

A Statistical Study on Critical Factors Influencing Time Overruns in Tamil Nadu Construction Projects

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Abstract— Time overruns are evidently frequent problems in the construction industries of many developed and developing countries. The purpose of this paper is to assess the factors leading to time overruns in construction projects of Tamil Nadu. Since there are additional special contributors to time overruns in the construction projects, the relative perceptions of Engineers working in the Government and Private Sectors have been studied, based on a listing of causal factors derived from previous studies together with other factors arising from special conditions of Tamil Nadu. It has been observed that a general agreement prevails between both sectors regarding causes of time overruns. The main five factors of time overruns considered in this paper are Consultant Related Factors, Contractor Related Factors, Labour Related Factors Material Related Factors Equipment Related Factors. Among the shortlisted forty sub factors, ten top rank factors have been selected for the reliability analysis and the preventive measures for the topmost factors have been suggested in this paper.

Index Terms— Construction industries, Factors, Tamil Nadu, Time Overruns.

I. INTRODUCTION

Construction industries are complex in nature which comprises of large number of groups such as contractors, clients, owners, Stakeholders and consultants. Despite this complexity, these industries play a major role in the development and achievement of society's satisfaction and goals. Project performance can be measured and evaluated using a large number of performance indicators that could related with time, cost and quality[1-22].

Most of the construction projects include the factors such as design error, inadequate scope, weather, project changes, and underestimating the time which are essentially needed to complete the project. Underestimating the construction time is detrimental because another important project may be delayed from going to bid until the current project is completed. Many public projects are extensions of a previous project, and inaccuracies in estimating project cost and construction time can result in improper sequencing of related projects or phasing within projects, thus construction time overruns much needed improvements. In recent years, there have been numerous studies on the identification of

influencing factors of project time overruns worldwide. Mansfield et al (1994) carried out a questionnaire survey amongst 50 contractor, consultant and client organizations in Nigeria and found out that the most important variables causing construction delays and cost overruns are poor contract management, financing and payment of completed works, changes in site conditions, shortage of materials, imported materials and plant items, design changes, subcontractors and nominated suppliers. While the top variables causing only cost overruns were revealed as price fluctuation, inaccurate estimates, delays, additional work. Kaming et al (1997) identified factors influencing construction time and cost overruns on high-rise building projects in Indonesia through a questionnaire survey administered on 31 project managers. A total of 11 variables (design changes, poor labour productivity, inadequate planning, material shortages, inaccuracy of material estimate, skilled labour shortage etc) were identified for time overrun and seven (materials cost increased by inflation, inaccurate quantity take-off, lack of experience of project location, lack of experience of project type etc) for cost overrun.

Al-Momani (2000) examined 130 public projects in Jordan and concluded that the main causes of delays include changes initiated by designers, client requirement, weather, site conditions, late deliveries, economic conditions, etc. Rwelamila and Hall found that the timely completion of a project was frequently seen as a major criterion of project success. In Australia, Bromilow found that only one-eight if building contracts were completed within the scheduled completion dates and the average time overrun exceeded 40%. Wilson examined the role of the owner and architect/engineer's roles in the prevention delay and resolution of construction claims. Wilson also summarized the causes of construction claims which include change orders, adverse weather and unclear contract agreement.

The successful execution of construction projects and keeping them within estimated time and prescribed schedules depend on a methodology that requires best engineering judgments. Many projects experience extensive delays, exceed initial time schedule and cost estimate which are unfavoured for clients, contractors and consultants. The outcome of this paper will assist owners, contractors, and consultants in understanding the reasons for time overruns, thus eliminating or minimizing these causes. This could be achieved by better management of the projects and by finding new methods for storing the critical materials from the beginning of the project. Furthermore, some remedial measures are also suggested for few factors which are considered as the topmost factors influencing time overruns in the construction projects.

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II. RESEARCH METHODOLOGY

This research methodology has been carried out with a combination of quantitative and qualitative methods. It was conducted in two stages. The first stage was conducted using a quantitative method through a questionnaire survey in a bid to generate information from a large sample population.

The second stage of the study was conducted using the qualitative method using semi-structured interviews. The reasons for using the interview in addition to the questionnaire survey were: to triangulate data obtained from the questionnaire survey; to enhance, intensively the depth of the questionnaire survey results through investigation on some of the factors highlighted.

