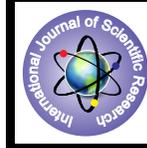


Study on Factors Influence of Resource Constraints in Time Overrun of Construction Projects



Engineering

KEYWORDS :

M. P. Venkatesh

Research Scholar, Division of structural Engineering, Department of Civil Engineering, Anna University, Chennai-600025, India

C.Umarani

Associate Professor , Division of structural Engineering, Department of Civil Engineering, Anna University, Chennai-600025, India

ABSTRACT

Resource constraints plays an important role in Indian construction projects. Effective resource management is a prerequisite for project success. This paper aims to identify the factors affecting resource scheduling in Indian construction projects, in the private and public sectors. From an extensive literature survey and based on experts' opinion, thirty three factors affecting resource scheduling were identified. For the quantitative confirmation of the effectiveness of factors affecting resource scheduling during the construction stage of a project, a questionnaire survey was conducted with construction professionals like clients, consultants and contractors. Subsequently, the collected data was analyzed, using the factor analysis method. The factor analysis was employed to group the factors under the principal factors, which were extracted into seven factors: Lack of equipment and manpower managerial incompetence, financial deficiencies, improper resource allocation, difficulties in special materials, improper construction and personnel management, lack of awareness and lack of mobilization. This paper recommends some critical factors to be considered during the resource scheduling process to minimize the construction time overrun.

Introduction

In India, construction is the second largest economic activity next to agriculture. It makes a significant contribution of nearly 11 per cent of India's Gross Domestic Product (GDP). The sector's contribution is likely to increase in the coming years. Infrastructure, road projects, highways, and power constitute a significant portion of this sector. A good construction project management lies in achieving the goal within a specific time, accomplishing technical performance, maintaining its schedule, and sticking to the budgetary cost of the project. A construction project involves a series of activities and each activity requires a certain resource. Management involves effectively managing resources such as manpower, material, equipment and finance. In some projects the resources are not effectively and efficiently managed, leading to overruns in the project duration. Unfortunately, over 40% of the Indian construction projects face time overruns ranging from 1 to 252 months (K. C. Iyer and K. N. Jha, 2006) and there are several studies that discuss about the factors affecting project overruns (Chan and Kumaraswamy, 1997; Frimpong et al., 2003; Acharya et al 2006; Sambasivan and Soon, 2007). The success of a project is measured in terms of its performance on schedule, cost, quality, and no disputes. Schedule overrun could control a major part of the cost overrun. Hence, this study discussed the major factors affecting the resource constraint in time overrun in Indian construction projects. There are many factors that affect the resource constraint performance either positively or negatively.

Research Methodology

Questionnaire Design

A questionnaire was prepared to assess the perception of clients, consultants and contractors on the relative importance of factors affecting resource scheduling in Indian construction projects. The questionnaire contained two main parts: the first part requested general information about the respondents, and the second part focused on the factors affecting the resource scheduling in Indian construction projects. The respondents were asked to indicate their responses on 33 well recognized factors affecting resource scheduling as identified. These factors were categorized into four groups, according to the origin of the resource, i.e., i) Manpower, ii) Material, iii) Equipment and iv) Finance related. The respondents were asked to rate the factors by using the Likert scale ranging from 1 (very low) to 5 (very high) to find the degree of importance.

Identification of Factors

A list of 33 factors affecting resource schedules are identified from the literature review and experts interview. Each factor is categorized by major groups such as 1. Manpower: absenteeism of labour, lack of Communication, labor injuries, disputes and

strikes, migrant of labour, lack of mobilization, lack of motivation, obtaining permits for migrant labour, personal conflicts among labour, shortage of labour, lack of skilled labour, and unqualified work force team 2. Equipment: availability of equipment, complication of advanced technology equipment, complication of hire, disruption of accessories, idle time, maintenance of equipment, and transportation of equipment 3. Materials: damage of materials in storage, damage of sorted materials while they are needed urgently, slow delivery of materials, imported, ordered materials and plant items, manufacturing difficulties of special materials, materials selection and changes in types and specifications during construction, poor procurement of materials, proportion of offsite prefabrication, poor quality of materials and shortage of construction materials 4. Financing: cash Flow (Inflow & Outflow), financing between the owner and contractor, financing by contractor during construction, slab of payment during construction and unavailability of financial incentives.

