SSRG International Journal of Civil Engineering
ISSN: 2348 – 8352 /doi:10.14445/23488352/IJCE-V6I1P103
Volume 6 Issue 1, 13-21, January 2019
© 2019 Seventh Sense Research Group®

Statistical Analysis of Risks for Construction Projects in Vietnam: from Private Owners' Perspective

Quang-Long Nguyen[#1] and Po-Han Chen[#2]

[#1] *Consultant Engineer, Consultant, and Inspection Joint Stock Company of Construction Technology and Equipment – CONINCO, No. 4, Ton That Tung St., Dong Da Dist., Hanoi, Vietnam.*
[#2] *Professor, Department of Civil Engineering, National Taiwan University, No. 1, Sec. 4 Roosevelt Rd., Da-An Dist., Taipei, 10617 Taiwan.*

Abstract

Asian countries have been playing an important role in the global economy. Besides Japan, China, and India, the ASEAN Economic Community is also a driving force for Asian economic growth. Since some ASEAN counties (e.g., Vietnam, Cambodia, Myanmar, etc.) have similar situations and are in need of construction, it is good to know the potential construction risks in these countries. In this paper, the construction risks in Vietnam are studied from a private owners' perspective.

A total of twenty-two risks related to the economy, politics, management, and law are identified from the literature, followed by pilot surveys with experts with many years of experience in the construction industry in Vietnam. 58 out of 86 questionnaires are collected for factor analysis with the Kaiser-Meyer-Olkin (KMO) and Bartlett's test. After the factor analysis, two politics-related risks are eliminated, leaving twenty risks grouped into six factors. These factors are further processed using a regression model. The results show that the owner's capital has the greatest impact on Vietnam's construction projects, while legal risks have the least. These findings would greatly help private owners plan construction projects in Vietnam and other similar ASEAN counties.

Keywords - *Risk management, factor analysis, multiple regression, construction, Vietnam.*

I. INTRODUCTION

After twenty years of economic reform, Vietnam has become one of the fastest-growing economies in the world. According to the overall ranking of the 2010 A.T. Kearney FDI (directed foreign investment) Confidence Index [1], Vietnam was ranked 12th and considered an attractive environment for foreign investors. With the rapid economic growth in Vietnam, many construction projects are going on, and effective control of project time, budget, and quality becomes an important issue. Moreover, the investments in projects by domestic construction companies have increased significantly, and reached a gross value of 545.2 trillion VND for the entire construction industry in 2010 [2]. In addition, the economic boom has resulted in the growth of Vietnamese construction companies and helped the major players, such as National Vietnam Industrial Construction Corporation (VNIC), Vietnam Construction and Import-Export Joint Stock (VINACONEX., JSC). Consultant and Inspection Joint Stock Company of Construction Technology and Equipment–CONINCO (CONINCO., JSC), successfully expand their businesses overseas.

The rapid growth and expansion of business forced Vietnamese construction companies to adopt modern project management and risk management methods. Due to the uniqueness of the cultural, social, and political situations in Vietnam, fine-tuning project and risk management methods is necessary [3]. In 2011, the Ministry of Construction of Vietnam disclosed in a report that the construction industry in Vietnam still had potential risks and high uncertainties despite some positive measures taken by the government previously [4]. The major problems associated with construction in Vietnam are delay, cost overrun, land acquisition, government efficiency [5]. Besides, Vietnam's economic and banking system is not very mature, which causes problems like inflation, fluctuations of interest rate and exchange rate, etc. For instance, the inflation rate was 6.8% in 2009 but shot up to 11.75% in 2010. The interest rate in Vietnam also has higher fluctuation compared to other ASEAN countries [6]. Ling and Bui studied the risks of foreign companies in Vietnam and found political risks (including corruption, etc.) most significant among all potential risks [3].

