KSCE Journal of Civil Engineering (2008) 12(6):367-377
DOI 10.1007/s12205-008-0367-7

Construction Management
www.springer.com/12205

Delay and Cost Overruns in Vietnam Large Construction Projects: A Comparison with Other Selected Countries

Long Le-Hoai*, Young Dai Lee, and Jun Yong Lee*****

Received January 10, 2008/Accepted July 16, 2008

Abstract

In-planned duration and cost at project closing are the two of criteria of successful project and successful project management. In Vietnam, regularly, construction projects have met delays and cost overruns. This research has employed a questionnaire survey to elicit the causes of this situation by interviewing 87 Vietnamese construction experts. Twenty one causes of delay and cost overruns appropriate with building and industrial construction project were inferred and ranked with respect to frequency, severity and importance indices. Spearman's rank correlation tests showed that there are no differences in the viewpoints between three principal parties in the project. A comparison of causes of time and cost overruns was done with various selected construction industries in Asia and Africa. Factor analysis technique was applied to categorize the causes, which yielded 7 factors: Slowness and Lack of constraint; Incompetence; Design; Market and Estimate; Financial capability; Government; and Worker. These findings might encourage practitioners to focus on delay and cost overruns problem that might have existed in their present or future projects.

Keywords: *large construction projects, delay, cost overruns, factor analysis, Vietnam*

1. Introduction

1.1 Background

In recent years, Vietnamese economy has grown up speedily. Following the growth of economy, infrastructure development and the urbanization are booming. And complying with them, the weight (importance) of the construction industry in the national economy has been increasing. Capital poured into construction sector reached the value of 13,202 billion VNDs (GSO[2]) and contribution of this industry into gross domestic product reached to 53,276 billion VNDs (GSO[1]) in 2005 (1$US = 15,500 VNDs). However, many problems have arisen during the construction projects implementation; out of which, two main concerns are delay and cost overruns. Along with delay and cost overruns, the frequently faced consequences are project failure, reduction of profit margin, and loss of belief of citizen in government funded projects, etc.

This research is carried out to find the root causes of delay and cost overruns arising during construction phase of projects in Vietnam. Causes of time and cost extensions can result from all phases of projects, works, and circumstance; however, major troubles usually thrive during construction phases. Construction projects have been mushroomed in Vietnam since 2000, so focus of this paper is limited to large construction projects only. Because it is difficult to exactly define large construction projects in Vietnam; in this paper we accompanied a previous study (Long *et al.*, 2004b) to define large construction project. In this context, a large construction project has been defined as a project with a total budget more than $1 million.

1.2 Research Objectives

This paper focuses on the construction stage of projects. The objectives of this paper are:

- To identify and rank the causes of delays and cost overruns in terms of degree of occurrence and level of severity.
- To examine the importance of the causes of delays and cost overruns.
- To test the strength of association between the rankings of the respondent groups.
- To uncover any underlying interrelationship existing among the causes in terms of degree of occurrence
- To compare the Vietnam situation with some selected countries.

*Ph.D. Student, Interdisciplinary Program of Construction Engineering and Management, Pukyong National University, Busan 608-739, Korea (E-mail: lehoailong@hcmut.edu.vn)
**Member, Professor, Division of Construction Engineering, Pukyong National University, Busan 608-739, Korea (Corresponding Author, E-mail: ydlee@pknu.ac.kr)
***Ph.D. Student, Interdisciplinary Program of Construction Engineering and Management, Pukyong National University, Busan 608-739, Korea (E-mail: cmkeng@chol.com)

2. Literature Review

Time and cost are the two common concerns of construction management. Many factors relate to delay and cost overruns and vary along with types of project, locations, sizes, and scopes. Large construction projects with their features of complexity and capital requirement have resulted interest to many researchers.

Delay and cost increase are common phenomena in projects worldwide. However, these are especially severe in developing countries. Kaming *et al.* (1997) exploited questionnaire survey in Indonesian high-rise construction projects. They identified 11 variables of delays and 7 variables of cost overruns. Out of which, materials cost increased by inflation, inaccurate quantity take-off and labor cost increased due to environment restriction are the first three causes of cost overruns; while design changes, poor labor productivity, inadequate planning, materials shortage and inaccuracy of materials estimate are first five causes of delays.

With person-interview survey of 450 randomly selected private residential project owners and developers in Kuwait, Koushki *et al.* (2005) identified estimates of time delays and cost increases and their causes. The three main causes of delays are changing orders, owners' financial constraints, and owners' lack of experience. And three first causes of cost overruns are contractor-related problems, material-related problems and owners' financial constraints. They recommended that to minimize time delays and cost overruns, project owners should require the availability of adequate funds, allocation of sufficient time and money at the design phase, and selection of a competent consultants and reliable contractor to carry out the work.

Frimpong *et al.* (2003) carried out a questionnaire survey in Ghana groundwater construction projects. They listed and ranked 26 factors responsible for project delays and cost overruns. The Kendall's coefficient of concordance was used to test the degree of agreement between owners, contractors and consultant and concluded that there was insignificant degree of disagreement.

Chang (2002) identified through 4 case project documents the reasons for cost and schedule increase and further quantified their contributions to this problem for engineering design projects. These reasons were grouped into three headings: mainly within the owner's control, mainly within the consultant's control, and beyond either the owner's or consultant's control.