To carry out the quantitative method, a total number of 100 questionnaires were distributed (50-Government engineers and 50-Private Engineers). Data were collected and analyzed using SPSS (Statistical Package of Social Sciences).

III. DATA COLLECTION

There are both direct and indirect relationship between causes and effects of delays in large construction projects. Based on table 2, a structured questionnaire survey was conducted to identify the significant factors affecting construction cost. A five point likert-scale of 1 to 5 was adopted to assess the degree of agreement of each cause where 1 represented ‘strongly disagree’, 2 ‘disagree’, 3 ‘moderately agree’, 4 ‘agree’ and 5 ‘strongly agree’. A total of 100 questionnaire sets were distributed (50 to engineers working in the government sector and 50 to the engineers working in the private sector) were received which formed 100% of responses. Statistical Package for Social Sciences (SPSS) was used to analyze the data. Table 1 shows the delay factors considered in this analysis.

Table .I Delay Factors

S.No	Delay Factors
I Consultant Related Factors	
1	Lack of experience of consultant in construction projects
2	Conflicts between consultant and design engineer
3	Inaccurate site investigation
4	Late in reviewing and approving design documents
5	Delay in approving major changes in the scope of work by consultant
6	Inadequate project management assistance
7	Late in reviewing and approving design documents
8	Poor communication and coordination with other parties
II Contractor Related Factors	
1	Frequent change of subcontractors
2	Inadequate contractor experience

3	Inappropriate construction methods
4	Incompetent project team
5	Poor site management and supervision
6	Rework due to errors
7	Unreliable subcontractors
8	Obsolete technology
9	Ineffective project planning and scheduling
10	Poor communication and coordination with other parties
III Labour Related Factors	
1	Low motivation and morale of labor
2	Personal conflicts among labor
3	Low productivity of labor
4	Works postponed due to Strike
5	Unqualified / inadequate experienced labor
6	Shortage of labor
7	Slow mobilization of labor
IV Material Related Factors	
1	Changes in material types and specifications during construction
2	Damage of sorted materials
3	Escalation of material prices
4	Poor quality of construction materials
5	Unreliable suppliers
6	Delay in manufacturing materials
7	Late delivery of materials
8	Poor procurement of construction materials
9	Shortage of construction materials
V Equipment Related Factors	
1	Frequent equipment breakdowns
2	Inadequate modern equipment
3	Low efficiency of equipment
4	Shortage of equipment
5	Slow mobilization of equipment
6	Improper equipment

The above considered delay factors were ranked using Relative importance factor and mean. Among the factors the top ten factors alone were listed out. Table 2 shows the top ten delay factors.

Table .J I Ranking of top ten Delay Factors

S. No	Factors Influencing Time Overruns	Government Engineers			Private Engineers		
		Mean	RII	Rank	Mean	RII	Rank
1	Poor communication and coordination with other parties	4.92	0.985	1	4.29	0.860	2
2	Poor site management and supervision	4.90	0.983	2	4.90	0.867	1
3	Late in reviewing and approving design documents	4.88	0.981	3	4.24	0.856	3
4	Conflicts between consultant and design engineer	4.85	0.969	4	4.18	0.844	4
5	Shortage of labours	4.45	0.950	5	3.90	0.825	7
6	Poor quality of construction materials	4.15	0.831	6	3.18	0.811	9
7	Shortage of construction materials	4.14	0.830	7	3.70	0.821	8
8	Incompetent project team	4.13	0.828	8	3.15	0.800	10
9	Rework due to errors	4.12	0.825	9	4.00	0.84	5
10	Equipment allocation problem	4.10	0.822	10	3.97	0.83	6

IV. DATA ANALYSIS

The reliability test depicts the consistency degree of the data collected. The Cronbach coefficient is a measure of the inner consistency. Reliability is in low level when Cronbach alpha is less than 0.3 and it cannot be accepted. Reliability is in high level when Cronbach alpha is more than 0.7 where it indicates inner consistency of indexes table is in high level and it can be highly acceptable. Nominally the value of alpha is desirable with the range higher than 0.5 to 0.6.

Table.III. Reliability statistics

S. No	Name of the respondents	No. of Factors	No. of Respondents	Cronbach's Alpha
1	Private Engineers	40	50	0.75
2	Government Engineers	40	50	0.71

In this study, the Cronbach alpha value is more than 0.7, this inner consistency between the engineers and factors involved in the study is in higher level and highly acceptable.