In short, Vietnam's construction industry is in urgent need of effective risk management, especially from the private owners' perspective [7]. Thus, this paper aims to identify the risks related to construction projects in Vietnam from various aspects to take appropriate strategies from the private owners' perspective.

This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/)

II. LITERATURE RELATED TO CONSTRUCTION IN VIETNAM

Long et al. researched large construction projects in Vietnam and found sixty-two related problems through a comprehensive survey [5]. These problems were found more related to contractors and consultants than owners and were grouped into five factors through factor analysis. Though these problems were studied and ranked, no mitigation measures were proposed. In 2008, Luu et al. studied a construction company's performance measurement in the An Giang province of Vietnam [8]. This study showed that financial issues were relatively less risky than other factors. It also put forward eleven effective solutions, which were grouped into four categories. It proposed a framework to measure large contractors' performance based on the balanced scorecard (BSC) and strengths-weakness-opportunities-threats (SWOT) approaches. Unlike Long et al.'s work in 2004, Luu et al.'s work was established only upon a single construction company and was not generalized [8]. Thus, Luu et al.'s work was negatively commented on by Ling and Bui in 2010 [3,8]. Ling and Bui showed the major factors affecting construction project output in Vietnam but deemed that their work could not be readily generalized due to reluctant respondents and so on [3]. Ling and Hoang published a paper on the political, economic, and legal risks of foreign companies in international construction projects in Vietnam [9]. However, the authors admitted their work was limited by its small sample size (only 18 experts consulted) and without qualitative evaluation of risk levels.

Because of the works mentioned above' deficiencies, this paper aims to conduct a comprehensive and general study, from private owners' perspective, on the risks related to economy, politics, management, and law in Vietnam with statistical analysis. It is hoped that the results of this study could lead to more successful construction projects in Vietnam.

III. RESEARCH METHODOLOGY

This research started with a comprehensive literature review, followed by summarizing from the literature, twenty-two common risks that affected the success of construction projects in Vietnam [3,5,8-11]. The identified risks were related to economy, politics, management, and law and were compiled for pilot tests by experts afterward. After the pilot tests, a questionnaire comprising the twenty-two risks was sent out to experienced professionals from various parties of construction projects in Vietnam. The collected data were analyzed using SPSS, and the factor analysis was utilized to group the twenty-two risks into six factors. The six factors were then used to run multiple regressions to discover the interrelationships among them and find the degree of influence for each factor on construction projects in Vietnam.

IV. PROJECT RISK MANAGEMENT

Risks exist in most businesses and industries, especially in the construction industry, due to the high uncertainty in the construction process [12-14]. Since risks would usually lead to problems or loss of time, cost, and quality, it is of paramount importance to study all the risks that might affect the contractor and apply project risk management in the course of construction [15-17]. Only with proper project risk management can the contractor well control the time, cost, and quality of a construction project [15,18]. According to "A Guide to the Project Management Body of Knowledge (PMBOK Guide) [19]," project risk management is described as:

"*Project risk management includes the processes of conducting risk management planning, identification analysis, response planning, and monitoring and control on a project. Project risk management objectives are to increase the probability and impact of positive events and decrease the probability and impact of negative events in the project."*

V. QUESTIONNAIRE SURVEY PROCESS

A number of risk-related questions affecting Vietnam's construction projects' success were collected through a comprehensive literature review. After compiling these questions into a preliminary questionnaire, six experienced professionals were invited for a "pilot test" of the questionnaire to screen out redundant or unnecessary questions. Since the six professionals are all top managers in construction companies in Vietnam, the pilot test results should be credible. Moreover, because these professionals were very interested in this research and thought it very practical, they provided lots of valuable suggestions, which contributed to the questionnaire's finalization. The final version of the questionnaire comprises 22 risk factors and a few open-ended questions. The questionnaire was disseminated through E-mail, online web links, and regular mail to many owners, designers, engineers, consultants, and project managers who had at least participated in one construction project in Vietnam from December 2010 to March 2011. Some face-to-face interviews were also arranged for survey data collection.

