Causes of Construction Delays of Apartment Construction Projects: Comparative Analysis between Vietnam and Korea

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Abstract

Construction delay caused considerable losses to project parties. Avoiding construction delays is important to save costs for project stakeholders. The main objective of this paper is to identify major causes of construction delays of apartment construction projects in Vietnam. Sixteen causes of delay were identified through a questionnaire survey of 166 professionals. Factor analysis was employed to categorize these causes. The results of the survey revealed the main causes of delay of apartment projects in Vietnam are: (1) owner's and contractor'S financial difficulties; (2) lack of experienced contractors; (3) late delivery of materials; (4) late construction site handover; (5) owner's late payments for completed works; (6) low bid prices; (7) inappropriate construction method; and (8) defective works and unnecessary reworks. Factor analysis uncovered that causes of delay can be grouped under five categories labeled the five INs: incompetence, ineffectiveness, inadequateness, inapplicableness and inconceivableness. Comparative analysis between the Vietnam construction industry (VCI) and the Korea construction industry (KCI) has been performed to infer valuable lessons for researchers and practitioners in the VCI and the KCI. Comparative analysis indicated that main causes of delay in the VCI somewhat differ from main causes of delay in the KCI. However, "contractor'S financial difficulties", "late construction site handover", "unnecessary rework", "incapable designers", "site clearance difficulties" are common causes of delay in the VCI as well as the KCI. The findings of this research can be used as a guideline to overcome problems in the VCI as well as in other construction industries. Since Korea has emerged as the first largest foreign investor in Vietnam, the results of this study may be useful not only to practitioners and researchers in Vietnam but also to participants in Korea.

Key Words: apartment projects, causes of delay, comparative analysis, empirical study, factor analysis, Korea, time overruns, Vietnam.

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1. Introduction

It is widely accepted that delays happen in most construction projects. Construction delays may result from inclement weather, late site handover, design changes, inexperienced management, site congestion, labor strikes, poor site management, material shortage and so on. Construction delays may cause considerable losses to project parties. Therefore, avoiding construction delays is important to save costs for project stakeholders and for the country as a whole.

Many people appraise Vietnam as a promising economy, thus there is a boom of the VCI. However the construction environment in Vietnam is risky due to poor infrastructure, backward management mechanisms, and a bureaucratic local government. Similar with other developing countries, such as Nigeria (Mansfield et al., 1994), Saudi Arabia (Assaf et al., 1995), Jordan (Sweis, 2007), Thailand (Ogunlana et al., 1996), Malaysia (Othman et al., 2006), and Indonesia (Kaming et al., 1997), Vietnam suffers from construction delays. As a result, a distinct need has emerged for identifying major causes of construction delays in the VCI.

The miraculous growth of Vietnamese economy during the past ten years leads to a boom of apartment construction projects. However, delays in apartment projects are still common in the VCI. As a common Vietnamese saying goes, "Problems with causes well identified are problems better-solved"; thus, identifying major causes of construction delays in apartment projects is a distinct need to avoid or reduce such delays in the VCI.

The objectives of this paper are:

(1) To identify major causes of construction delays on apartment construction projects funded by private owners;

(2) To analyze the relationships of these causes and thereby provide insight into construction delays in the VCI; and

(3) To compare the results of this study with the previous study from Korea.

Korea has emerged as the first largest foreign investor in Vietnam, pouring over 4.2 billion USD in 403 projects in 2007 (VNA, 2007). In the past eleven months, Korea businesses registered for additional 732 million USD (VNA, 2007a). Vietnam and the Korea have enjoyed steady growth in trade and investment. Two-way trade revenues increased to over 4.7 billion USD in 2006 from 490 million USD in 1992 (VNA, 2007b). Therefore, the results are useful not only to practitioners and researchers in Vietnam but also to participants in Korea and other regions.

