AN EMPIRICAL STUDY ON KEY DETERMINANTS OF CONSTRUCTION DELAY

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Abstract - *The purpose of this study is to investigate the causes of construction delay and its impact on client dissatisfaction. The factors are identified from literature and using these factors questionnaire is prepared and it consists of total of 40 factors causing delay. In order to collect data from the respondents, questionnaire method is used. The structured questionnaire form is send to various construction companies through email. This study has been conducted in and around Erode district for a period of seven months from July 2016 to January 2017. The study identified nine dimensions of construction delay.*

***Key Words*:** design, equipment, personal, manpower, experience, government, material, finance, owner.

1.INTRODUCTION

Delay factors are considered to be significant role in the delivery of a construction project on time, within budget and at the required quality [26]. The success of the construction project requires sound strategies, good practices and careful judgement for completion of project on schedule and with estimates cost [1]. Delays are the most common and costly problem encountered on construction projects. Construction delays are significant part of the project's construction life. Even with present advanced technology, and management understanding of project management techniques, construction delay projects continue to suffer incase of delays and project completion dates. The major reasons for delay includes strikes, rework, deficit organization, shortage of materials, machinery failure, change orders. Delays are costly to all parties involving in the construction industry and often result in litigation. The time and expense incurred to produce a claims document in itself is substantial. There is room for improvement in present practices for keeping track of delays. Therefore, introducing a exible and more accurate delay analysis technique can be valuable [23].

2. REVIEW OF LITERATURE

The following are the overview of literatures collected from past research and studies. The most noteworthy of them are relevant to the current study are being reviewed.

Adnan Enshassi et al (2016) assess the factors leading to time and cost overruns in construction projects, Gaza Strip. The survey included 110 delay factors, 42 cost overrun factors. This study concluded that the major causes could be removed by better management practices.

Remon F. Aziz et al (2016) lists the construction delay causes. The questionnaire was prepared and distributed to 500 construction from the identified 293 delay causes. Relative Importance Index (RII). The most contributing causes and groups to delays were identified, and some future suggestions were proposed.

Majed Alzara et al (2016) identifies the major causes of project delays in northern Saudi Arabia The delay factors were collected from the University Projects Director were then compared to Saudi construction projects. It gives a solution to minimize delay factors and improve its performance using Performance Information Procurement System.

Samer Alsharif and Aslihan Karatas (2016) analyzed a framework for identifying causal factors of delay for operable nuclear power plants projects.

Greeshma b Suresh and Dr.S.Kanchana (2015) had done a study on quantification of delay factors in construction industry in Kerala region. Top 10 major causes of construction delays in construction industry are identified.

Prakash Rao and Joseph Camron Culas (2015) outlines the major causes of construction delays, the effects of delays, and methods of minimizing construction delays. Site management and supervision, effective strategic planning, and clear information and communication channel are the methods to minimize delays.

Michal Gluzak and Agnieszka Lesniak (2015) outlines the findings of a survey aimed at identifying the most important causes of delays in construction works from the

client's perspective. A factor analysis was allow to interpret the dependencies between them.

K.L.Ravisankar et al (2014) conducted a study on the quantification of delay factors in construction industry. The questionnaire is formed consisting of total 50 delay factors and is sent to various construction companies by email and in by personal.

3. RESEARCH GAP

Although several studies have been conducted with regard to study on key determinants of construction delay, most of the studies have been conducted in western perspective. Only few studies have been conducted in Indian context. Therefore the researcher would like to fill the gap by way of studying the engineers, supervisor's views on construction delays.

With this background, the researcheres intend to identify the various dimensions of construction delay.

4. RESEARCH METHODOLOGY

4.1 Scope

The scope of the study is confined only to the engineer's, supervisor's views on construction delays in Erode district.

4.2 Period of study

The period of study is conducted during the period of September 2016 to January 2017.

4.3 Data collection methods

Primary data collection was done through questionnaire method. The first part of the questionnaire consists of the demographic profile of the respondents. The second part of the questionnaire was relating to factors that causes delay in construction sites.

4.4 Sampling method

The researchers adopted convenience sampling method for collecting data from the respondents.

Table-1: Number of questionnaire's distributed and received

S.No.	Taluks in erode	Distributed questionnaire's	Received response	Response rate
1	Erode	45	30	66%
2	Perundurai	45	30	67%
3	Modakkurichi	40	20	50%
4	Kodumudi	35	20	57%
5	Sathy	20	10	50%
6	Bhavani	20	15	75%
7	Anthiyur	15	12	67%
8	Gobi	40	35	78%
9	Thalavadi	10	6	60%
10	Total	250	178	65%

4.5 Construct development

The variables relating to the present study is drawn from the previous work done by-(Shebob et al, 2007), (Adnan Enshassi et al, 2016), (Sabah Alkass et al, 1996), **(**Arshi Shakeel Faridi et al, 2006), (Sadi A. Assaf and Sadiq Al-Hejji, 2006),(Remon F. Aziz et al 2016),(Greeshma b Suresh and Dr.S.Kanchana 2015).Suitable modification was made in the existing questionnaire to suit the requirements of the current study.