Around the world, many other researchers have been attracted on project delay problems. Many of them have paid attention to Asian and African countries. In Southeast Asia, these researchers are: Ogunlana *et al.* (1996) in Thailand, Kaming *et al.* (1997) in Indonesia, Sambasivan and Soon (2007) in Malaysia. Chan and Kumaraswamy (1996), Kumaraswamy and Chan (1998), Lo *et al.* (2006) have studied about Hong Kong, and Acharya *et al.* (2006) have studied about Korean perspective. Middle East countries, where petroleum and natural gas exports have played an important role in the economy, construction boom has consumed many research efforts. Assaf and Al-Hejji (2006) in Saudi Arabia, Koushki *et al.* (2005) in Kuwait, Faridi and El-Sayegh (2006) in UAE, and Odeh and Battaineh (2002), Sweis *et al.* (2007) in Jordanian construction industry are prominent. In other continents, Chang (2002) surveyed in US. And Frimpong *et al.* (2003) in Ghana, Mansfield *et al.* (1994), and Aibinu and Odeyinka (2006) in Nigeria are the other African researchers.

In Vietnam, large construction projects were studied by Long *et al.* (2004a) to identify project success factors, and by Long *et al.* (2004b) to identify common and general problems. Regarding these problems, Vietnamese government has also acknowledged the construction delays and cost overruns problems as the big headache now, especially with government-related funded projects (Ministry of Planning and Investment, 2003).

3. Questionnaire Design

This research has adopted field survey methodology to uncover factors influencing on delay and cost overruns arising during construction stage. To identify the delay and cost over run factors in Vietnamese construction market, literature reviews, case analysis published on newspaper and discussion with practitioners of all parties involved in construction industry were carried out. After that, a pilot questionnaire was prepared. The designed questionnaire was randomly distributed to three principal construction parties (owner, consultant and contractor).

For each factor, the respondents were requested to answer both frequency of occurrence and severity. A five-point scale of 0 to 4 is adopted for evaluating the effect of each factor. These numerical values are assigned to the respondents' rating: '0 = No happen; 1 = Rarely; 2 = Sometimes; 3 = Often; 4 = Always' for *frequency*, and '0 = No; 1 = Little; 2 = Moderate; 3 = Very; 4 = Extremely' for *severity*. In order to fit into conditions in Vietnamese Construction Industry (VCI), a pilot test was performed for preliminary questionnaire. Six experts in VCI were involved in this pilot test. They are two senior university lecturers in construction management; one city officer in Department of Construction, one public owner, one contractor and one professional project manager. Both of them have at least twelve years of experience in construction industry. They were asked to critically review the design and structure of the questionnaire. Their valuable comments were used to revise the research questionnaire. After revising the questionnaire, the second pilot questionnaire was resent to these six experts. At this time, the comments received were positive and no change was necessary. The questionnaire was ready to survey. It is impractical to separate construction managers from designers/consultants in Vietnam since there are no specialized construction management firms (Long *et al.*, 2004b).

In the structured part of the questionnaire, twenty one causes drawn from previous steps are listed in six respective groups:

- Owner-related group consists of financial difficulties of owner and slow payment of completed works.
- Contractor-related group involves poor site management and supervision, financial difficulties of contractor, obsolete or

unsuitable construction methods, inaccurate estimates, incompetent subcontractor and mistakes during construction.
- Consultants-related group consists of poor project management assistance, poor contract management, slow inspection of completed works and mistakes in design.
- Project-related group comprises design changes, additional works and slow information flow between parties.
- Material and labor group involves shortages of materials and shortages of skilled workers.
- External factors-related group consists of unforeseen site conditions, price fluctuations, bad weather and obstacles from government.

In addition, the respondents could add other causes that they experience in their projects. These very few added causes, however, are not significant additions.

4. Characteristics of Respondents

Face-to-face delivery are preferred to promote respondents and raise the response rate but several different means such as email and post are also employed. A total of 285 questionnaires are sent to construction professionals involved in large projects. The chosen projects locate in Ho Chi Minh City, Vung Tau, Binh Duong and Long An. These provinces are robustly developing economics zones in Vietnam. Questionnaires are collected and statistically processed by SPSS V13. Before analyzing, the incomplete data are eliminated to ensure they are adequate and appropriate for statistical testing. Eighty-seven full responses are obtained showing a response rate of 30.5%. Cronbach's alpha coefficients of internal consistency reliability tests for level of frequency responses and degree of severity responses are 0.717 and 0.701 respectively.

The response rate from contractors, owners and consultants is 43.7%, 33.3%, 23% respectively. Regarding number of years involved in construction, 37.9% of respondents have less than or equal to 5 years, 44.8% of those have between 5 and 10 years and 17.3% of those have 10 years or more. It would be better if the percentage of respondents whose experiences are 10 years or more can be increased. But these ratios reflect the current phenomenon of VCI, that is a large amount of young practitioners have been graduated in recent years to meet the vast human demand, and they have got high positions in their organizations.

Regarding type of projects involvement, 75.9% respondents are involved in building and industrial projects, 17.2% in hydroelectric and irrigation projects, 4.6% in bridge and road projects and 2.3% in others. Since most of the respondents are from building engineering sector, the survey results highlight the abundance of building and industrial projects.