2. Literature review

2.1 Factors influencing on construction delays

Major factors causing delays in construction projects have been reviewed and critically evaluated in many scientific journals and reports. Since delay with unclear definition can lead to misleading conclusions, the definition of delay must be explained clearly. In this paper, construction delay is defined as the time overrun beyond completion date specified in a contract of a construction project (Assaf and Al-Hejji, 2006). Based on the underlying relationships, delay factors can be grouped under nine categories. The categories are owners, contractors, consultants, materials, workforce, equipment, environment, and project characteristics. A summary of each category is as follows:

- Owner-related factors are factors caused by clients or project owners. Late payment for completed works (Mansfield et al., 1994; Frimpong et al, 2003), financial difficulties (Assaf et al., 1995; Odeh and Battaineh, 2002), slow decision making (Arditi et al., 1985; Ogunlana et al., 1996), inadequate supervision (Sanvido et al., 1992), inexperience management (Mulholland and Christian, 1999) poor communication (Sullivan and Harris, 1986; Dozzi et al., 1996) are typical factors cited in scientific journals.
- Contractor-related factors are factors attributable to

contractors. Construction errors (Mansfield et al., 1994; Mulholland and Christian, 1999), poor site management (Ogunlana et al., 1996; Chan and Kumaraswary, 1999; Odeh and Battaineh, 2002), improper planning and scheduling (Arditi et al., 1985; Ogunlana et al., 1996), inaccurate estimation (Assaf et al., 1995), inadequate experience (Odeh and Battaineh, 2002), poor contract management (Mansfield et al., 1994; Odeh and Battaineh, 2002), poor labor skills (Assaf et al., 1995) are common factors identified in previous studies.

- Consultant-related factors concern factors caused by consultants or designers. These factors may include design changes (Yates, 1993; Thomas et al., 1999), incomplete drawings and specifications, design errors (Mansfield et al., 1994, Ogunlana et al., 1996, Odeh and Battaineh, 2002), experience of the design team (Daoud, 1997; Sanvido et al., 1992), undefined scope (Songer and Molenaar, 1997), approval of drawings (Odeh and Battaineh, 2002; Arditi and Gunaydin, 1998), uncompromising attitude (Ogunlana et al., 1996).
- Material- and equipment-related factors are input factors of the construction process relating to materials and equipment domain, respectively. Shortage or late delivery of materials (Sullivan and Harris, 1986; Yates, 1993; Ogunlana et al., 1996; Mulholland and Christian, 1999; Thomas et al., 1999), availability and quality of equipment (Amirkhanian and Baker, 1992; Mulholland and Christian, 1999), low productivity of equipment (Assaf and Al-Hejji, 2006) are typical factors in this category.
- Workforce-related factors are factors in labor domain. They may include labor shortage (Arditi et al., 1985; Assaf et al., 1995; Odeh and Battaineh, 2002), labor dispute (Maloney and McFillen, 1986), labor strikes (Burleson et al., 1998), unqualified workforce, and personal conflicts among labors (Assaf and Al-Hejji, 2006).
- Environment-related factors are exogenous factors such as inclement weather (Sullivan and Harris, 1986; Mansfield et al., 1994; Odeh and Battaineh, 2002), changes in government regulations and laws, traffic control and restriction at jobsite (Thomas and Napolitan, 1995; Fisher and Rajan, 1996; Assaf and Al-Hejji, 2006), site conditions (Russel, 1993; Mulholland and Christian, 1999, Ng et al, 1998), slow municipality permits (Ogunlana et al., 1996; Odeh and Battaineh, 2002), excessive bureaucracy (Mansfield et al., 1994), community attitude toward a construction project (Assaf and Al-Hejji, 2006).
- Project-related factors are factors deriving from the project characteristics and the project delivery system. Unrealistic contract duration, ineffective delay penalties (Ogunlana et al., 1996; Assaf and Al-Hejji, 2006), type of project biding and award, and type of construction contract (Othman et al., 2006) are typical factors in this category

The existing literature on construction delays indicated that human and management factors are major sources of construction delays. Thus those human- and management-related factors are integral parts of a list of factors investigated to gain insight into delays in construction.

2.2 Previous studies on major causes of construction delays in the South-east Asia

There were few studies of causes of construction delays in Vietnam and South-east Asia. Table 1 presents a summary of previous studies on causes of construction delays in South-east Asia. Design changes, shortage of construction materials, inadequate contractor experience, and site management problems were found to be common cause of delays in construction projects.