The Sampling method

The random sampling technique was adopted in this study. The questionnaire survey were distributed to 463 randomly selected construction professionals associated with different organizations related to owners, consultants and contractors in the Indian construction Industry through India. The respondents were chosen through friends and referral networks. About 50% of the respondents who participated had more than '10 years' experience. A total of 240 responses were received from various professionals; 184 (69%) from contractors, 30 (23%) consultants and 26 (40%) clients out of the 265, 133 and 65 distributed questionnaires, respectively.

Factor Analysis

The factor analysis technique is applied to sort out the main factors in the resource schedule. The factor analysis was employed to define 33 numbers of factors into small sets of composite variables. The 33 factors were intercorrelated with the principal factor component method, and rotated to form a simple structure by means of varimax rotation. Variables found to be factor loadings less than 0.4 and cross-loadings less than 0.10 were eliminated from the list. The statistical package for social sciences (SPSS) was used for the factor analysis. Both these parameters justify that the factor analysis is applicable.

Based on Kaiser's criterion (Eigen value greater than 1), seven factors were extracted, and they represent 67.31percent of the total variance as shown in Table 1. However, before applying this technique, the suitability of data must be enquired. In this regard, Barlett's test of sphericity having significance at 0.000 indicates that the correlation matrix is an identity matrix

without significant correlation between variables. The Kaiser-Meyer-Olkin measure of sampling adequacy is sufficient with the value of 0.944, which is found to be greater than 0.7, which means the data set is likely to factor excellent. Both diagnostic tests confirm that the data are suitable for the factor analysis.

Table 1. Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	13.57	40.61	40.61	13.57	40.61	40.61	5.17	15.87	15.87
2	2.00	7.02	47.63	2.00	7.02	47.63	4.83	14.84	30.71
3	1.50	5.51	53.14	1.50	5.51	53.14	4.22	12.98	43.69
4	1.43	5.30	58.44	1.43	5.30	58.44	3.57	11.00	54.69
5	1.20	3.63	62.07	1.20	3.63	62.07	2.53	7.38	62.07

Interpretation of factors

An analysis of the thirty three factor affecting resource schedule items, yielded five factors. These five factors have a smaller set of composite variables. With respect to lack of Communication, poor procurement of materials, damage of materials in storage, absenteeism of labour, poor quality of materials were eliminated in the final factor loading list because of these variables having a factor loading of less than 0.4 and a cross-loading of less than 0.1. The variables which comprise one factor component with factor loadings, communalities, eigen value and variance are given in Table 2 and figure 1. The extracted factors are provided with a little cross loading and evidence of good convergent and discriminant validity. The five factors are weighted, based on the eigen value (1 to 7 in the descending order). The five factors are named: i) Resource barrier (DC1); ii) Inadequacy of resource (DC2); iii) Lack of finance difficulties (DC3); iv) Deployment of resource (DC4); and v) Unavailability of human resource issues (DC5).

Table 2 Factor Analysis Loading Results

Factors	Loading	Eigen value	Variance Explained (%)
DC1: Resource barrier		13.57	40.61
Personal conflicts among labour	0.69		
Manufacturing difficulties of special materials	0.68		
Labor injuries, disputes and strikes	0.66		
Disruption of accessories	0.62		
Damage of sorted materials while they are needed urgently	0.62		
Damage of materials in storage	0.59		
Idle time of equipment	0.58		
Imported, Ordered materials and plant items	0.58		
Obtaining permits for migrant labour	0.58		
Proportion of offsite prefabrication	0.55		
Complication of hire	0.45		
DC2: Inadequacy of resource		2.00	7.02
Slow delivery of materials	0.69		
Shortage in construction materials	0.64		
Poor maintenance of equipment	0.64		

Availability of equipment	0.62		
Complication of advanced technology equipment	0.58		
Poor quality of materials	0.58		
Transportation of equipment	0.51		
Materials selection and changes in types and specifications during construction	0.49		
Poor procurement of materials	0.46		
DC3: Lack of finance difficulties		1.50	5.51
Financing by contractor during construction	0.75		
Slab of payment during construction	0.69		
Financing between the owner and contractor	0.68		
Unavailability of financial incentive	0.63		
Cash Flow (Inflow & Outflow)	0.61		
DC4: Deployment of resource		1.43	5.30
Lack of Motivation	0.80		
Lack of Mobilization	0.74		
Absenteeism of labour	0.59		
Lack of Communication			
DC5: Unavailability of human resource issues management		1.20	3.63
Shortage of labour	0.70		
Lack of skilled labour	0.51		
Unqualified work force team	0.45		
Migrant labour	0.47		

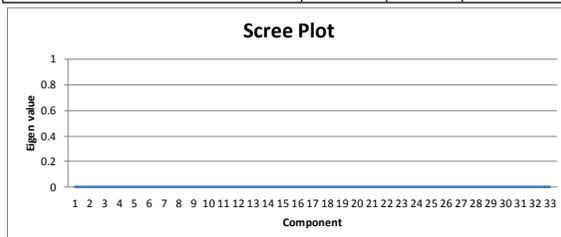


Figure 1 Scree Plot

Result and Discussion:

From the analysis results, we can conclude that the factors discussed below are the critical factors affecting resource scheduling.