V. RESULTS AND DISCUSSIONS

Delays can be minimized only when their causes are identified. Knowing the cause of any particular delay in a construction project would help avoiding the same. This project was therefore, aimed at identifying the major causes of delays in construction projects in the Tamil Nadu Construction Industry through a survey, and quantifies the perceptions of different parties relating to causes, responsible party and types of delay.

Based on the analysis, the top ranked factors were selected and the suggestions to overcome these delay factors were listed as follows.

1. Poor communication and coordination with other parties, Late in reviewing and approving design documents and Conflicts between consultant and design engineer:

These factors are consultant related factor. The consultants play a very important role in design-Related delays because as

they are the in charge of the design process in conjunction with the owner of the project. Design related issues such as changes in drawings, incomplete and faulty specifications and change orders have a very damaging effect on project completion times and invariably lead to cost escalations as well. These are issues that can be controlled with proper design process management and timely decision making. Any changes in the scope of work should be carried out it should be done in the earlier stage that is almost in the beginning of work. The decisions made early in the life of a project have the most profound effect on delivering a safe, quality project within the time and budget allocated. If a good coordination is provided by the consultants with the engineers in the projects at proper time then the project can be completed within the stipulated time.

2. Poor site management and supervision, Rework due to errors and Incompetent project team:

These factors are contractor related factors. The contractor has the major responsibility for delays in Construction-Related Delays. Delays due to lack of inspections are the most common in this stage. Because of these types of lacking, the rework has to be carried out which in turn results in the cost escalation of the projects. To overcome all these problems, the contractor should have a eligibility and capability to control his project team. He should be experienced to guide the workers involved in this work in a proper way.

3. Shortage of labours

This factor is labour related factor. Continuous coordination and relationship between project participants are required throughout the project life cycle for solving problems and developing project performance. Owners are encouraged to facilitate payment to labours in order to overcome delay, disputes, and claims. To improve the efficiency of labours, proper training and continuous encouragement should be provided by the contractors.

4. Poor quality of construction materials and Shortage of construction materials

This factor is material related factor. Proper planning should be carried out in storage of the construction materials to avoid the shortage of the materials. Quality materials should be of a greater interest for contractors in order to improve cost, time, and quality performance. This can be done by applying quality training and meetings that are necessary for performing an improvement.

5. Equipment allocation problem

This factor is material related factor. To avoid the shortage of equipments, proper planning and management are essentially needed. If good site supervision has been conducted, these delays can be easily avoided. To allocate the equipments in the construction process properly to deliver the construction work effectively, a program chart can be prepared using construction softwares like primavera, MS project etc.

These are some of the issues that can be controlled with proper design process management and timely decision-making.

VI. CONCLUSION

This paper aimed to investigate the factors influencing time overruns in construction industries of Tamil Nadu. A questionnaire was developed to get the data about the causes and effects of delay. The collected data was analyzed with the help of SPSS. Among the delay factors considered in this paper, Poor communication and coordination with other parties leads all other factors and considered as the topmost factor. The most important other nine factors are Poor site management and supervision, Late in reviewing and approving design documents, Conflicts between consultant and design engineer, Shortage of labours, Poor quality of construction materials, Shortage of construction materials, Incompetent project team, Rework due to errors and Equipment allocation problem. **Cronbach's Alpha** is used to check whether there is a degree of agreement between the selected factors and the respondents. This is because all the respondents are involved in this work. These analyses can update participants' knowledge and can assist them to be more familiar with project management techniques and processes.