For each identified risk, the interviewees were asked to rate its criticality and level of influence on a construction project's success in terms of loss of time or cost. A five-point Likert scale was adopted in the questionnaire survey. "1" and "5" indicated "Not critical" and "Extremely critical" in criticality, and indicated "Very low" and "Very high" in the level of influence, respectively (Table 1).

Table 1: Measuring scale used in the questionnaire survey

Rating	Risk criticality	Level of influence
1	Not critical	Very low or Not
2	Fairly critical	Low
3	Critical	Medium
4	Very critical	High
5	Extremely critical	Very high

In the questionnaire survey, 86 questionnaires were sent out, and 58 completed questionnaires were received. The response rate was around 68% and was considered meaningful.

VI. DATA ANALYSIS AND DISCUSSION

The collected data were analyzed using the factor analysis (together with Cronbach's α) and multiple regression analysis. Details of the analyses and discussions are shown below.

A. Background information of survey respondents

58 completed questionnaires out of the 86 disseminated ones were received, achieving a response rate of nearly 68%. The response rate was deemed adequate according to the Kaiser-Meyer-Olkin (KMO) results and Bartlett's test.

For the 58 completed questionnaires, 11 were from directors or managers of construction companies or developers, 17 from vice directors or vice managers, and 30 from engineers/architects (Table 2). 93.1% of the respondents have participated in at least five construction projects in Vietnam, and 53.4% of the respondents have more than ten years of working experience in the construction industry (Tables 3 & 4). Given the respondents' experiences and professionalism, the questionnaire survey results could be considered representative and reliable.

Table 2: Dissemination information of survey questionnaires

Position in construction organization	**Number of questionnaires disseminated** (1)	**Number of questionnaires completed** (2)	**Response rate %** $(3)=\frac{(2)}{(1)}*100\%$
Director/Manager	20	11	55.0%
Vice Director/ Vice Manager	26	17	65.4%
Engineer/Architect	40	30	75.0%
Total	86	58	67.4%

Table 3: Number of projects involved by respondents

No. of projects	**Frequency**	**%**	**Cumulative %**
≥ 10 projects	36	62.1	62.1
5-10 projects	18	31.0	93.1
≤ 5 projects	4	6.9	100
Total	58	100	

Table 4: Number of years of experience of respondents

No. of years	**Frequency**	**%**	**Cumulative %**
> 10 years	31	53.4	53.4
≤ 10 years	19	32.8	86.2
≤ 05 years	8	13.8	100
Total	58		

B. Reliability of collected data

The reliability or internal consistency of the collected data was measured using the "Cronbach's α." According to Peterson, if a Cronbach's α is between 0.8 and 1, the scores (i.e., survey data) are considered reliable [20]. A Cronbach's α between 0.7 and 0.8 could be acceptable depending on the objective and context of research.

Cronbach's α of the collected survey data calculated using SPSS is 0.890, which indicates the good reliability or internal consistency of the collected data (Table 5). Table 6 shows the values of Cronbach's α when an item is removed, in turn, from the pool of items. Since all the values are greater than 0.8, it indicates that the questionnaire's risk-related items were properly designed and the survey results (or the scores) were reliable. Because of the items' strong internal correlations, there is no need to eliminate any of them in the analysis.

Table 5: Cronbach's α of the collected data

Reliability Statistics	
Cronbach's α	Number of items/variables
0.890	22

Table 6: Assessment of reliability when an item is removed

No.	**Code**	**Item**	**Cronbach's α if this item is removed**
1.	E-1	Unusual fluctuation in foreign exchange and convertibility	0.889
2.	E-2	The state of flux of interest rate and inflation rate	0.886
3.	E-3	Escalation of material, machine price, and employee wage	0.895
4.	E-4	Unfair competition with state-owned enterprises	0.884
5.	E-5	Cost overrun	0.891
6.	E-6	Risk in an investment capital of Owner	0.886
7.	P-1	Change in Vietnamese Law system	0.885
8.	P-2	Expropriation of ownership	0.882
9.	P-3	Corruption from government agencies	0.892