5. Index Analysis

The data are processed through three types of indices:

• *Frequency index*: This index expresses occurrence frequency of factor responsible for delay and cost overruns. It is computed as per following formula:

$$F.I. = \frac{\sum_{0}^{4} a_i n_i}{4N} \quad (1)$$

where: a = constant expressing the weight assigned to each responses (ranges from 0 for *No happen* to 4 for *Always*), n = frequency of each response, N = total number of responses.

• *Severity index*: This index expresses severity of factor that caused delay and cost overruns. It is computed as per following formula:

$$S.I. = \frac{\sum_{0}^{4} a_i n_i}{4N} \quad (2)$$

where: a = constant expressing the weight assigned to each responses (ranges from 0 for *No Severe* to 4 for *Extremely*), n = frequency of each response, N = total number of responses.

• *Importance index*: This index expresses the overview of factor based on both their frequency and severity. It is computed as per following formula:

$$IMP.I. = F.I. \times S.I. \quad (3)$$

6. Ranking of Factors

6.1 Ranking of Causes in Terms of Occurrence and Severity

Table 1 and 2 show the frequency indices, the severity indices of twenty one causes and their rankings. These causes are rated by three different respondent groups. It can be seen from these two tables that there is nearly no difference in the ranking orders of occurrence and severity by overall. It means that the more the cause frequently happens, the more it severely impacts the project duration and budget. The deviation of the occurrence ranking order from the severity ranking order in each respondent group is small and can be negligible. The first five causes in overall ranking have a good agreement between three parties of projects. However, there is a closer consensus between consultants and overall.

Poor site management and supervision, poor project management assistance, financial difficulties of owner and financial difficulties of contractor are ranked as the first problems. All these problems belong to three different parties. Two of them are financial difficulties which are popular in developing countries. The other two relate to incompetence and inexperience of human resources in large projects in Vietnam. Contractors accept their weakness in site management and supervision. Contractors and owners have opposite views about financial issues. This contradiction is possibly due to the culture within project or the expectation of one party to the other.

From fifth to twelfth, all causes have both F.I. and C.I. higher than 0.6. In this range, problems relate to all categories except

Table 1. Frequency Index and Ranking

Causes	Overall		Owner		Contractor		Consultant		Group
	F.I.	Rank	F.I.	Rank	F.I.	Rank	F.I.	Rank	
Poor site management and supervision	0.813	1	0.786	3	0.829	1	0.825	1	Contractor
Poor project management assistance	0.798	2	0.821	1	0.778	3	0.800	2	Consultant
Financial difficulties of owner	0.780	3	0.714	7	0.819	2	0.800	2	Owner
Financial difficulties of contractor	0.768	4	0.810	2	0.722	4	0.789	4	Contractor
Design changes	0.707	5	0.724	5	0.697	6	0.700	5	Project
Unforeseen site conditions	0.650	6	0.760	4	0.632	7	0.529	16	External
Slow payment of completed works	0.645	7	0.655	9	0.622	8	0.675	6	Owner
Inaccurate estimates	0.635	8	0.643	11	0.622	8	0.650	7	Consultant
Shortages of materials	0.628	9	0.558	16	0.711	5	0.556	12	Material/labor
Mistakes in design	0.626	10	0.724	5	0.618	10	0.500	18	Consultant
Poor contract management	0.610	11	0.661	8	0.605	14	0.550	14	Consultant
Price fluctuations	0.606	12	0.648	10	0.618	10	0.525	17	External
Obsolete or unsuitable construction methods	0.594	13	0.536	18	0.608	13	0.650	7	Contractor
Incompetent subcontractors	0.594	13	0.611	12	0.592	15	0.575	10	Contractor
Slow inspection of completed works	0.585	15	0.556	17	0.611	12	0.579	9	Consultant
Mistakes during construction	0.564	16	0.571	15	0.553	18	0.575	10	Contractor
Slow information flow between parties	0.562	17	0.574	14	0.556	17	0.556	12	Project
Additional works	0.552	18	0.607	13	0.513	19	0.550	14	Project
Shortages of skilled workers	0.518	19	0.481	19	0.566	16	0.474	19	Material/labor
Bad weather	0.446	20	0.370	20	0.487	20	0.474	19	External
Obstacles from government	0.404	21	0.370	20	0.405	21	0.447	21	External

contractor. Consultants are responsible for many problems. External related factors contribute two items. This group, follows the first four causes, is common and has high impacts since Vietnamese practitioners haven't got familiar with large projects.

Less influencing on projects than previous causes, problems ranking from thirteen to eighteen are mainly contributed by contractors and project related issues. Obsolete methods cannot suit the high quality demand and the complexity of large projects. Subcontractors, very often small or medium firms, are inexperienced with this project type. Mistakes occur frequently during construction. All lengthen project duration and put the cost of project up in construction stage. Participants have not perceived the importance of communication that helps an incidental issue could be solved earliest by party best able to manage it or by shared efforts. Additional works, such as removing existing unknown facilities, removing unknown war weaponry, non-value added works, are mentioned as one cause.

Of twenty one problems, shortages of skilled workers, bad weather and obstacles from government have the lowest ranks. Contractors who directly employ workers rate the shortages of skilled workers more critical than the other groups. Construction workers are available but skilled ones qualified for this project type are not. Vietnam is located in tropical zone. The climate in Vietnam is divided into two distinguished seasons. The rainy season with high rainfall and the dry season with high temperature bring about low productivity. Developing infrastructure system is a national strategy. The central government have tried to help the investors especially who invest in large and mega projects. However, bureaucracy and corruption are hardly eradicated.