3. Research method

3.1 Conceptual research framework

Table 1. Summary of previous studies of causes delays in construction projects (South-East Asia)

Major causes of construction delays	Authors	Country
● Change order ● Incomplete drawings ● Shortage of design professionals ● Materials management problems ● Deficiencies in organization of contractors ● Shortage of construction materials ● Late delivery by suppliers	[1]	Thailand
● Design changes ● Inadequate planning ● Inaccuracy of materials estimate ● Poor labor productivity ● Inaccuracy prediction of craftsmen production rate ● Materials shortage ● Skilled labor shortage	[2]	Indonesia
● Factors related to project characteristics ● Factors related to excusable delays	[3]	Malaysia
● Contractor's improper planning ● Contractor's poor site management ● Inadequate contractor experience ● Inadequate client's payments for completed works ● Problems with subcontractors ● Shortage in material ● Labor supply ● Equipment availability and failure	[4]	Malaysia
● Design changes ● Site congestion ● Weather events ● Differing site conditions	[5]	Singapore

References: [1] Ogunlana et al, 1996; [2] Kaming et al., 1997; [3] Othman et al., 1988; [4] Sambasivan and Soon, 2007; [5] Ng et al, 1998

Table 2. Respondent profile

Respondent group	Distribution	Responses
Owners	55	31
Site supervisors	45	26
Designers/consultants	50	28
Contractors	130	81
Total	280	166

Since selection of appropriate framework is important to gain a good study, the frameworks of previous studies on construction delays were adapted to ascertain the conceptual research framework (Figure 1). Identifying potential delay factors is the importantly initial step of this research.

3.2 Questionnaire

A set of potential delay factors was uncovered from a rigorous literature review of previous studies on construction delays. Unstructured interviews were the appropriate selection to add or remove potential factors during the preliminary questionnaire design. In order to be suitable for the VCI conditions, the preliminary questionnaire was tested. An expert group of five practitioners and three researchers was involved in the pilot test. Test participants were asked to revise the final survey questionnaire. This provided 42 potential delay factors. The final survey questionnaire was designed and distributed to a random sample of owners, site supervisors, designers and contractors, in the filed of apartment projects in Ho Chi Minh city, Vietnam. The respondents rated factors using five-point Likert-scale rating (from 1=' not important to construction delays' to 5=very important to construction delays'). Before questionnaire distribution, respondents were also explained that construction delay means the time overrun beyond completion date specified in a contract of a construction project (Assaf and Al-Hejji, 2006).

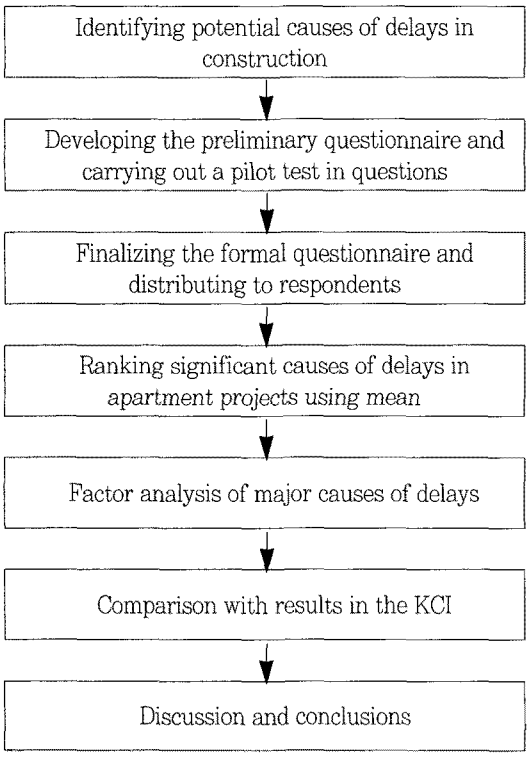

Figure 1. The conceptual research framework

3.3 Data collection

Two hundred and eighty questionnaires were distributed. The authors received 166 responses showing a response rate of 59%. This rate is appropriate for surveys in the construction industry (Arditi et al., 1985). Data analysis ascertained 16 significant delay factors having the mean value higher than 3.5. Standard deviation of these significant factors was small enough to conclude the respondents agreed on its significance. In addition, the reliability analysis resulted in Cronbach' S alpha coefficient to be 0.808. This coefficient is large enough to confirm the reliability of the measure scale used in the questionnaire

The large proportion (58%) of top (48%) and functional managers (10%) reflected the reliability of collected data for identifying factors affecting the construction delay (Table 2). The proportions of the respondents in terms of number of years involved in construction were: less than or equal to 5 years (29%), between 5 and 10 years (52%), and 10 years or more (19%). It would have been better if the proportion of respondents with 10 years or more could be increased.