10.	P-4	Unstable political apparatus	0.886
11.	Mr-1	Slow approval and permit for the project	0.883
12.	Mr-2	Government policies are unjust	0.884
13.	Mr-3	Inconsistence and overlapped levels of the government system	0.879
14.	Mr-4	Unprofessional project management	0.883
15.	Mr-5	The weak management capacity in projects implementation with foreigner partners	0.888
16	Mr-6	The incompetence of involved parties in the projects	0.886
17.	Mr-7	Lack of competent human resources	0.884
18.	Mr-8	Unforeseen risks due to lack statistical data	0.880
19.	L-1	Insufficient and improper legal framework	0.887
20.	L-2	Lack of policies about intellectual property protection	0.886
21.	L-3	Policies of land acquisition and compensation	0.885
22.	L-4	The lack of policies, laws, and legal documents	0.885

C. Adequacy of sample size

"Sample size" is always a big concern in statistical analyses. Since factor analysis is utilized in this research, it is necessary to check on the sample size's adequacy for factor analysis.

Usually, a response-to-variable ratio of 4 to 1 (4:1) is required for factor analysis. That means for a questionnaire comprising 22 risk factors in this study, at least 88 responses should be received. However, Field proposed that sample size adequacy for factor analysis could be checked using the Kaiser-Meyer-Olkin (KMO) and Bartlett's test, with a minimum required sample size of 50 [21]. The KMO's index, which ranges from 0 to 1 and compares the magnitudes of the observed correlation factors to the partial ones' magnitudes, allows us to evaluate whether a sample size is suitable for factor analysis. The larger the KMO index value, the more suitable the sample size for factor analysis. The threshold value of the KMO index for factor analysis is 0.5 (Field 2005). Based on Field's findings, Hair et al. further suggested that factor analysis was suitable for multivariate data analysis [22].

The Bartlett's test is the method for testing the null hypothesis "H_o," i.e., the correlation among all observed variables equal to zero or the inter-correlation matrix derived from a population equal to an identity matrix. Factor analysis analyzes data when correlations among all observed variables, or the correlation matrix is not an identity matrix. Factor analysis can be applied when "Sig < 0.05" is satisfied in Bartlett's test.

After conducting the KMO and Bartlett's test for the collected survey results using SPSS, the obtained KMO value was 0.712 (Table 7), which was perceived as "Good" concerning the suitability of the sample size for factor analysis according to Field (2005). Moreover, the significance of Bartlett's test was very high (Sig < 0.001). Thus, the factor analysis could be applied to group the variables (or risk factors) into representative factors in this study.

Table 7: Results of KMO and Bartlett's test (for the original set – 22 variables)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.712
Bartlett's Test of Sphericity	**Approx. Chi-Square**	676.636
	df	231
	Sig.	.000

D. Factor Analysis

Factor analysis is to group a number of observed and correlated variables into a small number of representative factors that are unobserved and uncorrelated. In factor analysis, factor loadings are the correlation coefficients between variables and factors. Factor loadings between 0.4 and 0.5 are considered mediocre, and factor loadings above 0.5 are considered meaningful. In addition, the eigenvalue of an extracted factor should be greater than 1.0 [22].

In this study, the 22 risk factors in the questionnaire survey were analyzed using factor analysis, and the obtained factors would be used for multiple regression analysis later. After running factor analysis in SPSS, two variables (P-2 "*Expropriation of Ownership*" and P-4 "*Unstable political apparatus*") were eliminated due to their less-than-0.5 factor loadings. The factor loadings for P-2 and P-4 were 0.438 and 0.498, respectively. After removing P-2 and P-4, the computed KMO value was 0.742, and the significance was less than 0.001, indicating the validity for factor analysis (Table 8). There were six factors extracted from the remaining 20 variables, with meaningful factor loadings of 0.72105 (Table 9). It can be seen in Table 10 that all the factor loadings are greater than 0.5, and the eigenvalue of the sixth factor (i.e., Component 6) after rotation is 1.737, greater than 1.0 (Table 9).

