

Study on Reasons for Delays in Civil Engineering Project in China

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Abstract

Project delay is a conspicuous and common problem in the construction Industry, and it is one of the most important reasons leading to runaway in progress rate, quality, investment and dispute in related aspects. Big loss is often caused by project delays. If main factors that influence progress can be found by means of investigation and studying, a model that can forecast the rate of progress in project may be built. The model has very important significance in settling down some problems, such as project delay and blindness usually existed in Chinese project at present. First, construction duration is analyzed. Next, 8 major factor categories are determined, which include 54 main delay factors. Then, based on data collected from 122 valid questionnaires, 10 key factors are determined. Finally, influencing factors and consistency of delay factor categories for construction duration caused by contractors, consultants, designers and clients are worked out. Reliability of the investigation is determined and conclusions are presented.

Key words

Project management, project delay, delay factors, delay factor categories

1. Background of Study

Project delay is one of the most important reasons leading to runaway in progress rate, quality, investment and dispute in the related aspects, and there exists the in negligible influences in the economic and social benefits on a project. In a large number of projects big losses are often caused by project delay. If main factors that influence progress can be found by means of investigation and

studying, a model that can forecast the rate of progress in project may be built. The model has very important significance in setting some problems, such as project delay and blindness usually existed in Chinese projects at present, and has the great significance in making the project finished on time and using as soon as plausible, and increasing the economic and the social benefits.

There are a lot of research results about project delay in western developed countries. Now the researches on this are still little in china. Some of the research results remain in subjective and qualitative methods. The researches on project control pay particular attention to the technological aspects, but omit the premise of the schedule----the objective factors of the project; therefore, the results are influenced greatly.

2. Investigation Organization

2.1 Analysis of factors influencing construction duration

Civil engineering projects have the features, such as huge, complex and long in period, ect. So there are many factors influencing the construction duration. If it is controlled effectively, overall analysis and forecasts must be made on all kinds of factors that are influenced. On the one hand, it can help to fully initializing favorable factors, preventing unfavorable ones, and fitting progress target into the reality. On the other hand, it also helps lay down preventive measures before it happens, take effective measures control when it happens and carry on proper remedies appropriate after it happens, with the aim of reaching to reduce the deviations between actual and planned progress, and realizing the active and dynamic controls.

The factors are divided into man, technique, material, facility and fitting, fool, fund, hydrology, geology and meteorology, environment, society and the others etc according to tie natures in which the factor of man is the most factor. From their sources, some come from construction unit, some come from design teams and consultant or supply unit, some come from the government management department, related-unit and society and some come from the natural conditions. Below we will analyze several main factors.

1. Related-unit influence

The units in charge of construction on the project play the crucial roles on the construction progress, but there are also many units to influence the construction progress, such as construction units, client, design-team, bank credit department, building material, supply department, water and electricity supply and transport department, and the government. The design unit makes the mistakes in the drawings or other related units change the design plan, material and equipment can't supply on time, or the quality and standard don't agree with the requirement. These would influence the construction. That funds for the construction are not paid on time would also interrupt or slow down the construction.

2. Changes of Construction Condition

The hydrological geology agrees with investigate design in the construction project. Bad

weather, rainstorm, high temperature and flood would influence the construction schedule, and result in the temporary shutdown.

3. Technological mistake

The unit in charge of construction takes improper technological measures, and technological accidents happen during the construction, lack of the experience of using new technology, new material and new structure, which can't ensure its quality and technological accidents occurrences.

4. Poor constructional management

That the organization of construction is unreasonable, labor and constructional machinery are not allocated rationally and the layout plan is arranged unreasonably will influence the construction progress.

5. Accident occurrence

If the unexpected accident occurs in the construction, such as war, fire disaster, heavy natural disaster and great constructional accident occurred in the constructional progress, the project schedule would also be influenced.