4. Findings and analysis

4.1 Average of time overrun in apartment projects

The respondents were asked to express the proportion of all projects that they had been involved with that were delayed. More than two-third of them confirmed that they have often encountered construction delay whereas 4% of them rarely encountered and 24% of them always encountered. This implied that the construction delay is 'common disease' s in the VCI. In addition, about 46% of respondents indicated that the average of time overrun is between 10% and 20% of the original construction duration while 24% of them confirmed it took more than 20% of the construction duration.

Table 3. Significant causes of delay in apartment construction projects

Factor group	Causes of delay	Overall		Mean of each respondent group			
		Mean	Rank	Owners	Site supervisors	Designers	Contractors
POW	Financial difficulties of owners	4.23	1	4.26	4.19	4.25	4.23
COT	Lack of experienced contractors	4.13	2	4.29	4.27	3.82	4.14
MAT	Late delivery of materials	4.07	3	4.35	3.92	3.89	4.07
COT	Financial difficulties of contractors	3.98	4	4.35	3.85	3.79	3.94
POW	Late site handover	3.94	5	3.87	3.81	3.96	4.00
POW	Late payments by owners for completed works	3.80	6	3.48	3.69	3.46	4.07
COT	Low awarded bid prices	3.73	7	3.52	3.27	3.75	3.96
COT	Inappropriate construction methods	3.70	8	3.81	3.54	3.61	3.74
COT	Defective works and unnecessary reworks	3.67	9	3.87	3.58	3.54	3.68
CET	Escalation of material prices	3.66	10	3.87	3.15	3.50	3.79
COS	Incapable site supervisors	3.64	11	4.00	3.42	3.29	3.70
CET	Inclement weather	3.63	12	3.61	3.81	3.54	3.62
POW	Site clearance difficulties of owners	3.57	13	3.39	3.73	3.54	3.59
POW	Incapable owners/project managers	3.56	14	3.71	3.58	3.50	3.52
COS	Shortage of design professionals	3.55	15	3.97	3.23	3.11	3.64
COT	Shortage of equipment	3.52	16	3.68	3.73	3.11	3.53

Note: CET=construction environment; COS=consultants/designers; COT=contractors; MAT=materials; POW=project owners

4.2 Ranking of major causes of delays

Data analysis uncovered that human- and management-related causes are prominent. Table 3 shows the most 16 significant delay factors that influenced the construction delay. The top main causes of delay in construction of building projects and industrial construction projects included financial difficulties of owners and contractors, lack of experienced contractors, late delivery of materials, late site handover, late payments by owners for completed works, low bid prices, inappropriate construction method, and defective works and unnecessary reworks.

Contractors and designers/consultants ranked 'Financial difficulties of owner' s as first rank. An acceptable explanation is that shortage of national budget and bureaucratic procedures in payments issued by the local authorities are the main causes of this situation. The Vietnamese government, a large customer of the VCI, empowered local authorities to undertake, as essential owners, medium and large projects. Thus financial difficulties in national budget of local government may cause serious problems in payments for completed construction works.

As shown in Table 3, all respondent groups considered' Lack of experienced contractors' as the second rank. In Vietnam, there are no specialized construction management firms (Long et al., 2004); therefore, weak capacity of project management units (PMU) may cause delays in procurement or faults in bid selection process. As a result, most contracts may be entrusted construction works to inexperienced contractors.

Owners evaluated "Late delivery of materials" and "Financial difficulties of contractors" as the first source of delay. These imply that weak competence of project managers/owners in procurement planning and contract management resulted in project delay. These problems seem very popular in developing countries (Koushki et al., 2005; Assaf and Al-Hejji, 2006).

According to Table 3, 'Shortage of design professionals' and was ranked relatively low by all parties. Notably, owners rated this factor as important whereas contractors and consultants evaluated unimportant. Since the VCI is still the labor-intensive industry (Long et al., 2004) the lowest significant factor attributing to the cause of delay in construction projects in Vietnam is shortage of equipment.