Another way to show the proper number of extracted factors is the scree plot, which plots eigenvalues against extracted factors (Figure 1). In Figure 1, it is clearly shown that six factors, with an eigenvalue greater than 1.0, are the proper number.

The six uncorrelated factors extracted from the identified risk factors in this study are:

- Factor 1 (F1): *Risk group related to delay of the construction process*;

- Factor 2 (F2): *Risk group related to laws in Vietnam*;
- Factor 3 (F3): *Risk group related to human and construction firms*;
- Factor 4 (F4): *Risk group related to cost overrun*;
- Factor 5 (F5): *Risk group related to contracts and foreign partners*; and
- Factor 6 (F6): *Risk group related to owner's capital*.

The variables (i.e., risk factors) under each of the six extracted factors are shown in Table 11.

Table 8: Results of KMO and Bartlett's test (for the modified set – 20 variables)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.742
Bartlett's Test of Sphericity	**Approx. Chi-Square**	586.360
	df	190
	Sig.	.000

Table 9: The eigenvalues concerning each linear factor before extraction, after extraction and after rotation (*after removal of P-2 & P-4*)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.578	32.892	32.892	6.578	32.892	32.892	3.656	18.278	18.278
2	2.142	10.708	43.600	2.142	10.708	43.600	2.698	13.489	31.767
3	1.925	9.624	53.224	1.925	9.624	53.224	2.686	13.341	45.198
4	1.554	7.768	60.992	1.554	7.768	60.992	1.848	9.241	54.439
5	1.177	5.886	66.878	1.177	5.886	66.878	1.797	8.983	63.422
6	1.045	5.227	72.105	1.045	5.227	72.105	**1.737**	8.684	**72.105**
7	0.913	4.566	76.672						
8	0.771	3.857	80.528						
9	0.607	3.035	83.564						
10	0.537	2.684	86.248						
11	0.486	2.430	88.677						
12	0.456	2.279	90.956						
13	0.406	2.032	92.988						
14	0.332	1.659	94.647						
15	0.283	1.417	96.604						
16	0.239	1.195	97.259						
17	0.200	1.000	98.260						
18	0.143	0.715	98.975						
19	0.113	0.564	99.539						
20	0.092	0.461	100.000						

Extraction Method: Principal Component Analysis

Table 10: Grouping of 20 variables into six factors (Rotated Component Matrix[a])

Code	Items	Component					
		1	2	3	4	5	6
P-1	Change in Vietnamese Law system	0.848					
Mr-2	Government policies are unjust	0.833					
Mr-3	Inconsistence and overlapped levels of the government system	0.817					
Mr-1	Slow approval and permit for the project	0.805					
L-3	Policies of land acquisition and compensation		0.865				
L-2	Lack of policies about intellectual property protection		0.743				

L-1	Insufficient and improper legal framework		0.566				
L-4	The lack of policies, laws, and legal documents		0.541				
P-3	Corruption from government agencies			0.728			
E-4	Unfair competition with state-owned enterprises			0.664			
Mr-6	The incompetence of involved parties in the projects			0.609			
Mr-4	Unprofessional project management			0.578			
Mr-7	Lack of competent human resources			0.546			
Mr-8	Unforeseen risks due to lack statistical data			0.511			
E-3	Escalation of material, machine price, and employee wage				0.875		
E-5	Cost overrun				0.868		
E-1	Unusual fluctuation in foreign exchange and convertibility					0.768	
Mr-5	The weak management capacity in projects implementation with foreigner partners					0.695	
E-6	Risk in an investment capital of Owner						0.739
E-2	The state of flux of interest rate and inflation rate						0.660

Extraction method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalization
[a] Rotation converged after 9 iterations.

