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# Evaluation of Time and Cost Factors in Indian Construction Projects

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**Abstract:** Time and cost performance is that the basic criteria for achievement of any project. Unfortunately construction industry in India has been regarded as industry facing poor performance leading to failure in achieving effective time and cost performance. As a consequence most of the project face huge amount of time and cost overrun. This study assessed the time and cost performance of construction projects in India using structured questionnaire survey. This study can facilitate the practitioners to implement the mitigation live at starting stage so as to attain palmy construction projects.

**Keywords:** Cost overrun, Cost performance, Time overrun, Time performance, Delay

## I. INTRODUCTION

Construction industry is extremely dynamic sector and plays vital role within the development of country and therefore in India, construction industry started a zoom since its independence. However, construction industry in India is facing chronic issues together poor performance of time and cost, construction waste, poor productivity and over dependent of foreign workers. This motivated the authors to study the review of time and cost performance of construction projects in India. However, this study was restricted to the development construction projects in Madhya Pradesh. In the construction industry, the aim of project management is to make sure that comes on time, inside budget and achieve other project objectives. A palmy project is that the solely project they has accomplished its technical performance, maintained its schedule, and remained inside monetary fund project. Project management tools and techniques play an important role in the effective management of a project. Construction time and cost are fundamental considerations in project management and regarded as most important parameters for measuring success of any project. Poor performance of time and cost can lead to a significant amount of time and cost overrun which is global phenomenon.

Time overrun can be defined as late completion of works as compared to the planned schedule or contract schedule. It occurs when the progress of a contract falls behind its scheduled program. It may be caused by any party to the contract and may be a direct result of one or more circumstances. A contract delay has adverse effects on both the owner and contractor (either in the form of lost revenues or extra expenses) and it often raises the contentious issue of delay responsibility, which may result in conflicts that frequently reach the courts. Cost overrun can be considered as the difference between actual cost of a project and its Cost limit. It occurs when the resultant cost target of a project exceed its cost limits where Cost limit of a project refers to the maximum expenditure that the client is prepared to incur on a completed building project while cost target refers to the recommended expenditure for each element of a project. Construction cost which is out of control adds to investment pressure, increases construction cost, affects investment decision- making and wastes the national finance might result in corruption or offence .

## II. LITERATURE REVIEW

Al-Momani (2000) conducted a quantitative analysis of construction delays by examining the records of one hundred and thirty public building projects constructed in Jordan. There were presented the regression models of the relationship between actual and planned project duration for different causes of delays.

Assaf et. al (1995) identified fifty six causes of delay under nine major groups and evaluated their relative importance index by them in Saudi Arabia. They were concluded that contractor owners and architects in general agree to the ranking of individual delay factors while contractors and architects substantially agree with the ranking of groups of delay factors while contractors and owners, and architects and owners don't agree.

Faridi and El- Sayegh (1995) identified that over 50% of construction projects experience delay due to factors such as delay in approval of construction drawings, poor pre-planning and slow decision making process. Comparing the key factors of

construction delay across UAE, the Kingdom of Saudi Arabia (KSA) and Lebanon, the research asserted that delay in approval, owner's slow decision making and material shortages are common causes of construction delay across the region. However, the findings those other high ranked factors in UAE had no significant impact in KSA construction projects clearly highlight the fact that factors causing construction delay cannot be considered common across the countries.

Mansfield et. al (1994) reported the causes of delays and cost overrun in Nigerian construction projects. There were identified sixteen major factors that caused delays and cost overruns in Nigeria.

The most important items agreed on by the contractor, consultants, and public clients surveyed were the financing and payment for completed works, poor contract management, change in site conditions, and shortages of materials inaccurate estimation, and overall price fluctuations.

Issaka Ndekugri, Nuhu Braimah, and Rod Gameson 2008, This paper gives insights with respect to an observational examination into the present practice in the usage of these frameworks in the United Kingdom, as an element of a more broad examination gone for working up a structure for upgrading put off cases examination.

Kamrul Ahsan, Indra Gunawan 2010, This examination concentrates on cost and calendar issues of universal development (ID) ventures. The investigation distinguishes that most late tasks encounter fetched under run an abnormal cost and calendar variety connection in ventures. Assist we distinguish the underlying drivers of venture postponement and cost under run.

L. Muhwezi, J. Acai, G. Otim 2014, Building development extends in Uganda's development industry are encountering a boundless of deferrals.

The reason for this examination was to survey the elements causing delays and their impacts on building development extend in Uganda. This examination sorted the reasons for delay under four primary gatherings of expert related, temporary worker related, customer related and outer related and after that surveyed their effects on postpone utilizing relative significance list (RII) as a reason for investigation. The RII for all postpone elements and gathering of classifications was figured in order to rank the variables.

### III. DATA COLLECTION

Data collection was carried out in two stages combining quantitative and qualitative methods.

In first stages quantitative methods was adopted using structured questionnaire survey to gather information regarding time and cost performance of construction. 5-point likert scale as (Very high important); ( high important); (Medium Important); (Low Important) and (Very Low Important) was adopted to understand the perception of personnel of the client, consultant and contractors organization involved in handling construction projects in Malaysia respondents regarding significant causes of time and cost overrun.

Relative Importance index (RII) calculation was used to determine relative significance and ranking of cost and time overrun factors.