Resource barrier

The first factor consisted of eleven positively loaded variables. It has an eigen value of 13.57, and accounted for 40.61 percent of the total variance. Table 2 showed that this factor is related to barrier of resource, that was caused during the construction phase. The elements of this factor are personal conflicts among labour, manufacturing difficulties of special materials, labor injuries, disputes and strikes, disruption of accessories, damage of sorted materials while they are needed urgently, damage of materials in storage, idle time of equipment, imported, Ordered materials and plant items, obtaining permits for migrant labour, proportion of offsite prefabrication, and complication of hire. These activities are related to obstruction of resource.

Inadequacy of resource

This factor consisted of nine positively loaded elements. It has an eigen value of 2.00 and accounted for 7.02 percent of the total variance. The elements of the factors are slow delivery of materials, shortage in construction materials, poor maintenance of

equipment, availability of equipment, complication of advanced technology equipment, poor quality of materials, transportation of equipment, materials selection and changes in types and specifications during construction, poor procurement of materials. All these activities are due to the inadequacy of the contractors and sub-contractors during the construction stage.

All these activities are due to the incapability of the owners and contractors during the construction stage.

Lack of finance difficulties

This factor consisted of five positively loaded elements. It has an eigen value of 1.50 and accounted for 5.51 percent of the total variance. The elements of the factors are financing by contractor during construction, slab of payment during construction, financing between the owner and contractor, unavailability of financial incentive, and cash flow (Inflow & Outflow). These factors are related to incapability of the owners and contractors during the construction stage.

Deployment of resource

This factor consisted of four positively loaded elements. It has an eigen value of 1.43, and accounted for 5.30 percent of total variance. The elements of this factor are lack of motivation, lack of mobilization, absenteeism of labour, and lack of communication. This factor is related to a lack of awareness of the contractors and sub-contractor involved in the manpower of customized items.

Unavailability of human resource issues management

This factor consisted of four positively loaded elements. It has an eigen value of 1.20, and accounted for 3.63 percent of the total variance. The elements of the factors are shortage of labour, lack of skilled labour, unqualified work force team, and migrant labour. These factors are related to the inefficiency of personnel management.

Conclusion

This study identified problems related to factors affecting the resource schedule, due to overruns during the construction phase from different viewpoints of the parties with respect to three types of indices. The factor analysis is employed to group them as the principal factors. With the factor analysis technique, seven factors were extracted in 67.3 percent out of the 33 principal factors based on the eigen value (factor loading less than 0.4 and cross-loading less than 0.1) as follows: lack of equipment and manpower managerial incompetence, financial deficiencies, improper resource allocation, difficulties in special materials, improper construction and personnel management, lack of awareness and lack of mobilization. The findings could help the practitioners to gain a better understanding of the problems influencing the budget and time of the projects during the construction stage. By taking care of these potential factors in their present and future projects, construction participants can reduce and control the extent of delays and cost overruns.

REFERENCE

- [1] Chan D.W.M and Kumaraswamy M.M, " A comparative study of causes of time overruns in Hong Kong construction projects", International journal of project management, Vol. 15 (1977), No 1, pp. 55-63. | [2] Iyer K. C and Jha K. N., "Critical Factors Affecting Schedule Performance: Evidence from Indian Construction Projects. Journal of Construction Engineering and Management, Vol. 125 (1999), No3, p. 142-150. | [3] Murali Sambasivan and Yau Wen Soon, "Causes and effects of delays in Malaysian construction industry", International journal of project management, Vol. 25 (2007), No 4, p. 517-526. | [4] Nirmal Kumar Acharya, Young Dai Lee, Soo Yong Kim and Jong Chool Lee, 'Analysis of Construction Delay Factor: A Korean Perspective', Proceeding of the 7th Asia Pacific Industrial Engineering and management Systems conference, 17-20 December (2006), Bangkok, Thailand | [5] Yaw Frimpong, Jacob Oluwoye, Lynn Crawford, " Causes of delay and cost overruns in construction of ground water projects in a developing countries; Ghana as a case study", projects", International journal of project management, Vol. 21 (2003), pp. 321-326.