Table 11: The variables under each factor and the corresponding eigenvalues

Factor	No.	Code of original variables	Name of original variables/items	Eigenvalues
F1	1	P-1	Change in Vietnamese Law system	3,656
	2	Mr-2	Government policies are unjust	
	3	Mr-3	Inconsistent and overlapped levels of a government system	
	4	Mr-1	Slow approval and permit for the project	
F2	1	L-3	Policies of land acquisition and compensation	2,698
	2	L-2	Lack of policies about intellectual property protection	
	3	L-1	Insufficient and improper legal framework	
	4	L-4	The lack of policies, laws, and legal documents	
F3	1	P-3	Corruption from government agencies	2,686
	2	E-4	Unfair competition with state-owned enterprises	
	3	Mr-6	The incompetence of involved parties in the projects	
	4	Mr-4	Unprofessional project management	
	5	Mr-7	Lack of competent human resources	
	6	Mr-8	Unforeseen risks due to lack statistical data	
F4	1	E-3	Escalation of material machine price and employee wage	1,848
	2	E-5	Cost overrun	
F5	1	E-1	Usual fluctuation in foreign exchange & convertibility	1,797
	2	Mr-5	The weak management capacity with foreigner partners	
F6	1	E-6	Risks in invested capital of Owner	1,737
	2	E-2	The state of flux of interest rate and inflation rate	

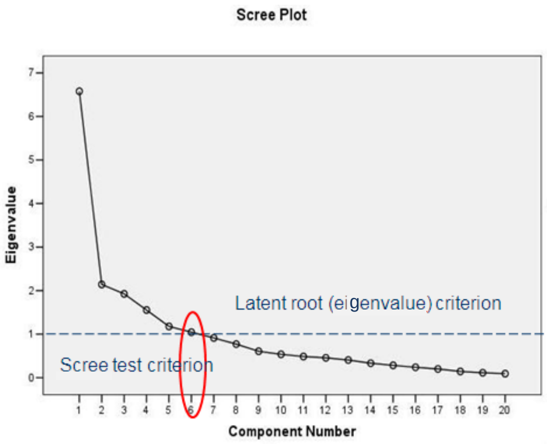

Figure 1: The Scree Plot in the final (third) step of factor analysis

E. Multiple regression analysis

A multiple regression model was utilized to find out how the six extracted factors would impact a construction project in Vietnam and was formulated as follows:

$$Impact\_on\_projects = \beta_1 * F_1 + \beta_2 * F_2 + \beta_3 * F_3 + \beta_4 * F_4 + \beta_5 * F_5 + \beta_6 * F_6 \quad (1)$$

where "Impact_on_projects" indicates the level of impact of the factors on the success or failure of construction projects in Vietnam, and β_1, β_2, β_3, β_4, β_5, and β_6 are the regression coefficients.

According to Hair et al. [22], the minimum required R^2 for a sample size of 58, six independent variables, and a significant level of 0.001 is 28.224%. Since the obtained R^2 in this model was 90.2%, greater than 28.224%, the results were acceptable. Moreover, the adjusted R2 (0.890) value in Table 12 indicated that the six extracted factors could explain 89% of the success or failure of Vietnam's construction projects. The value of the Durbin-Watson test, 2.091 (with $2 < 2.091 < 4–d_u=4–1.639=2.361$; $d_u = 1.639$ when N = 58 cases k = 6 factors), in Table 12 showed that the regression model was highly acceptable. The F value (78.106) and significance value (< 0.001) in Table 13 also verified the soundness of the regression model.