4.3 The attitudes of different project parties towards major causes

Table 4. The results of Spearman' s test

Respondent group	Spearman's correlation coefficient	Significance level
Owners - Site supervisors	0.694	0.01
Site supervisors - Designers	0.851	0.01
Designers - Contractors	0.838	0.01
Owners - Contractors	0.754	0.01

To uncover the attitudes of different project parties towards major causes, the Spearman' S correlation test was applied. There were strong agreements on the rank regarding degree of importance. The Spearman' S correlation coefficients for ranking of the importance of causes between site supervisors and designers, designers and contractors, contractors and owners and owners and site supervisors are 0.851, 0.838, 0.754, and 0.694, respectively (Table 4). The above results of statistical tests suggest that there is a high degree of agreement between all respondent groups. As a result, there is no attempt to analyzing data towards different groups. The overall point of view is reasonable.

4.4 Factor analysis of major causes

Factor analysis (FA) is an appropriate solution to obtain multivariate interrelationships existing among the major causes because of its usefulness in analyzing the structure of the correlations among large number of variables by defining a set of common underlying dimensions, known as factors or components (Hair et al., 1998). The main benefits of factor analysis are: (1) exposing the hidden dimensions or constructs which may or may not be apparent from direct analysis; (2) reduction

of number of variables, by combining two or more variables into a single factor; (3) identification of groups of inter-related variables, to see how they are related to each other; and (4) focusing analyst' S attention on the unique core elements instead of the redundant attributes.

The top-sixteen highly-ranked causes were selected for factor analysis because of their significant importance. The means of these factors were greater than 3.5 and their standard deviation values were less than 1.083 on a scale of 1-5. Hair et al. (1998) suggested that each variable' S communality should be equal to, or greater than, 0.5 to have sufficient explanation. Consequently, two causes - late site handover and owner' S site clearance difficulties - were absent from factor analysis. The remaining 14 causes of delays were appropriate for factor analysis.

According to Sharma (1996), there are rules of thumb required to ascertain that the present data set are appropriate for factor analysis. They are the Bartlett' S test for sphericity and the Kaiser-Meyer-Olkin (KMO) measure. The Bartlett' S test sphericity, also called the test of identity matrix, is a statistical test to assess whether or not the correlation matrix is appropriate for factoring (Sharma, 1996). For the collected data set, the SPSS package resulted in the Bartlett' S test statistic to be highly significant (p=0.000). This indicated that the correlation matrix is not orthogonal (i.e., the major causes are correlated among themselves) (Sharma, 1996). The KMO measure of sampling adequacy is a measure of the homogeneity of variables (Sharma, 1996). Kaiser and Rice (1974) cited in Sharma (1996) suggested that the overall KMO measure should be greater than 0.80; however, a measure of above 0.60 is tolerable. Therefore, the value of the KMO measure of sampling adequacy (0.782) confirmed that the variables were appropriate for factor analysis.

Since an eigenvalue is a measure of how a standard variable contributes to the principle components (Kaming etal., 1997), the important factors are those whose eigenvalues are greater than or equal to 1. Principal component analysis (PCA) produced five extracted factors, with descending order from 4.168 for factor 1 to 1.001 for factor 5 (Table 5). As shown in Table 5, percentage of variance describes proportion of variance explained by each component. For example, component 1 accounted for 29.77% of the variance. Since the interpretation of the factor structure simply results from orthogonal rotations (Sharma, 1996), varimax, which is a popular type of orthogonal rotations, is used to interpret these factors.

Based on varimax rotation, factor analysis uncovered that 14 causes of delays in apartment projects can be grouped under five factors, which can be labeled the five INs: incompetence, inexperience, inadequateness, inapplicability, and inconceivableness (Table 6). Factor 1 labeled 'incompetence' concerns lack of capable human