6.2 Importance of Problems

Table 3 shows the importance indices and rankings of causes consistent with various parties. As importance index is calculated from multiplying frequency index by severity index, rankings of causes based upon IMP.I. have mostly no change. All parties met an agreement that, bad weather and obstacles from government are the least important causes of time and cost extension.

7. Spearman's Rank Correlation

Spearman's coefficient of rank correlation is used to demonstrate whether there is the agreement or disagreement among each pair of parties. Table 4 illustrates the results of Spearman coefficient and significance level calculations. A conclusion can

Table 2. Severity Index and Ranking

Causes	Overall		Owner		Contractor		Consultant		Group
	S.I.	Rank	S.I.	Rank	S.I.	Rank	S.I.	Rank	
Poor site management and supervision	0.817	1	0.786	3	0.829	2	0.842	1	Contractor
Poor project management assistance	0.807	2	0.822	2	0.778	3	0.842	1	Consultant
Financial difficulties of owner	0.795	3	0.741	7	0.834	1	0.800	3	Owner
Financial difficulties of contractor	0.777	4	0.828	1	0.729	4	0.790	4	Contractor
Design changes	0.715	5	0.742	5	0.703	6	0.700	5	Project
Unforeseen site conditions	0.650	6	0.760	4	0.635	7	0.530	16	External
Slow payment of completed works	0.647	7	0.679	9	0.622	9	0.650	7	Owner
Inaccurate estimates	0.643	8	0.679	9	0.611	13	0.650	7	Consultant
Shortages of materials	0.636	9	0.577	16	0.716	5	0.556	12	Material/labor
Mistakes in design	0.634	10	0.742	5	0.622	9	0.500	18	Consultant
Poor contract management	0.625	11	0.679	9	0.608	14	0.579	9	Consultant
Price fluctuations	0.622	12	0.693	8	0.622	9	0.527	17	External
Obsolete or unsuitable construction methods	0.610	13	0.556	18	0.625	8	0.658	6	Contractor
Incompetent subcontractors	0.609	14	0.654	12	0.592	15	0.579	9	Contractor
Slow inspection of completed works	0.587	15	0.574	17	0.615	12	0.553	14	Consultant
Mistakes during construction	0.572	16	0.590	15	0.554	18	0.579	9	Contractor
Slow information flow between parties	0.569	17	0.593	14	0.557	17	0.556	12	Project
Additional works	0.567	18	0.648	13	0.509	19	0.553	14	Project
Shortages of skilled workers	0.525	19	0.500	19	0.568	16	0.474	19	Material/labor
Bad weather	0.458	20	0.404	20	0.487	20	0.474	19	External
Obstacles from government	0.414	21	0.404	20	0.403	21	0.448	21	External

Table 3. Importance Index and Ranking

Causes	Overall		Owner		Contractor		Consultant		Group
	IMP.I.	Rank	IMP.I.	Rank	IMP.I.	Rank	IMP.I.	Rank	
Poor site management and supervision	0.664	1	0.617	3	0.686	1	0.695	1	Contractor
Poor project management assistance	0.644	2	0.675	1	0.605	3	0.674	2	Consultant
Financial difficulties of owner	0.620	3	0.529	7	0.683	2	0.640	3	Owner
Financial difficulties of contractor	0.597	4	0.671	2	0.526	4	0.623	4	Contractor
Design changes	0.505	5	0.537	5	0.490	6	0.490	5	Project
Unforeseen site conditions	0.423	6	0.578	4	0.401	7	0.280	16	External
Slow payment of completed works	0.418	7	0.445	10	0.386	8	0.439	6	Owner
Inaccurate estimates	0.408	8	0.436	11	0.380	12	0.423	8	Consultant
Shortages of materials	0.399	9	0.322	16	0.509	5	0.309	14	Material/labor
Mistakes in design	0.397	10	0.537	5	0.384	10	0.250	18	Consultant
Poor contract management	0.382	11	0.448	9	0.368	14	0.318	12	Consultant
Price fluctuations	0.377	12	0.449	8	0.384	10	0.276	17	External
Obsolete or unsuitable construction methods	0.362	13	0.298	18	0.380	12	0.428	7	Contractor
Incompetent subcontractors	0.362	13	0.400	12	0.351	15	0.333	10	Contractor
Slow inspection of completed works	0.343	15	0.319	17	0.376	13	0.320	11	Consultant
Mistakes during construction	0.322	16	0.337	15	0.306	18	0.333	10	Contractor
Slow information flow between parties	0.320	17	0.340	14	0.309	17	0.309	14	Project
Additional works	0.313	18	0.393	13	0.261	19	0.304	15	Project
Shortages of skilled workers	0.272	19	0.241	19	0.321	16	0.224	20	Material/labor
Bad weather	0.204	20	0.150	20	0.237	20	0.224	20	External
Obstacles from government	0.167	21	0.150	20	0.163	21	0.200	21	External

Table 4. Spearman Rank Correlation

	Frequency index		Severity index		Importance index	
	Spearman rank correlation coefficient	Significance level	Spearman rank correlation coefficient	Significance level	Spearman rank correlation coefficient	Significance level
Owners – Contractors	0.718	0.01	0.768	0.01	0.776	0.01
Contractors – Consultants	0.653	0.01	0.731	0.01	0.693	0.01
Owners – Consultants	0.576	0.05	0.572	0.05	0.581	0.05

be inferred from these results that there is a very good agreement between three parties in ranking these causes despite frequency, severity or importance index. Although some slightly contrary opinions exist between owner and contractor, the highest degree of agreement belongs to this pair (71.8% with frequency, 76.8% with severity and 77.6% with importance indices). The lowest degree of agreement appears between owner and consultant (about 57%). Due to good agreements between parties in ranking causes of delay and cost overruns, all data could be used as a whole for further analysis.