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REFERENCES

- [1] **Al-Moumani. H.A (2000)**, Construction delay: a quantitative analysis. *International Journal of Project Management* **18** pp. 51-59 .
- [2] **Ashwini Arun Salunkhe, and Rahul S. Patil (2014)**, Effect of Construction Delays on Project Time Overrun: Indian Scenario *International Journal of Research in Engineering and Technology* eISSN: 2319-1163.
- [3] **Amir Hossein Alavifar and Shadab Motamedi (2014)**, Identification, Evaluation and Classification of Time Delay Risks of Construction Project in Iran. *Proceedings of the International Conference on Industrial Engineering and Operations Management Bali, Indonesia, January 7 – 9, 2014.*
- [4] **Andi, A, Lalitan J.D, and Loanata V. R. (2010)**, Owner and Contractor Perceptions Toward Factors Causing Delays in Structural and Finishing Works *Civil Engineering Dimension*, Vol. 12, No. 1, 8-17 ISSN 1410-9530.
- [5] **Adnan Enshassi, Sherif Mohamed, and Saleh Abushaban` (2009)**, Factors Affecting The Performance Of Construction Projects In The Gaza Strip. *Journal Of Civil Engineering And Management* **15(3)**: 269–280.
- [6] **Bromilow. F. J.**, Measurement of scheduling of construction time and cost performance in the building industry, *The Chartered Builder*, 1974, p. 10.
- [7] **Enas Fathi Taher, R.K. Pandey (2013)**, Study of Delay in Project Planning and Design Stage of Civil Engineering Projects *International Journal of Engineering and Advanced Technology (IJEAT)* ISSN: 2249 – 8958, vol.2(3).
- [8] **Haseeb M et al. (2011)**, Problems Of Projects And Effects Of Delays In The Construction Industry Of Pakistan *Australian Journal of Business and Management Research* Vol.1 No.5 [41-50] | September.
- [9] **Haseeb M et al. (2011)**, Causes and Effects of Delays in Large Construction Projects of Pakistan *Kuwait Chapter of Arabian Journal of Business and Management Review* Vol. 1, No.4;

- [10] **Jyh-Bin Yang, and Chih-Kuei Kao (2009)**, Review of Delay Analysis Methods: A Process-Based Comparison *The Open Construction and Building Technology Journal*, 2009, 3, 81-89.
- [11] **Kaming, P.F, Olomolaiye, P.O, Holt, G. D, & Harris, F. C. (1997)**. Factors Influencing Construction Time and Cost Overruns on High-rise Projects in Indonesia. *Construction Management and Economics*, Vol.15, No.1, 83-94
- [12] **Koushki P. A, Al-rashid K and Kartam N (2005)**, Delays and cost increases in the construction of private residential projects in Kuwait. *Construction Management and Economic* (March 2005) **23**, 285–294
- [13] **Majid, M.Z.A. (1998)**, “Factors of non-excusable delays that influence contractor’s performance”, *Journal of Management in Engineering*, **14(3)**: 42–49.
- [14] **N.R. Mansfield, O.O. Ugwu and T. Doran, (1994)**, Causes of delay and cost overruns in Nigerian construction projects. *International Journal of Project Management* pp. 254–260.
- [15] **Pandey M.K., et al. (2012)**, Delay Computation Using Fuzzy Logic Approach *IJ. Intelligent Systems and Applications*, 2012, **11**, 84-90.
- [16] **Ramanathan.C et al. (2012)**, Construction delays causing risks on time and cost-A critical Review, *Australian Journal of Construction Economics and Building*, **12(1)**, 37-57
- [17] **Ravisankar K. L, Dr. AnandaKumar S M.E., Ph.D., and Krishnamoorthy V M.com., M.B.A., M.Phil (2014)**, Study on the Quantification of Delay Factors in Construction Industry *International Journal of Emerging Technology and Advanced Engineering*.
- [18] **Rwelamila.P.D., and K. A. Hall**, Total system intervention: an integrated approach to time, cost and quality management, *Construction Management and Economics* **13** (1995) 235-241.
- [19] **Ubani E.C, Okorocho K.A and Emeribe S.C (2011)** Analysis Of Factors Influencing Time And Cost Overruns On Construction Projects In South Eastern Nigeria. *International Journal of Management Sciences and Business Research* Volume 2, Issue 2- ISSN (2226-8235).
- [20] **Wilson R. L**, Prevention and resolution of construction claims, *Journal of Construction Division* **108 (CO3)** (1982) 390-405.
- [21] **Yahya Rahsid, Saif ul Haq and Muhammad Shakeel Aslam (2013)**, Causes of Delay in Construction Projects of Punjab-Pakistan: An Empirical Study *Journal of Basic and Applied Scientific Research* **3(10)** 87-96.
- [22] **Zarabizan Zakaria, Syuhaida Ismail, Aminah Md. and Yusof (2013)**, Causes of Final Account Closing Delay: A Theoretical Framework *World Academy of Science, Engineering and Technology International Journal of Social, Management, Economics and Business Engineering* Vol:7 No:10



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