Used same method to investigate causes of delay in construction projects, also used same approach to investigate the causes and effects of construction delay in Indian construction industry. RII will be calculated with following expression:

$$RII = \frac{\sum_{i=1}^5 W_i X_i}{A \times N}$$

Where

RII = Relative importance index

W = weighting given to each factor by respondents and it ranges from 1 to 5

X = frequency of  $i^{th}$  response given for each cause

A = highest weight (i.e. 5 in this

N = total number of participants

**IV. QUESTIONNAIRE TABLE**

Groups/Factors	Very low important	Low important	Medium Important	High important	Very high important
<b>(1) Cost factors</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Market share of organization					
Liquidity of organization					
Cash flow of project					
Project design cost					
Material and equipment cost					
Project labor cost					
Project overtime cost					
Cost of rework					
Cost of variation orders					
Regular project budget update					
Cost control system					
<b>(2) Time factors</b>					
Site preparation time					
Planned time for project construction					
Time needed to implement variation orders					
Time needed to rectify defects					
Average delay in claim approval					
Average delay in payment from owner to contractor					
Availability of resources as planned through project duration					
Average delay because of closures and materials shortage					
<b>(3) Quality factors</b>					
Conformance to specification					
Availability of personals with high experience and qualification					
Quality of equipments and raw materials in project					
Participation of managerial levels with decision making					
Quality assessment system in organization					
Quality training/meeting					
<b>(4) Productivity factors</b>					
Project complexity					
Number of new projects / year					
Management-labor relationship					

Absenteeism rate through project					
Sequencing of work according to schedule					
<b>(5) Client Satisfaction factors</b>					
Information coordination between owner and project parties					
Leadership skills for project manager					
Speed and reliability of service to owner					
Number of disputes between owner and project parties					
Number of reworks					
<b>(6) Regular and community satisfaction factors</b>					
Cost of compliance to regulators requirements					
Number of non compliance to regulation					
Quality and availability of regulator documentation					
Neighbors and site conditions problems					
<b>(7) Health and Safety factors</b>					
Application of Health and safety factors in organization					
Easiness to reach to the site (location of project)					
Reportable accidents rate in project					
Assurance rate of project					
Learning from own experience and past					
<b>(8) Environment factors</b>					
Pollution quality					
Noise level					
Wastes around the site					
Climate condition in the site					

#### A. Anova Hypothesis

Two-way ANOVA was performed to assess the strength of association between the causes of time and cost overrun. Two-way ANOVA technique is used when the data are classified on the basis of two factors. ANOVA technique in context of two-way design when repeated values are not there: A we do not have repeated values; we cannot directly compute the sum of squares within samples. Therefore, we have to calculate this residual or error variation by subtraction, once we have calculated the sum of squares for total variance and for variance between varieties of one treatment as also for variance between varieties of the other treatment.

The various steps involved are as follows:

- 1) Use the coding device, if the same simplifies the task.
- 2) Take the total of the values of individual items (or their coded values as the case may be) in all the samples and call it T.
- 3) Work out the correction factor as under; Correction factor= $(T)^2/n$



- 4) Find out the square of all the item values (or their coded values as the case may be) one by one and then take its total. Subtract the correction factor from this total to obtain the sum of squares of deviations for total variance. Symbolically, we can write it as; Sum of square of deviations for total variance or total

$$SS = \sum X^2_{ij} - (T^2)/n$$

- 5) Take the total of difference columns and then obtain the square of each column total and divide such squared values of each column by the number of items in the corresponding column and take the total of the result thus obtained. Finally, subtract the correction factors from this total to obtain the sum of squares of deviations for variance between columns (or SS between columns)
- 6) Take the total of difference rows and then obtain the square of each row total and divide such squared values of each row by the number of items in the corresponding row and take the total of the result thus obtained. Finally, subtract the correction factors from this total to obtain the sum of squares of deviations for variance between rows (or SS between rows).
- 7) Sum of squares of deviations for residual or error variance can be worked out by subtracting the result of the sum of (5th) and (6th) steps from the result of (4th) step stated above. In other word,
- 8) Total SS – (SS between columns + SS between rows) = SS for residual or error variance.

- 9) Degree of freedom (d.f.) can be worked out as under;

$$\begin{aligned} \text{d.f. for total variance} &= (c \cdot r - 1) \\ \text{d.f. for variance between columns} &= (c - 1) \\ \text{d.f. for variance between rows} &= (r - 1) \\ \text{d.f. for residual variance} &= (c - 1)(r - 1) \end{aligned}$$

Where c = number of columns

r = number of rows

ANOVA table can be set up in the usual fashion as shown below ;

Annova Table I

Source of variation	Sum of squares (SS)	Degree of freedom (d.f.)	Mean square (MS)	F –ratio
Between columns treatment	$\sum(T_j)^2/n_j - (T)^2/n$	(c-1)	SS between columns/(c-1)	between columns/MS residual
Between row treatment	$\sum(T_i)^2/n_i - (T)^2/n$	(r-1)	SS between rows/(r-1)	between rows/MS residual
Residual or error	Total SS - (SS between columns + SS between rows)	(c-1)(r-1)	SS residual/(c-1)(r-1)	
Total	$\sum X_{ij}^2 - (T)^2/n$	(c.r-1)		

In the table c = number of columns

r = number of rows

SS residual = Total SS – ( SS between columns + SS between rows )

Thus, MS residual or the residual variance provides the basis for the F- ratios concerning variation between columns treatment and between rows treatment. MS residual is always due to the fluctuations of sampling, and hence serves as the basis of the significance test. Both the F-ratios are compared with their corresponding table values, for given degree of freedom at a specified level of significance , as usual and if it is found that the calculated F-ratio concerning variation between columns is equal to or greater than its table value, then the difference among columns means is considered significant. Similarly, the F-ratio concerning variation between rows can be interpreted.

#### IV. CONCLUSION

Poor time and cost performance are major problems faced by today's construction industry. Hence, this study assessed time and cost performance in construction industry of India and identified major inhibiting factors. Structured questionnaire survey was carried out amongst the contractors, consultant and client personnel which resulted in gathering 40 samples. Analysis was carried out statistically using Two- way ANOVA hypothesis.

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