8. Factor Analysis

8.1 Factor Analysis

Factor analysis technique is applied to sort out the main causes of time and cost over runs. However, before applying this technique, 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 not an identity matrix. Kaiser-Meyer-Olkin measure of sampling adequacy is sufficient with the value of 0.635. Both of these parameters justify that the factor analysis can be applicable.

Principal component factor analysis technique is employed. Using latent root criterion we can see that 7 factors can be extracted (with eigenvalues greater than 1). Fig. 1 is the scree plot of twenty one items as analyzed in previous sections. Statistics of initial variance explained and after rotation are shown in Table 5. With seven extracted factors, 64.9% of variance is accounted for schedule and cost extension.

Table 6 shows the seven factor loadings extracted from factor analysis technique except for loading values less than 0.5. The varimax orthogonal rotation of principle component analysis is used in this study to group factors. These seven factors are named:

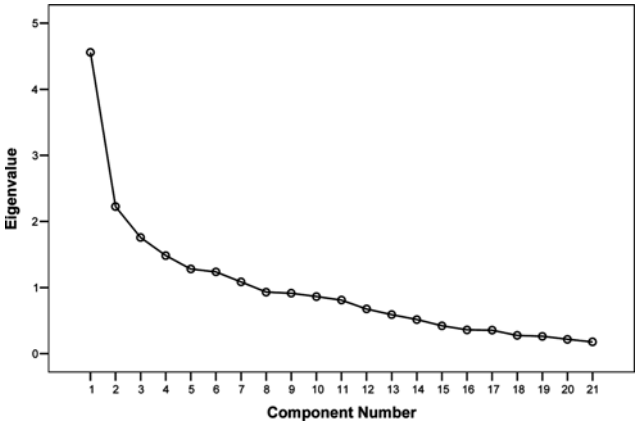

Fig. 1. Scree Plot of Factors

- Slowness and Lack of constraint as *DC1*;
- Incompetence as *DC2*;
- Design as *DC3*;
- Market and Estimate as *DC4*;
- Financial capability as *DC5*;
- Government as *DC6*;
- Worker as *DC7*.

8.2 Discussion of Factor Analysis Results

8.2.1 Slowness and Lack of Constraint

This factor consists of 'slow payment of completed works', 'poor contract management', 'obsolete or unsuitable construction methods' and 'unforeseen site conditions'. This factor relates to all parties. To minimize their consequences, all parties should identify clear responsibility for each party in contract. Slow payment of completed works is a very common complaint

Table 5. Total Variance Explained

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.559	21.712	21.712	2.316	11.029	11.029
2	2.226	10.600	32.311	2.244	10.688	21.717
3	1.757	8.367	40.678	2.198	10.466	32.183
4	1.484	7.064	47.743	2.145	10.214	42.398
5	1.281	6.098	53.840	1.738	8.275	50.673
6	1.237	5.891	59.732	1.609	7.663	58.335
7	1.085	5.167	64.898	1.378	6.563	64.898

Table 6. Factor Analysis Loading Results

Causes	Factors						
	DC1	DC2	DC3	DC4	DC5	DC6	DC7
Slow payment of completed works	0.658						
Poor contract management	0.648						
Obsolete or unsuitable construction methods	0.560						
Unforeseen site conditions	0.519						
Poor site management and supervision		0.869					
Slow information flow between parties		0.679					
Poor project management assistance		0.590					
Mistakes in design			0.796				
Design changes			0.778				
Additional works			0.526				
Shortages of materials				0.774			
Inaccurate estimates				0.699			
Price fluctuations				0.520			
Financial difficulties of contractor					0.787		
Financial difficulties of owner					0.587		
Obstacles from government						0.772	
Shortages of skilled workers							0.675
Bad weather [a]							
Mistakes during construction [a]							
Incompetent subcontractors [a]							
Slow inspection of completed works [a]							

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 9 iterations.
[a]: loading less than 0.5

of contractors about project's client. This cause often exists in government funded project that payment procedure takes a long time. Contract management is always a problem of developing countries. Most cases, many efforts have spent on being awarded contract and paid little attention to contract. Contract related works are regularly poor or cursory so that contract cannot be used as a tool in conflicting resolution. There are many legal documents issued by government trying to instruct or control contract management works in construction but there should be experts and professionals in contract management. Obsolete and inadequate equipments and methods prevent construction works from possibility of acceleration. In large construction project, possession of modern technology is indispensable factor to succeed and sustain (Long *et al.*, 2004a). Many attempts have put into import or transfer technology from other countries and got some first success. But these attempts have just been scattered. One difficulty arises that is how to fit new modern technology to Vietnam and to train human operating this technology. Another rather frequently faced and big adverse affect cause in large projects in Vietnam is unforeseen site conditions which currently lead to delay and more cost. Large projects often mean more complicated design or necessary technology, and in addition, geological conditions change unexpectedly along the length of Vietnam, mainly due to very soft soil. With such these risks, it is necessary to consider the conditions of contract to equitably allocate risks between parties.