Table 5. Result of factor analysis using varimax orthogonal rotation

Factor	Factor labels	Causes of delay	Factor loading	Communalities
1	Incompetence	Incapable site supervisors	0.775	0.725
		Low awarded bid prices	0.675	0.568
		Shortage of design professionals	0.662	0.646
		Lack of experienced contractors	0.500	0.584
2	Ineffectiveness	Defective works and unnecessary reworks	0.732	0.626
		Shortage of equipment	0.709	0.533
		Inappropriate construction methods	0.644	0.647
3	Inadequateness	Financial difficulties of owners	0.841	0.798
		Financial difficulties of contractors	0.717	0.690
4	Inapplicableness	Late payments by owners for completed works	0.886	0.837
		Escalation of material prices	0.530	0.741
5	Inconceivableness	Site clearance difficulties of owners	0.809	0.661
		Inclement weather	0.502	0.589

Note: Variables having factor loadings with values less than 0.50 are not shown in the table

resource in the VCI. Factor 2 labeled 'ineffectiveness' concerns lack of effective management at construction sites. Factor 3 labeled 'inadequateness' concerns undercapitalizing for completed construction works. Factor 4 labeled 'inapplicableness' relates to complexity of a payment procedure in Vietnam and poor contract management. Factor 5 named 'inconceivableness' related to unexpected events causing negative impacts to apartment projects.

The communalities of the determinants of delay, as shown in Table 6, describe the proportion of variance in the variables accounted for delays in apartment projects by the extracted factors. For example, 83.7% of variance in "Late payments by owners for completed works" is accounted for delays specified by five extracted factors. Table 6 also presents factor loading of the determinants of delay. It is loosely to explain that factor loading is the correlation coefficient between an original variable or determinant and an extracted factor (Kaming et al, 1997).

5. Discussion of factor analysis results

5.1 Incompetence

Incompetence is 'a serious complaint' in the VCI. This factor consisting of incapable site supervisors, low bid prices, shortage of design professionals, and lack of experience contractors is a serious delay cause for apartment construction projects in Vietnam. Recently, Vietnam has been experiencing a boom in construction due to the continual growth of the Vietnamese economy during the past ten years. This leads to higher demand for investment opportunities and higher demand for capable human resource (HR). However, the HM available in the VCI did not meet the requirements for apartment construction projects. As a result, respondents highly ranked this factor as a major cause of delays.

5.2 Ineffectiveness

Ineffectiveness is widely recognized as a major cause of delays in apartment projects. It reflects that lack of effective construction management may strongly affected construction delays in apartment projects. This factor also indicates that local contractors may face deficiency in site planning and controls. Poor project planning and scheduling at site may resulted in ineffective construction management.

In addition, most apartment projects in Vietnam are high-rise buildings. On high-rise construction, tower cranes, vertical hosts, concrete pumps, and batching plant are needed. Contractors may own the equipment or rent it. However, the equipment available cannot always meet the need, because there are limited hire outlets (Kaming et al., 1997). Consequently, shortage of equipment may perhaps cause delays in apartment projects.

Table 6. Initial statistics of factor analysis causes of delays in apartment projects

Component	Eigenvalue	Percentage of Variance	Cumulative percentage
1	4.168	29.771	29.771
2	1.426	10.184	39.955
3	1.353	9.662	49.616
4	1.240	8.857	58.474
5	1.001	7.148	65.622
6	0.882	6.300	71.922
7	0.780	5.574	77.496
8	0.696	4.970	82.466
9	0.523	3.738	86.204
10	0.487	3.478	89.682
11	0.463	3.304	92.986
12	0.371	2.651	95.637
13	0.326	2.330	97.967
14	0.285	2.033	100.000

Note: Communality of all causes of delay is set equal to 1.0

5.3 Inadequateness

This factor consists of financial difficulties of owners and contractors, which may result from undercapitalizing for completed works. In the three decades since Vietnam has gone from communism to a form of capitalism, it has Asia' S second-fastest-growing economy, with 8.4 percent growth last year (Bradsher, 2006). However, Vietnam is still a relatively poor country with US$726 per capita at the market exchange rate (2006 estimate). The VCI intensively needs funds to meet rapid growth in construction and housing. However, the financial capacity of Vietnamese investors cannot always meet the capital demand. As a result, reliance on a bank loan adds to financial burden on the owner and contractor. Recently, the foreign direct investment (FDI) partially makes up financial shortages in Vietnamese apartment projects. While Vietnam is far from a rich country, high foreign investment may help it to become richer.