2.2 Design of questionnaire

To survey the causes of project delay, the quantitative analysis must be made from different angles and different sides (client, consultant and contractor) to study the causes of project delay, the questionnaire used can also be divided into two tables, the first is mainly to survey the place of work, special field of study, age, the title of a technical post, and the length of service of each respondent in order to understand the causes of project delay from different places, different professions, different levels. Thus, the subjective influence of the factors for oneself is decreased from the surveyed party. The second is the main part in this survey, and on the basis of the factor analysis; the factors are classified into 8 major categories, 56 concrete categories. The 8 major categories involve client, unit in charge of construction, project, labor, constructional mechanical equipment building materials, and design-team and external factors. In addition, each factor is divided into 5 grades in this survey and 5,4,3,2,1 in proper order, because of its simplicity and suitability for evaluating the effort of each factor on the project delay. And a corresponding weighting is given to 5 grades, in order that facilitate to obtain the effect degree of each factor in the construction and vividly.

3. Data Analysis

3.1 Sample Introduction

144 copies of the questionnaires were sent out and 122 of the organizations (26 clients, 36 consultants, 60 contractors) responded to the survey, including all aspects relating to projects, with a rate of recovery of 85%. From the targets of survey (see figure 1): numbers of Peron that engage in this work are relatively average in the period of work. Sample distribution is more reasonable.

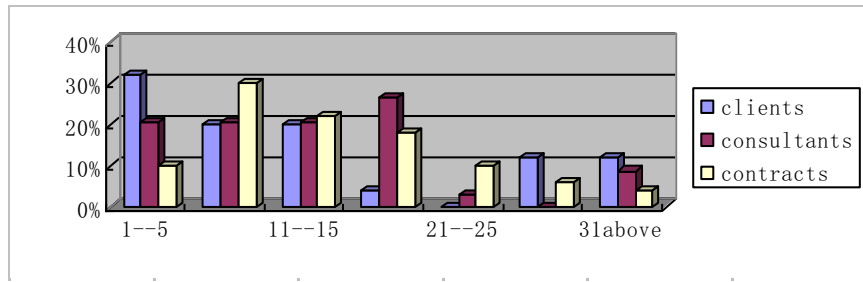


Fig. 1—Distribution of construction work experiences of related specialists

3.2 Results of data analysis

The analysis are made on project delay in Hong Kong by the mean score in the ref.[1]. In this paper, using this method the data obtained from the questionnaire survey were also analyzed, as the statistical targets in clients, consultants\engineering and unit in charge of construction respectively. The mean score (MS) for each factor was calculated by the following formula:

$$MS = \frac{\sum_{i=1}^5 (f_i, s)}{N}, \text{ in which } (1 \leq MS \leq 5, 1 \leq i \leq 5)$$

Where: MS—the average score for each factor of doing

f_i —number of delay factor responding to degree of the effect (1-5)

i —degree of the effect ($i=1, 2, 3, 4, 5$)

s —weighting

And N —total numbers responding to each delay factor

Using this method, the score of each factor is obtained. Due to the limited space of this paper, the process of analysis was omitted. From the result of analysis, the scores of the finest ten factors far exceed ones of other factors. Therefore they could be taken for emphasis to research. The ten factors are:

- 1.Progress fund can't be paid on time;
- 2.Material is not supplied in time;
- 3.Material quality is not up to standard;
- 4.Drawing isn't complete;
- 5.Poor site management;
- 6.Project manager's ability is limited;
- 7.Unforseen geological conditions;
- 8.Geological investigation information isn't accurate;
- 9.Shortage of managers;
- 10.Lack of construction experience