8.2.2 Incompetence

'Poor site management and supervision', 'slow information flow between parties' and 'poor project management assistance' create this factor which composed of two most critical causes in large construction projects in Vietnam. This is also all-parties concerned factor. Poor site management and supervision has been tough problem in Vietnam and represented the weakness of contractors. Training skilled human resource in site management is insufficient. Superintendent is often rated on years of experience without updating knowledge. Contractor selection stage must receive more serious consideration. Clients are suggested to

enforce acceptance standards and consider designated site proposals as criterion for tender evaluation (Lo *et al.*, 2006). Testing practically contractors' experience and competency through successful projects in the past should have bigger weight in score-scale of contractor selection. Similarity should apply to consultant selection that requires consultants to demonstrate their satisfaction and ability carrying out their role in all project activities (Lo *et al.*, 2006). Many of researches have done in the world to propose applicable model for contractor selection, Vietnam needs a resemblance. Communication is a critical success factor of construction project. Setting information flows or communication channels between parties that run effectively to quick solve differences, difficulties arising during implementation is not too hard or expensive in the IT (information technology) era. Although project management is now gradually professionalized in Vietnam after applying 'Open door' policy and many foreign project management consultants have been joining to this market, but in fact, this work remains poor (Report of Ministry of Planning and Investment, 2003). Practitioners lack project management skills. Competent project manager and competent project team play a key role in successful project management and in preventing project from delay or extra cost.

8.2.3 Design

In developing country, going with fast swelling of construction industry, it should take more significant care of design-related problems. These are not only found in Vietnam but elsewhere in the world. Design factor is constituted by three variables 'mistakes in design', 'design changes' and 'additional works'. Mistakes in design or poor design come from low-competence of designer have frequently existed. Inspection and approval of design or drawing process has been poor, especially with government-funded projects. Design consultancy organizations have been mushrooming from 2000 but the quantity does not mean the quality. Unrealistic designs lead to changes or owners unclearly specify the scope of project results in projects delayed or postponed. These have reduced project's profits or have caused extravagance. Lo *et al.* (2006) have suggested that comprehensive planning, risk assessment is important at the outset of project. Chan *et al.* (1996) have proposed that design offices should establish a system to control and evaluate variations and an effective contingency plan to deal with unexpected situations. State management of design hasn't been stringent. Applying ISO standard to design works might be a good solution however strict and close management from appropriate authorities or owners is always the best. The more the skilled designer has been identified at the tender stage, the less the cost and time have paid for design-related headache arising later (Chan *et al.*, 1996).

8.2.4 Market and Estimate

'Shortages of materials', 'inaccurate estimates' and 'price fluctuations' have composed the fourth factor. This factor has much effect on construction projects. Large projects need special materials that must be imported from other countries or ordered distinctly wasted project time, human resource. In other hand, the fast development of construction industry demanding a large amount of materials as cement, steel, bricks, etc. have contributed to the shortage of materials and have caused the prices on the rise. This cause has also similar rank in other researches as Kaming *et al.* (1997); Odeh *et al.* (2002); Frimpong *et al.* (2003); Sambasvian *et al.* (2007). Unreliable material suppliers occasioned the blame for lack of materials. Many times, the suppliers are profited from materials speculation. A similarity of ranking between researches can be found with inaccurate estimates. The contractors are ultimate party responsible for poor estimation but owners and consultants are also responsible as Long *et al.* (2004b) suggested. Solutions are just competence and commitment of parties in planning and careful survey. Price fluctuation, escalation in most cases, is rather difficult to predict because it is objective. It is principally the results of the high inflationary trend in developing countries or the speculation of suppliers as mentioned. It should be prepared and approved in such a mechanism in which benefit of parties must be guaranteed and fair.

8.2.5 Financial Capability

This factor comprises two current problems of VCI relating to both owners and contractors financial capability. These two variables ranked third and fourth about their importance on the project delay and cost overruns. Many large construction projects is now delayed (not only in construction stage) because of insufficient fund. Owners should prepare an available fund for project, build financial plan to pay contractor as in contract agreement. On the other hand, contractors must prepare a detail financial plan for project that prove feasibility and it should be submitted and ratified by owner as one of criteria for contract award. Lo *et al.* (2006) found that develop an effective disciplinary mechanism to tackle non-performers by sharing information among clients on the performance of their consultants and contractors as a corresponding mitigation measure.

8.2.6 Other Factors

Other factors, Government and Worker, produce less adverse effects on project during construction phase (ranked 19 and 21). However, practitioners also should pay attention to them to minimize latent risks. Vietnamese government has invited the investment from foreigner and tried to 'red carpet' all investors. Many government-related problems have been reduced. However, corruption, bureaucracy, intricate documentation have still hindered the interest of investors (IER, 2003). The fast development of construction industry demands a large number of workers. Number of construction worker increase year by year following the booming of projects but skilled ones remain inadequacy. The low quality and productivity workers will impact on the progress of projects; especially large construction projects that exploiting complex and modern technology.

9. Comparison with Some Selected Countries

The objective of this section is to get a general view about the causes of time and cost overruns among developing countries and some Asian developed countries through an examination of five major causes from this survey and eight different selected previous studies. The selected researches are up-to-date or have been done in recent years after 2000, the years of recovery and redevelopment after Asian economic crisis. Although these researches are not definitely similar about the purpose and methods of survey, the comparison are useful for understanding the problems of construction projects in developing and Asian countries.