5.4 Inapplicableness

This factor consisting of "Late payments by owners for completed works" and "Escalation of material prices" may result from complex procedures in payments and poor contract management. In Vietnam, although private participation has increased for a past decade, the government is still a largest customer of the VCI. The government enacted several decrees and circulars to instruct a payment procedure for completed works. However, these decrees and circulars itself cause inequality in contract relationships between owners and contractors for apartment projects funded by the government. According to Decree 99/2007, owners employ contractors to carry out construction works, but owners have no money to pay for completed construction works. The Treasury directly pays to contractors. Although the Treasury has no responsibility for the confirmation of completed works and corresponding costs, it has the right to check bill of quantities and to cut any amount of work. Therefore, bureaucracy and corruption in the Treasury may bring out late payments for completed works in construction projects funded by the government.

Vietnam has made the shift from a central command-based economy to a market orientation-based economy. Thus the escalation of material prices cannot avoid. Vietnamese contractors are generally employed on unit-price contracts. With the escalation of material prices, owners may suffer from an increase in the fund of apartment projects. As a result, they choose late payments for completed construction works as an easy solution to solve this problem. This can perhaps explain why contractors indirectly blame their difficulties on the owners by ranking 'late payments by owners for completed construction works' 3rd most important cause of delay.

Moreover, since construction works involve huge amounts of money (Sambasivan and Soon, 2007), construction works may be interrupted by late payments by owners because contractors cannot bear construction expenses.

The Federation Internationale Des Ingenieurs-Councils (FIDIC) form of contract, which is popular in developing countries, is rarely used in Vietnam. Most contractors submit low bids, have inability to manage contracts, carelessly consider articles of the contract, and these then bring out much dispute about payments for extra works. In above context, dispute can break construction woks and have strongly influenced on delays.

5.5 Inconceivableness

The interruptions in apartment projects in Vietnam may result from slow project site clearance. According to the Vietnamese Land Law, owners must completely compensate for land used of a new project before starting site clearance. Depending on conditions of each project, local government then allow to clear the whole or partial project area in order to mitigate adverse impacts to local communities. Thus, slow site clearance of the remaining area may cause critical delays. 'Owner' s difficulties in

site clearance' such as funding deficiencies, complex procedures of compensation for land used, slow permits of local governments, conflicts with neighbors may cause slow site clearance and subsequently influence on delay.

In Vietnam, Vietnam has a tropical monsoon climate, with humidity averaging 84 % throughout the year. Annual rainfall is substantial in all regions and torrential in some, ranging from 120 centimeters to 300 centimeters (Wikipedia, 2007). The average annual temperature is generally higher in the plains than in the mountains and plateaus. Except in some of the highlands, seasonal temperatures vary only a few degrees, usually in the 21℉–28℉ range. In addition, Vietnam suffers from at least six typhoons for year. As a result, inclement weather in Vietnam may cause major delays in apartment projects.

6. Comparison with the previous research in the Korea construction industry (KCI)

This survey shows 16 major causes of delays for apartment construction projects in the VCI. Since Korea has emerged as the first largest foreign investor in Vietnam in 2007, a relevant question is "are these causes of delay similar with construction projects in Korea?". In order to answer this question, data from the previous research was assembled for comparative analysis between the VCI and the KCI. Acharya et al. (2006) has studied construction delays in Korea. Therefore, data assembled from this study and the research of Acharya et al. (2006) are shown in the Table 7. Although the purpose and methods of both surveys somewhat differ, the comparison results may provide thorough insight into delays of construction projects between Vietnam and Korea.

"Financial difficulties of contractors" is cited in both studies but it is rather acute in Korea while it has relatively high important in Vietnam. Korea is a developed country, thus Korean contractors may face very few difficulties in project finance. Most Vietnamese contractors are small and medium in size. They often resort to low bid prices to win contracts. Consequently, "Financial difficulties of contractors" is one of major causes of delays in Vietnam.

Although Vietnam and Korea differ from the Law of land used, late construction site handover have highly important in both countries. The Vietnamese owners may face difficulties in compensation for the right land used while the Korean owners suffer from buying the land.

