization-related. for resources unconstrained situation The findings suggest that the following should be considered in resource management: identifying the work front, adopting pull planning approach, creating a common resource pool with resources allotted on a rental basis, a training programme to the staff, and finally migrating the mind-set to the resource-constrained environment .for resources constrained situation. The findings suggested top-up via subcontracting, proactive pull planning, introducing buffers (critical chain), proper training, working overtime, training the culture of the organization towards better communication, coordination, and collaboration and automating repetitive activities to improve the reliability of achieving baseline project performances.

Ashwini Arun Salunkhe (January 2018): The main objective of this paper is to statistically explore the severity of critical construction delay factors. Subsequently, a questionnaire survey is performed with experts from field in government as well as private sector, assessing the rank of delay factor so that importance index and score of delay factors can be scrutinized. One hundred and sixteen delay factors were identified during the research. SPSS®, VERSION 16 was used to evaluate statistical parameters for large database within short period. Non parametric test is conducted for the evaluation of relationship between the participants on their agreement about critical construction delay factors. Author identified main critical delay factors and ten most important factors were: (1) Late revising & approving relevant documents by owner; (2) delays in payments by owner; (3) Conflicts of consultant with design engineer; (4) Rework in construction faced by contractor; (5) Problems in financing project progress by contractor; (6) Is contractor compatible with new technology; (7) Poor Material management; (8) unavailability of skilled labours; (9) Unavailability of equipment; (10) Disputes in soil investigation.

Fatemeh Nouban, Nivin Ghaboun (December 2017): Author discusses about various literature review about factors affecting the methods of construction project scheduling also new development in scheduling techniques. It is very clear from the documents available in the literature that the most important factors affecting scheduling process for any project are the financial situation of the owners and contractors, resources availability, weather conditions, change orders, clear understanding of the project scope, communication between involved parties, prices escalation, and the delays in contractors' payment as well as the managers, and engineer's experience. Other factors such as government regulations, bureaucracy, and lack of experience of the owners depend on the political and economic situation of the country during the last years, many models were developed to improve the scheduling of vertical and horizontal projects by considering many constraints. These models include the artificial neural networks (ANN), linear programming and fuzzy linear programming, location-based management system (LBMS) and support vector machines (SVM).

Ashish Chandu Pawar, Prof. S. V. Wagh, Asst. Prof. Nikhil V. Bhalerao (August 2016): The objective of this study is to identify the major causes of delays, the effects of delays, finding importance of each delay factors by Relative Importance and Importance Index method and methods /recommendations of minimizing delays in Residential Construction project. This study is carried out based on literature review and a questionnaire survey. A total of seventy delay factors with nine major groups are identified. The Importance to each seventy factors and nine major groups are found. The major causes which affected the overall residential projects are: External Factors, Contractor Factors, Material Factors, Owner Factors, Design Factors, Equipment Factors, Consultant Factors, Labour Factors and Project Related Delay Factors. The result by these two methods gives percentage wise distribution to each major delay factors. The result of these delay factors effected by percentage wise distribution by Importance Index Method is given as; External Factors 46.49%, Contractor Factors 44.85%, Material Factors 43.72%, Owner Factors 43.69%, Design Factors 42.2%, Equipment Factors 40.77%, Consultant Factors 37.06%, Labour Factors 35.88% and Project Related Delay Factors 31.80% and the result by Relative Importance Method is given by; External Factors 0.464, Contractor Factors 0.449, Material Factors 0.444, Owner Factors 0.435, Design

Factors 0.421, Equipment Factors 0.408, Consultant Factors 0.369, Labour Factors 0.360 and Project Related Delay Factors 0.315. As the value of Relative Importance Index value ranges from 0 to 1 whereas Importance Index value ranges from 0 to 100 %.

Murat Gunduz, Ahmad Mohammed Ali Yahyab (May 2015): Study focused on Middle East region. In order to achieve this objective, 25 project success factors are identified by reviewing related literature. The factors are assessed for their impact and contribution to the actual performance of the project on three criteria: schedule, cost, and quality. Then a questionnaire is developed and sent to different experts in the construction industry. The collected data of 111 responses is then analysed statistically by using different tools such as: importance index, Spearman's rank correlation factor and T-test.

Ifeyinwa M.J. Orji1, Sun Wei(February 2013): This paper provides a high- level bibliography, structured overview and limited critique of nine project scheduling under resource constraints problems; resource-constrained project scheduling problem (RCPS), pre-emptive resource-constrained project scheduling problem (PRCPS), generalized resource-constrained project scheduling problem (GRCPSP) , resource-constrained project scheduling problem with generalized precedence relations (RCPS-GPR), Time/cost trade-off problems (TCTP) , Discrete time/resource trade-off problems (DTRP), Multi-mode resource-constrained project scheduling problems (MRCPS), Resource levelling problems (RLP) and Resource-constrained project scheduling with discounted cash flows (RCPSDC). The current developments, strengths, and weaknesses of the scheduling approaches to the stated problems are considered. This paper has summarized an extensive array of research on the various aspects of the project scheduling under resource constraints problems.

Desai Megha1, Dr. Bhatt Rajiv (March 2013): The Author conducted literature review through books, conference proceedings, internet and international project management journals. As the outcome of this phase, 59 causes of delays for residential construction projects were identified. These causes were categories in nine main groups as: Project related, Owner related, Contractor related, Consultant related, Design-related, Material related, Equipment related, Labour related and External factors depending on their nature and mode of occurrence. The second phase includes preparation of two type of questionnaire based on two different approach used for giving ranking to causes of delay of residential construction projects. These study suggests two different techniques for ranking of causes of delay. In first technique Relative Importance Index (RII) of each cause of delay can be calculated and in second technique Importance index is calculated as a function of frequency and severity indices.

Janusz Kulejewski (June 2011): This paper regards to the scheduling of a construction project under ill-defined constraints of time and resources for the execution of works. Fuzzy numbers are used for modelling the imprecision of constraints. Two methods of the measurement of fuzzy constraints satisfaction are presented. The first method uses the possibility measures based strictly on the assumptions of the fuzzy sets theory. The second method uses the measure based upon the concept of the α -cuts of a fuzzy number and the probability theory. The numerical examples are given for the comparison of both methods. The results confirm that the use of the probabilistic measure provides the neutralization of the assessment of the fuzzy constraints meeting and improves the construction schedule.

3. CONCLUSIONS

All the papers reviewed above are mainly focuses on to identify the different constraints for delays in construction projects. Identifying and removing constraints from bottleneck activities help to reduce uncertainties in construction processes and increases the transparency of project management. Construction projects are subject to numerous constraints of various types, including contractual due dates, resource limitations, and safety, financial, and managerial constraints. But the previous study has not covered the effectiveness for particular infra-structure construction project. And it is necessary to quantify the different constraints for delays in infrastructure construction project work and also for this, recommending corrective measures for the same.

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