Poor site management and supervision is the most severe in Vietnam (rank 1). It relates to ability of both contractors and consultants. It appears seriously in various countries such as Malaysia (rank 2) and UAE (rank 5). In Korea, a developed country, site-related trouble caused delays but it mainly come from owners and consultants ('changed site conditions' rank 2 and 'failure to provide site' rank 3). Regarding, poor project management assistance, consultants should be responsible. Poor project management assistance consists of project manager and project team who lack of management knowledge and hold low competence. Vietnam has just changed to market economy in recent years. Either quality or quantity of human resources who have expertise in managing and running construction projects is very scarce. A small match with UAE is accepted here ('shortage of manpower', rank 4) because both Vietnam and UAE is still on the learning curve as discussed in Faridi and El-Sayegh (2006).

Finance problems of owner caused schedule and expenditure increase not only in Vietnam but in many other nations, especially in developing nations: Malaysia (rank 4), Ghana (rank 1) and Nigeria (rank 2); and special situation economy, Kuwait (rank 2), with post-invasion of Iraqi. And the financial problems of contractor, the fourth importance factor in Vietnam, exist in Hong Kong, Jordan and Nigeria as first rate and fifth in Ghana. Contractors mostly advance their money for projects and just receive the payment after completing work packages or all project works. If contractors meet financial difficulties, project progression will be affected. This problem is frequent and severe in Vietnam. Low financial capability contractors are frequently awarded contracts due to loose and inexplicit bidding mechanism. Design changes, rank 5 in Vietnam, arise in the form of change orders cause much extra time and cost in almost all economies but rank in first five positions just only in Kuwait and Jordan, where the construction industry is booming.

The five most important causes of delay and cost overruns of Vietnam construction industry, with large-scale projects as representative, also turn up in different countries, but more similar to developing economies. This study contributes to the trend that developing countries have faced analogous problems on the way of advancement.

Table 7. Comparison among Countries

	Major causes				
	1	2	3	4	5
Vietnam (This study, 2007) (1)	Poor site management and supervision	Poor project management assistance	Financial difficulties of owner	Financial difficulties of contractor	Design changes
Malaysia (Sambasivan, 2007) (2)	Improper planning	Site management	Inadequate contractor experience	Finance and payments of completed work	Subcontractors
South Korea (Acharya *et al.*, 2006) (2)	Public interruptions	Changed site conditions	Failure to provide site	Unrealistic time estimation	Design errors
Hong Kong (Lo, 2006) (2)	Inadequate resources due to contractor/lack of capital	Unforeseen ground conditions	Exceptionally low bids	Inexperienced contractor	Works in conflict with existing utilities
UAE (Faridi, 2006) (2)	Preparation and approval of drawings	Inadequate early planning of the project	Slowness of the owner's decision-making process	Shortage of manpower	Poor supervision and poor site management
Jordan (Sweis, 2007) (2)	Financial difficulties faced by the contractor	Too many change orders from owner	Poor planning and scheduling of the project by the contractor	Presence of unskilled labor	Shortage of technical professionals in the contractor's organization
Kuwait (Koushki, 2005) (2)	Change orders	Financial constraints	Owner's lack of experience	Materials	Weather
(3)	Contractor	Materials	Financial constraints	Change orders	Weather
Ghana (Frimpong, 2003) (1)	Monthly payment difficulties	Poor contract management	Material procurement	Inflation	Contractor's financial difficulties
Nigeria (Aibinu, 2006) (2)	Contractors' financial difficulties	Clients' cash flow problem	Architects' incomplete drawing	Subcontractor's slow mobilization	Equipment breakdown and maintenance problem

(1): Delay and cost overruns; (2): Delay only; (3): Cost overrun only

10. Conclusions

By administering and analyzing a questionnaire survey, this research has identified problems related to delays and cost overruns during construction phase and then ranked them from different viewpoints of parties with respect to three types of indices. In overall context, *poor site management and supervision, poor project management assistance, financial difficulties of owner, financial difficulties of contractor; design changes* are five most frequent, severe and important causes. Spearman rank correlation tests result in no significant disagreements between parties of project in respect of ranking these causes. Factor analysis is employed to group them as principal factors. With factor analysis technique, 7 factors are extracted: *Slowness and Lack of constraint; Incompetence; Design; Market and Estimate; Financial capability; Government; and Worker*. A comparison with other selected studies expressed that developing countries have faced analogous problems on the way of advancement. Competency and finance are popular problems.

From these results, again, it is noted that most causes of delay and cost overrun of construction project relate to the human and management problems. Improving ability of managers, engineers working in VCI is necessary and emergent. Training of human resource for construction industry is in vast demand. This is a task that does not only concern quantity but quality also. In Vietnam, training future engineer stresses on structural design and leave a gap in planning, managing and organizing knowledge. Project feasibility study must receive a serious attention and must be done carefully; especially, with government funded projects. A mechanism that closely stipulates feasibility study, contractor selection, financing etc. must have to be built and seriously applied. Consistent models for contractor selection sufficient with project types should be researched and realized in VCI. Alarming from this paper, contract management work should be focused. Although Vietnamese government has regulated many decrees or circulars ruled this work and published contract template, it always needs professionals to do contract work and suit template to real project conditions.

