Statistical Analysis of Delay Factors and Success Factors on Building Construction Projects

Kenjale P.A.[1], Prof Khatri A.P.[2]

[1]*M.E. Civil (construction and management) second year student , Department of Civil Engineering, TSSMs BhivarabaiSawant college Of Engineering &Research,Narhe, Pune*

[2]*Assistant Professor , Department of Civil Engineering,TSSMs BhivarabaiSawant college Of Engineering &Research,Narhe, Pune*

ABSTRACT

It has been observed that almost all project in construction industry delayed and over budget. Project schedule delays due to changes occur during construction, consequently impacting the project in its completion. Delay in construction projects is defined as late completion of project as compared to the planned schedule. Delays in construction projects are quite expensive; sometimes they may result in severe damages to involved parties. The time and cost for the performance of project are usually important to the employer and contractor. Project delays always contributed as expensive to all parties. The purpose of this research is to identify critical success and delay factors which can help project parties to reach their intended goals with greater. Totally Twenty-Eight delay factors & seven success factors were shortlisted to be made part of the questionnaire survey. According to the case study results, the most contributing factors and categories (those need attention) were discussed, some recommendation were made in order to minimize and control delays in construction projects. Also this project can serve as guide of all construction parties with effective management in construction projects to achieve a competitive level of quality and a time effective project. Statistical Prediction model for estimating actual project duration with delay was implemented on a real case study & tested the accuracy of prediction model.

Keywords*: Delay Factors, Success Factors, Construction Planning, Construction Costs, Project Management, Forecasting, Statistical Models*

1.INTRODUCTION

The problem of delay in the construction industry is a common phenomenon. Delays occur in most building construction projects, either simple or complex. In construction, delay can be understood as the extension of time in the completion of project, shortly delay is failure to complete project in targeted time & estimated cost as defined in contract. Construction delay and their claims are an integral part of construction. Construction delay is considered to be one of the recurring problems in the construction industry and it has an adverse effect on project success in terms of time, cost and quality. For the owner, delay is loss of income through lack of production capacity and rentable space or a dependence on present facilities. In some situations, for contractor, delay is higher overhead costs because of prolonged work period, higher costs of material through rise and due to labour cost increases.

Completing projects on time indicates of efficiency, though the construction process is subjected to many unpredictable factors, which result from many sources. Such sources include the resources availability, performance of parties, involvement of other parties, environmental conditions, , and contractual relations. However, it is rarely that a project is completed within the targeted time. The building Construction project is large and requires huge capital outlays. In typical manner, the work gives low rates of return in accordance with the amount of risk involved. Delays on construction projects are a worldwide problem. They are always accompanied by cost and time overruns. Project delays have harmful effect on parties in terms of a growth in relationships, trust, litigation, arbitration, cash-

flow difficulties, and a general feeling of confidence towards each other. Therefore, it is necessary to define the actual reasons of delay in order to reduce and avoid the delays in any construction project. The aim of this research is to know the critical success and delay factors which can help project parties to reach their targeted goals with greater efficiency and to study the different delay analysis techniques.

2. MATERIAL AND METHODS

The Delphi technique is a extensively used and approved method for collecting data from respondents within their area of expertise. The technique is set up as a group discussion process which aims to attain a convergence of opinion on a specific real-world issue. This process has been used in different areas of study such as program designing, needs evaluation, policy fixation, and resource utilization to develop a full range of alternatives, explore underlying assumptions, also correlate judgments on a subject spanning a wide range of disciplines.

The Delphi technique is best suited as a process for consensus-building by using a series of questionnaires delivered using multiple ideas to gather data from a panel of selected topics. Selection of subjects, time boundaries for taking and completing a study, the chances of less response rates, and feedback from the respondent group are fields which should be taken in account when designing and conducting a Delphi study.

Profession of respondents	No. of respondents
Contractors	11
Engineers	19
Total	30

Table 1: No. of respondents

Years of experience	No. of respondents
1 to 5 years	1
5 to 10 years	6
10 to 15 years	9
Above 15 years	14

Table 2: Respondents years of experience

A. Analysis

For the Analysis of questionnaire survey Relative Importance Index (RII) is used. In this method all the factors/questions from the questionnaire are ranked on the basis of their Importance.

$$RII = \sum W/(A*N)$$

W= Weighting given to each statement by respondent from 1 to 4

Ranking: Scale(1 to 4)
Not Important
Slight Important
Moderate Important
Important

A= Higher response (i.e 4 in this case)
N=Total no. of respondents
Sample Example of Inadequate Planning
RII= 106/4*30= 0.88