4.6 Descriptive statistics

The demographic profile in the questionnaire features the experience level of the respondent, their salary level, their level of designation in the department they are working in. The total survey was conducted in 250 out of whom only 178 questionnaires could be collected. The response rate of the survey was 65 percent. The survey were conducted among deputy managers, structural engineers, quantified engineers, safety officers, design engineers, site engineers, supervisors, assistant engineers.

5. ANALYSIS AND DISCUSSIONS
5.1 Reliability statistics

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There is a number of diverse methods towards evaluating reliability of a scale. In this study the method hired is cronbach"s reliability.

Cronbach"s α is the most normally used procedure to estimate reliability. It is highly precise and has the advantage of only requiring a single application of the

scale. Hence cronbach"s α was obtained and found to be of adequate magnitude[16].

Table-2: Reliability Statistics

Cronbach's Alpha	N of Items
.901	40

Table-3: Reliabilities of various dimensions of construction delay

S.No.	Dimensions	Reliability statistics
1	Design	0.89
2	Equipment	0.86
3	Personal	0.85
4	Manpower	0.852
5	Experience	0.845
6	Government	0.862
7	Material	0.898
8	Finance	0.875
9	Owner	0.862

5.2 Exploratory factor analysis

The researcher studied the measured delay items by using exploratory factor analysis via principal component analysis in order to examine whether the items in fact measure the pre-specified constructs.

Prior to conducting the factor analysis, the two tests were achieved in order to check the possible existence of multi-collinearity or correlation among the items and the appropriateness of factor analysis. Initially, inspection of the correlation matrix exposed the presence of many coefficients of 0.3 and above, which supports the factorability of the correlation matrix .Then, to verify if the dataset was appropriate for factor analysis, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy value has to be equal to, or greater than, 0.6 and that the Barlett's test of sphericity value is important, where the significant value should be 0.05 or smaller. However, for this study, the KMO value is 0.652 and Bartlett's test is significant therefore, it is appropriate to conduct the factor analysis.

Table -4: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.652
Bartlett's Test of Sphericity	Approx. Chi-Square	1110.3
	Df	378
	Sig.	0.000

The next stage of analysis was to evaluate the delay elements. In order to examine whether the items of a construct shared a single underlying factor and to establish the discriminant validity of the constructs under investigation, an exploratory factor analysis (EFA) was achieved.

Exploratory factor analysis using a principal component analysis (PCA). Varimax with Kaiser normalisation was applied prior to factor rotation, thus keeping factors with an eigenvalue of 1 or greater.

The 40 items measured the key determinants of construction delay in and around Erode district. The research model is subjected to the PCA using SPSS Version 16. The exploratory factor analysis of delay reveals the presence of 9 components with eigenvalues exceeding 1; these 9 components accounted for 69.657 per cent of the total variance.

The underlying factors were labelled as follows:

Factor 1: Design – This encompasses 6 items that represent 27.940 percent of the variance. The items are all related to delay in construction industry.

Factor 2: Equipment – This includes 6 items that account for 7.454 per cent of the variance. This item deals with the importance of support from the top management for reducing delay in construction industry and to enhance quality practices and for achieving company excellence.

Factor 3: Personal – This consists of 6 items. This construct focuses on the construction quality information that influences company performance. This factor signifies 6.633 per cent of the variance.

Factor 4: Manpower – This comprises 4 items that deal with the importance of management of materials. It accounts for 5.928 per cent of the variance.

Factor 5: Experience– This includes 4 items that are associated key determinants of delay in construction industry. This factor explains 5.4 percent of the variance.

Factor 6: Government – This includes 2 items that are related to the practice of delay as a means of attaining high standards of organisational performance. This factor explains 4.903 per cent of the variance.

Factor 7: Material –This component accounts for 4.409 per cent of the variance with 4 items.

Factor 8: Finance– Only 1 item are included in this component.This component is significant with factor explains 3.817 per cent of the variance.

Factor 9: Owner– Here 7 items are included. This component is significant with factor explains 3.173 per cent of the variance [8].

Table -5: Total Variance explained

S.No.	Factors	Initial Eigen Values	Variance Explained	Cumulative Percent
1	Design	10.33	27.940	27.940
2	Equipment	2.758	7.454	39.394
3	Personal	2.454	6.633	42.028
4	Manpower	2.193	5.928	47.956
5	Experience	1.998	5.400	53.356
6	Government	1.814	4.903	58.258
7	Material	1.631	4.409	62.667
8	Finance	1.412	3.817	66.484
9	Owner	1.174	3.173	69.657

Initially, all the 40 variables were used. After rejecting those items that have inadequate loadings, we reduced to nine factors. The identified factors explain percent of total variance. The factors are named as follows:

- Design related factors
- Equipment related factors
- Personal related factors
- Manpower related factors
- Experience related factors
- Government related factors
- Material related factors
- Finance related factors
- Owner related factors

6. CONCLUSIONS

The purpose of this study was to identify the important dimensions of construction delay. For this, the researchers employed exploratory factor analysis. This study identified nine dimensions. These are design, equipment, personal, manpower, experience, government, material, finance, owner. These study findings would help the policy makers to identify the important dimensions of construction delay. Eventhough the study has achieved its objectives, it has certain limitations (i.e) the researchers adopted convenient sampling method. In future, similar study could be conducted by adopting some other sampling methods. This study adopted only exploratory factor analysis for identifying important dimensions of construction delay and in future confirmatory factor analysis could be used.

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