Since "Inadequate experience of contractors" is one of very important cause of delay in Vietnam whereas it

Table 7. Comparison major causes of delay in this study with the previous research in the Korea construction industry

The Vietnam construction industry		The Korea construction industry	
This research (2008)		Acharya et al. (2006)	
Causes of delay	Rank	Causes of delay	Rank
Financial difficulties of owners	1	Interruptions from public	1
Lack of experienced contractors	2	Changed site conditions	2
Late delivery of materials	3	Late construction site handover*	3
Financial difficulties of contractors	4	Unrealistic project time estimation	4
Late construction site handover	5	Design errors	5
Late payments by owners for completed works	6	Slow decisions making in change orders*	6
Low awarded bid prices	7	Excessive extra works	7
Inappropriate construction methods	8	Inadequate early planning by owners	8
Defective works and unnecessary reworks	9	Time taking in obtaining permits from local authority	9
Escalation of material prices	10	Subcontractor abandoned the project in the middle	10
Incapable site supervisors	11	Financial difficulties of contractors*	11
Inclement weather	12	Interruptions by scope changes	12
Site clearance difficulties of owners	13	Incomplete supply of drawings, specifications, etc	13
Incapable owners/project managers	14	Rework due to wrong drawings, etc	14
Shortage of design professionals	15	Force majeure (Acts of God)	15
Shortage of equipment	16	Severe accidents by inexperienced contractors*	16

Note: *: Causes of delay in the KCI were rephrased after discussion with the corresponding author of Acharya et al. (2006).

received low rating in Korea, it may be concluded that this is a special cause of delay of developing economies.

In Vietnam, "Financial difficulties of owners" is an extremely important cause of delay whereas it absent from the context of the KCI. This is very useful for Korean contractors, who would like to win contracts in Vietnam, to prepare articles of construction contracts.

"Interruptions from public" is the leading cause of delay in Korea while it received no rating in Vietnam. A possible explanation is that construction legislation in the KCI is very strict, thus any activity bringing out negative impacts to communities will be interrupted by the local government. It is converse in Vietnam. However, Vietnam was accepted into the WTO on November 7, 2006, thus new legislation is going to be enacted for fulfillment requirements of strictly legal system in the VCI.

Moreover, shortage of manpower is the leading problem in the VCI whereas the KCI faces such problem. Korean investors and contractors should consider this problem when they would like to invest in Vietnam. When implementing any apartment projects in Vietnam, Korean developers should well plan for compensation of the right of land used to remove delays at next stages because well planed apartment projects is well executed.

7. Conclusions

The major objective of this paper is to identify major causes of construction delay of apartment construction projects in Vietnam. Factor analysis was used to uncover interrelations between major causes and then gain insight problems in the VCI. Comparative analysis between the VCI and the KCI has been performed to infer valuable lessons for researchers and practitioners in the VCI and the KCI.

The results of the survey revealed the main causes of delay of apartment projects in Vietnam are: owner' S financial difficulties, contractor' S financial difficulties, lack of experienced contractors, late delivery of materials, late construction site handover, owner' S late payments for completed works, low bid prices, inappropriate construction method, and defective works and unnecessary reworks.

Factor analysis uncovered that identified causes of delay can be grouped under 5 categories labeled the five INs: incompetence, ineffectiveness, inadequateness, inapplicableness and inconceivableness. The results can be used as a guideline to overcome problems in the VCI as well as in other construction industries.

The results of comparative analysis indicated that main causes of delay in the VCI somewhat differ from main causes of delay in the KCI. However, "contractor' s financial difficulties, "late construction site handover", "unnecessary rework", "incapable designers", "site clearance difficulties" are common causes of delay in the VCI as well as the KCI.

The results of this survey can be used to gain better understanding of the VCI. Moreover, the results are useful not only to practitioners and researchers in Vietnam but also to participants in Korea and other regions.

Although extensive efforts were taken into this research, limitations are unavoidable. The survey was made on apartment construction projects located in Ho Chi Minh city, thus it may seem inappropriate to generalize for the whole of Vietnam on the basis of the data. However, a large proportion of apartment projects in Vietnam are located Ho Chi Minh city.

Since the VCI differs from the KCI in terms of the context, comparing causes of delays on apartment projects in the VCI with causes of delays on construction projects in the KCI may not be much meaningful. Moreover, since apartment projects somewhat differ from construction projects, the comparison may be less confident. However, the construction industry across countries still has the same major characteristics.

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