No.	Causes of delay	Rank
1	Inadequate planning	1
2	Labour productivity	2
3	Site management	3
4	Construction methods	4
5	Sub-contractor performance	5
6	Shortage of material	5
7	Labour supply	5
8	Preparation & approval of drawings	6
9	Mistakes and discrepancies in contract document	7
10	Inappropriate overall organizational structures	7
11	Lack of communication between the parties	7
12	Owner interference	8
13	Unrealistic contract duration and requirements imposed	8
14	Change orders	8
15	Mistakes and discrepancies in contract document	9
16	Inadequate Contractor Experience	9
17	Waiting time for approval of tests and inspection	10
18	Quality of material	10

Table 3: Most Important causes of delay as per ranking The above analysis shows the delay factors rated by the experts and their ranking. It can be seen that in above ranking Inadequate Planning has the highest RII and has been ranked first in the table. Similarly top ten ranking factors from above analysis can be considered as most important factors which should be mostly considered during the execution of work.

No	Success factors	Rank
1	Project manager's capabilities and experience	2
2	Use of control system	1
3	Project manager's goal commitment	3
4	Organizational planning	5
5	Clarity of project scope and work definition	4
6	Safety precautions and applied procedures	6
7	Project team's motivation and goal orientation	4

Table 4: Overall ranking of success factors

The above analysis shows that the success factors rated by the experts and their ranking. It can be seen that in above ranking "Project manager's capabilities and experience" has the highest RII and has been ranked first in the table and other factors also arranged as per their ranking in this table.

3.RESULT AND ANALYSIS:-

The data collection helps us to gather the information regarding current scenario, so that we can analyze the variables of our interest and reach to a conclusion and carry our research in the particular area. From previous analysis of collected data from construction projects field, the planner can predict approximately the construction actual time of any new construction project before construction using the following equation:

$$DC=1+\sum_{=4}^{=1}(dj \times ERIIj)/\sum_{=4}^{=1}(ERIIj)$$

$$PAD= DC \times PSD$$

Where DC is the project Delay Coefficient; ERIIj (%) is the Equivalent weighted average percentage of Relative Importance Index per category; dj is the percentage of each category impact ranged between (0.00–1.00), PAD is the total Predicted Actual Duration of the studied project; and PSD is the total Planned Scheduled Duration before constructing the studied project.

Where, $ERIIj\ (\%) = \sum_{=1}^{=}(Pn \times ORIIn)/\sum_{=1}^{=}(Pn)$

Where ERIIj (%) is the Equivalent weighted average percentage of Relative Importance Index per category; ORIIn (%) is the Overall weighted average percentage of Relative Importance Index per factor of specific category, which is calculated based upon total years of experiences of all respondents; n is the number represents the factor number in the related category (from first factor of category n = 1 to from last factor of category n = N); and Pn is the priority weight of the studied factor. It is clear that the results of studied factor.

No.	Category Items	ERII	Dj
1	contractor related causes	79.14	35
2	labor and equipment	79	35
3	Client related causes	68.125	40
4	Contract relationships related causes	67	37
5	Material related causes	66.67	43
6	Contract related causes	66.67	33
7	Engg/Consultant related causes	66.3	30
8	External Causes	52.2	66

Table 5: Equivalent average relative importance index of category & Percentage of each category impact Calculation of Delay coefficient

$DC= 1+\sum_{=4}^{=1}(dj \times ERIIj)/\sum_{=4}^{=1}(ERIIj) = 1+ 0.37 = 1.37$ In case study it was found that total planned project duration before start date was 445 working days, while total actual project duration after completion was 586 working days. While total actual project duration before constructing the studied project can be predicted from the following formulas

$$DC= 1.37$$

$$PAD= 1.37*445= 611 \text{ Days}$$

4.CONCLUSION:-

To improve control in building construction projects, the influence of the main factors affecting it must be identified and recognized. This research has identified and based on the quantified relative importance indices, determined the influence ranks of twenty eight factors causing delay in construction projects. The explored factors were classified under the following eight primary classifications:

1. Client related causes
2. Contractor related causes
3. Engineer/ consultant related causes
4. Material related causes
5. Labor and equipment related causes
6. Contract related causes
7. Contract relationships related causes
8. External causes.

Then quantified relative importance indices of delay factors and demonstrated the ranking of the factors according to their importance level of delay. Delphi method also used to rank the most needed critical success factors for building construction. These success factors can be used to avoid the delay factors. Prediction model for estimating actual project duration was implemented; a real case study tested the accuracy of prediction model. This statistical method could assist the decision makers in identifying factor causing delay and complete the project on planned schedule time

5.REFERENCES:-

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