The findings could help the practitioners to gain better understanding about the problems influencing on budget and time of large projects during 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. The research findings are not useful for only participants in VCI but others in developing countries.

Researches to build practical models assessing the changes of schedule and cost that fit VCI circumstances are now prospective and necessary. Nowadays, there have been many efforts focused on this domain such as mathematical models, artificial intelligence models etc. But in fact, these efforts are scattered and haven't been appraised. The results from this research can be used as input variables in such models.

References

Acharya, N.K., Lee, Y.D., and Im, H.M. (2006). "Investigating delay factors in construction industry: A Korean perspective." *Korean Journal of Construction Engineering and Management*, Vol. 10, pp. 177-190.

Aibinu, A.A. and Odeyinka, A. (2006). "Construction delays and their causative factors in Nigeria." *J. Constr. Eng. Management,* ASCE, Vol. 132, No. 7, pp. 667-677.

Assaf, S.A. and Al Hejji, S. (2006). "Causes of delay in large construction projects." *Int. J. Project Management*, Vol. 24, pp. 349-357.

Berstein, S. and Bernstein, R. (1999). *Elements of statistics*, Schaum's Outlines Series, Mc Graw-Hill.

Chan, D.W.M. and Kumaraswamy, M.M. (1996), "An evaluation of construction time performance in the building industry." *Building and Environment*, Vol. 31, No. 6, pp. 569-578.

Chang A. Shing-Tao (2002). "Reasons for cost and schedule increase for engineering design projects." *J. Management Eng.,* ASCE, Vol. 18, No. 1, pp. 29-36.

Dissanayaka, S.M. and Kumaraswamy, M.M. (1999). "Comparing contributors to time and cost performance in building projects." *Building and Environment*, Vol. 34, pp. 31-42.

Faridi, A.S. and El-Sayegh, S.M. (2006). "Significant factors causing delay in the UAE construction industry." *Construction Management and Economics*, Vol. 24, No. 11, pp. 1167-1176.

Frimpong, Y., Oluwoye, J., and Crawford, L. (2003). "Causes of delay and cost overruns in construction of groundwater projects in a developing countries; Ghana as a case study." *Int. J. Project Management*, Vol. 21, pp. 321-326.

Vietnam General Statistics Office[1] (GSO[1]). *Report of Gross domestic product* (Vietnamese), retrieved at: http://www.gso.gov.vn/default.aspx?tabid=388&idmid=3&ItemID=4751

Vietnam General Statistics Office[2] (GSO[2]). *Report of Capital investment of Vietnamese industries* (Vietnamese), retrieved at: http://www.gso.gov.vn/default.aspx?tabid=392&idmid=3&ItemID=6218

Institute for Economic Research (IER) – Hochiminh City (2003). *Results of economic integration and WTO participation preparation – report of HCM City vice chairman Nhan N.T.* (Vietnamese) retrieved at: http://www.vienkinhte.hochiminhcity.gov.vn/xemtin.asp?idcha=1862&cap=4&id=1865

Kaming, P.F., Olomolaiye, P.O., Holt, G.D., and 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, pp. 83-94.

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 Economics*, Vol. 23, No. 3, pp. 285-294.

Kumaraswamy, M.M. and Chan, D.W.M. (1998). "Contributors to construction delays." *Construction Management and Economics*, Vol. 16, No. 1, pp 17-29.

Lo, T.Y., Fung, I.W.H., and Tung, K.C.F. (2006). "Construction delays in Hong Kong civil engineering projects." *J. Constr. Eng. Management,* ASCE, Vol. 132, No. 6, pp. 636-649.

Long, N.D., Ogunlana, S.O., and Lan, D.T.X. (2004a). "A study on project success factors in large construction projects in Vietnam." *Journal of Engineering, Construction and Architectural*, Vol. 11, No. 6, pp. 404-413.

Long, N.D., Ogunlana, S., Quang, T., and Lam, K.C. (2004b). "Large

construction projects in developing countries: a case study Vietnam." *Int. J. Project Management*, Vol. 22, pp. 553-561.

Mansfield, N.R., Ugwu, O.O., and Doran, T. (1994). "Causes of delay and cost overruns in Nigeria construction projects." *Int. J. Project Management*, Vol. 12, No. 4, pp. 254-260.

Ministry of Planning and Investment (2003). *Report of supervision and assessment works in 2003*, Number:799/BKH-ĐT&GSĐT (Vietnamese).

Odeh, A.M. and Battaineh, H.T. (2002). "Causes of construction delay: Traditional contracts." *Int. J. Project Management*, Vol. 20, pp. 67-73.

Ogunlana, S.O, Promkuntong, K., and Jearkjirm, V. (1996). "Construction delays in a fast-growing economy: comparing Thailand with other countries." *Int. J. Project Management*, Vol. 14, No. 1, pp. 37-45.

Sambasivan, M. and Soon, Y.W. (2007). "Causes and effects of delays in Malaysian construction industry." *Int. J. Project Management*, Vol. 25, pp. 517-526.

Sekaran, U. (2003). *Research methods for business*, A Skill Building Approach, 4th Ed., John Wiley & Sons Inc.

Sweis, G., Sweis, R., Hammad, A.A., and Shboul, A. (2007). "Delays in construction projects: The case of Jordan." *Int. J. Project Management*, Article in Press.