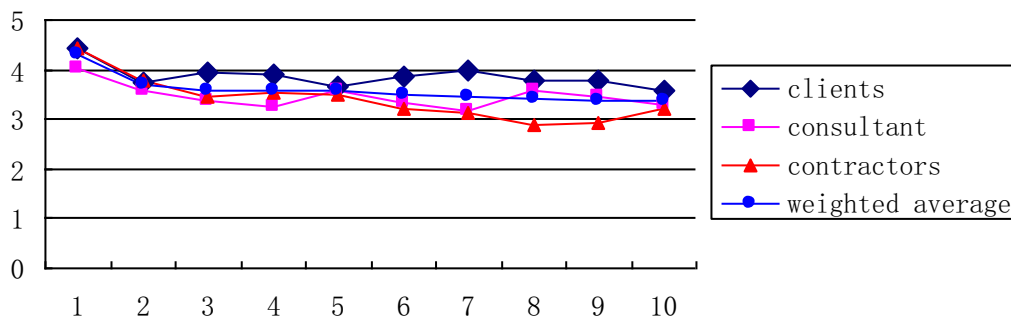


Fig.2 Profiles of the mean scores for the 10 factors

In addition, using the same method, we analysis the significance of each factor influence the construction period. The result of analysis can be seen from Table 1.

Table 1. Analysis of analogical factors

Category	Category name	Client		Consultant		Contractor		Weighting average	
		MS	R	MS	R	MS	R	MS	R
2	Related to contractor-	2.24	8	4.22	1	3.74	1	3.40	1
3	Related to Deign-team	3.28	1	2.99	3	2.8	4	3.02	2
4	Related to Project	3.17	3	2.94	4	2.91	2	3.01	3
5	Related to Labor	3.24	2	2.99	2	2.76	5	3.00	4
1	Related to Client	3.13	4	2.91	5	2.88	3	2.97	5
7	Related to Material	2.99	5	2.78	6	2.67	7	2.81	6
8	Related to other factors	2.88	6	2.7	7	2.71	6	2.76	7
6	Mechanical equipment-related	2.86	7	2.48	8	2.51	8	2.62	8

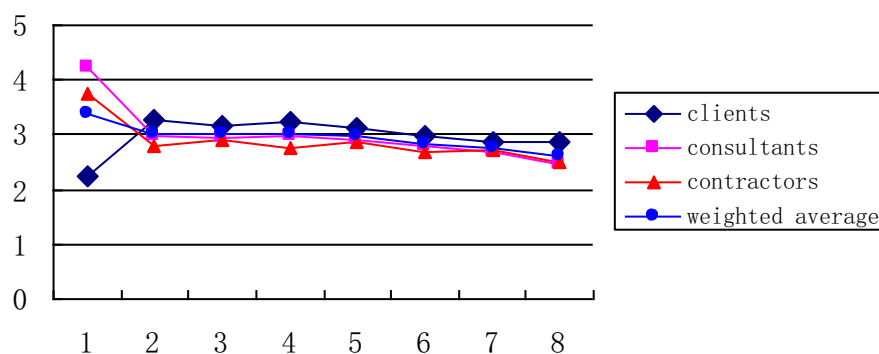


Fig. 3—profiles of the means scores for the 8 major factor categories

Key to 8 major factor categories: 1. Contractor-related 2. Deign-team-related 3. Project-related 4. Labor-related 5. Client-related 6. Material-related 7. External factors-related 8. Plant/Equipment-related As shown in Fig2, in the 8 major factor categories, they are followed by significance contractor, Design team ones, project, labor, client, material, other factors, mechanical equipment factors.

3.3 Analysis of “Rank agreement factor”

From the above analysis of the above, clients, consultants and contractors all consider the influences of first 10 factors on project delay consistently, but have no identical ideas in the influence degree of each factor on project delay.

To verify the consistency of different opinions from various groups in the survey, a “rank agreement factor (RAF) is used for any two groups in Ref.[2]. By using the prescribed formula Ref.[2], the

“Percentage Disagreement” and the Percentage agreement” were then obtain from the RAFs.