The coefficients of the six factors in the regression model are listed in Table 14, and the model (with unstandardized coefficients) is shown as follows:

$$Impact\_on\_projects = 0.544 + 0.149 * F1 + 0.078 * F2 + 0.085 * F3 + 0.069 * F4 + 0.180 * F5 + 0.259 * F6$$

In Table 14, the six factors' standardized coefficients (or Beta coefficients) indicate the levels of impact of the six factors. "F6: Risk group related to owner's capital" has the greatest impact on the success or failure of a construction project in Vietnam, followed by "F1: Risk group related to delay of the construction process." "F2: Risk group related to laws in Vietnam" has the least impact. The ranking of the six factors based on their levels of impact is shown in Table 15.

Table 12: Model summary of the regression analysis

Model	R	R Square	Adjusted R Square	Std. The error of the Estimate	Durbin-Watson
1	0.950[a]	0.902	0.890	0.13705	2.091

[a] Predictors:
- (Constant),
- F1: Risk group related to delay of the construction process;
- F2: Risk group related to laws in Vietnam;
- F3: Risk group related to human and construction firms;
- F4: Risk group related to cost overrun;
- F5: Risk group related to contracts and foreign partners;
- F6: Risk group related to owner's capital;

[b] Dependent Variable: Level of factors' impact on construction projects in Vietnam

Table 13: ANOVA result in the multiple regression analysis

Model		Sum of Squares	df	Mean Square	F	Sig.
1	**Regression**	8.802	6	1.467	78.106	.000[a]
	Residual	0.958	51	0.019		
	Total	0.976	57			

[a] Predictors:
- (Constant),
- F1: Risk group related to delay of the construction process;
- F2: Risk group related to laws in Vietnam;
- F3: Risk group related to human and construction firms;
- F4: Risk group related to cost overrun;
- F5: Risk group related to contracts and foreign partners;
- F6: Risk group related to owner's capital;

[b] Dependent Variable: Level of factors' impact on construction projects in Vietnam

Table 14: Regression coefficients in the regression analysis

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.544	0.169		3.213	0.002
	F1: Risk group related to delay of construction process	0.149	0.025	0.324	6.015	0.000
	F2: Risk group related to laws in Vietnam	0.078	0.031	0.138	2.545	0.014
	F3: Risk group related to human and construction firms	0.085	0.033	0.155	2.568	0.013
	F4: Risk group related to cost overrun	0.069	0.019	0.163	3.574	0.001
	F5: Risk group related to contracts and foreign partners	0.180	0.035	0.261	5.203	0.000
	F6: Risk group related to owner's capital	0.259	0.041	0.348	6.319	0.000

a. Dependent Variable: Level of factors' impact on construction projects in Vietnam

Table 15: Ranking of the six factors based on the levels of impact

Item	Content					
Standardized coefficient	0.348	0.324	0.261	0.163	0.155	0.138
Factor	F6	F1	F5	F4	F3	F2
Risks in each factor	E6 E2	P1 Mr2 Mr3 Mr1	E1 Mr5	E3 E5	P3 E4 Mr6 Mr4 Mr7 Mr8	L3 L2 L1 L4
Rank of factor	1	2	3	4	5	6

F. Discussions on the findings

Risks related to owner's capital (F6) are perceived to have the greatest impact on a construction project's success or failure in Vietnam. In practice, it is sometimes difficult for private owners to have sufficient funds for their projects. This causes delays and problems from time to time. One example is a commercial-cum-residential project in Hanoi. This project was delayed because of the owner's difficulty in the payment process [3]. Another example is the Wartsila Electric Power Project. It was stopped due to insufficient investment capital and undecided selling price of electricity in an unsuccessful negotiation.

Delay-related risks (F1) have the second greatest impact on construction projects in Vietnam. This is mostly attributed to the tedious process of getting approvals and permits from the Vietnamese government. Quite a few interviewees complained that the owner had to go through many government agencies, such as the Ministry of Construction (MOC), the Ministry of Planning and Investment (MPI), the Ministry of Transportation (MOT), and some local government offices, to acquire the necessary approval or permit, and this was a time-consuming process. Also, frequent changes and inconsistency of relevant laws and regulations, and different interpretations of policies by the central and local governments led to delays in construction.