For any two groups, let the rank of the i th items in Group 1 be R_{i1} and in Group 2 be R_{i2} . N be the number of item and $j=N-i+1$. The “Rank Agreement Factor” is defined as:

$$RAF = \frac{\left(\sum_i^N |R_{i1} - R_{i2}|\right)}{N}$$

With a maximum RAF:

$$RAF_{max} = \frac{\left(\sum_{i=1}^N |R_{i1} - R_{j2}|\right)}{N}$$

The “Percentage Disagreement” is defined as:

$$PD = \frac{\sum_{i=1}^N (|R_{i1} - R_{i2}|)}{\sum_{i=1}^N (|R_{i1} - R_{j2}|)} \times 100\%$$

The “Percentage agreement” is then given as:

$$PA=1-PD$$

By adopting the above method, the RAF on the factors and factor categories of survey respondents are analyzed (see Fig4 and 5)

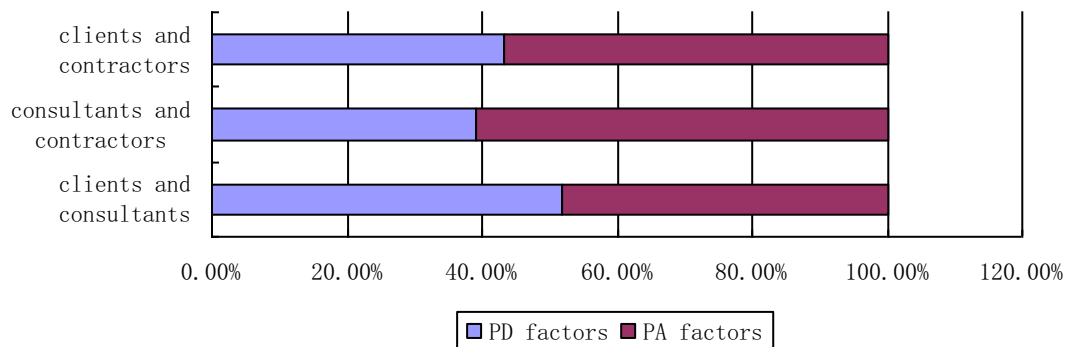


Fig. 4—percentage agreement of 10 most significant factors between different groups of survey respondents

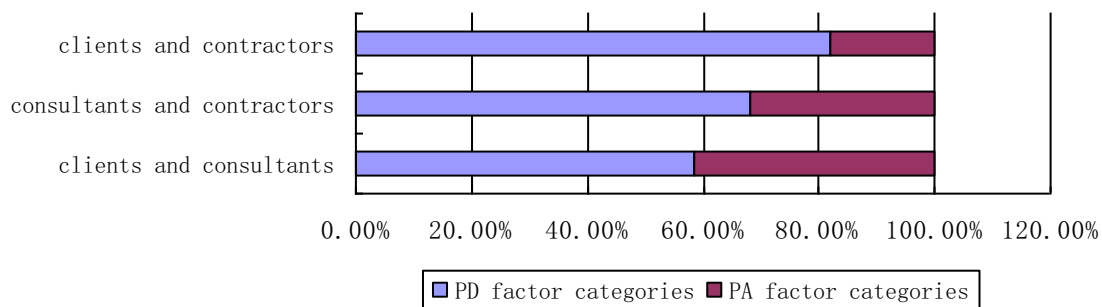


Fig .5 Percentage agreements of 8 major factor categories between different groups of survey respondents

It has been seen from above Figure, because each party related to project is on different position in the whole project. Their standpoint and starting point would have some differences. Judged by factors categories, there are big differences among clients and contractors, consultants and contractors, and between clients and consultants. From the factors, consultant and contractors have identical views, but there are big differences among clients, consultants or contractors. All the differences above are in the allowable scopes. So the results are acceptable.

4. Conclusions

This paper analyzes the factors that influence the construction duration on the basis of survey, obtains the 10 significant factors, and makes the test of identity using the rank agreement factors and percentage agreement indicators. The results of analysis could be taken as the inference in the constructional control.

It is worthy of special attention that because the objects of investigation come from different sides related to the project, there are big differences in the rank agreement factors, Although they are acceptable, there still are some influences on the result, and the analysis must further be made to avoid influences of “percentage agreement”.

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