In addition to the two abovementioned groups of risks, the impact of contract- and foreign-partner-related risks (F5) is deemed significant as well. In general, most local contractors and private owners in Vietnam are incapable of collaborating with foreign partners due to cultural differences and the lack of required language and professional skills. Furthermore, the fluctuation (especially devaluation) of the Vietnamese currency is another risk that might affect the collaboration with foreign partners in the course of construction.

The risks of cost overrun (F4) have a greater impact than the risks related to human and construction firms (F3). Cost escalation of construction projects in Vietnam results from many causes, such as improper feasibility studies, unrealistic forecast of future cash flows, wrong estimates of unit prices, etc. Also, EPC (Engineering, Procurement, and Construction) and BOT (Build, Operate and Transfer) projects in Vietnam usually suffer from huge cost escalation, which from time to time affects the start of projects. Risks related to human and construction firms are mostly due to difficulty recruiting professional and competent people for projects.

Law-related risks have the least impact on construction projects in Vietnam. The best mitigation measure against law-related risks is to have clear provisions in the contract, which will reduce the impact of such risks to a minimum.

VII. CONCLUSIONS

In this research, a questionnaire survey comprising twenty-two risks related to the economy, politics, management, and law for construction projects in Vietnam was conducted. The collected survey data were processed by factor analysis, after which two politics-related risks were eliminated. The remaining twenty risks were grouped into six factors, which were further processed using a regression model. The results indicated that risks related to the owner's capital had the greatest impact on the success or failure of construction projects in Vietnam, followed by the risks related to delaying the construction process. Law-related risks had the least impact.

REFERENCES

[1] A.T. Kearney, Inc,. The 2010 A.T. Kearney FDI confidence index. Investing in a Rebound., USA, Figure 11,10, (2010).

[2] General Statistics Office. (2010). Socio-economic situation in 2010. General Statistic Office of Vietnam, <http://www.gso.gov.vn/default.aspx?tabid=621&ItemID=10835>. (2011).

[3] Ling, F.Y.Y., and Bui, T.T.D. Factors affecting construction project outcomes: A case study of Vietnam. Journal of Professional Issues in Engineering Education and Practice, 136 (3),(2010), 148 - 155.

[4] Bao, A. (2011). Ministry of construction: The real estate has many latent risks. VN economy, <http://vneconomy.vn/20110110020216348p0c17/bo-xay-dung-bat-dong-san-con-tiem-an-nhieu-rui-ro.htm> 2011.

[5] Long, N.D., Ogunlana, S., Quang, T., Lam, K. C. Large construction projects in developing countries: a case study from Vietnam. International Journal of Project Management, 22(7), (2004), 553-561.

[6] The World Factbook (2011). Central Intelligence Agency (CIA), USA. <https://www.cia.gov/library/publications/the-world-factbook/geos/vm.html> (2011).

[7] Xuan, T. Nothing is in construction risk management. VN Economy, <http://vneconomy.vn/62812P0C5/con-so-khong-trong-quan-ly-rui-ro-xay-dung.htm> (2008).

[8] Luu, T.V., Kim, S.Y., Cao, H.L., and Park, Y.M., Performance measurement of construction firms in developing countries., Construction Management and Economics, 26 (4),(2008) 373-386.

[9] Ling, F.Y.Y., Hoang, V.T.P. Political, Economic, and Legal Risks faced in the International project: A case study of Vietnam. Journal of Professional Issues in Engineering Education and Practice, 136 (3), (2010), 156 - 164.

[10] Wang, S.Q., Dulaimi, M.F., and Aguria, M.Y. Risk management framework for construction projects in developing countries. Construction Management and Economics, 22 (3), (2004), 237-252.

[11] Cuong, TQ. Policy analysis for improving the performance of PPP project in Vietnam. A case study from BOT Phu My Bridge Project. MS Thesis, Civil Engineering, and Geosciences, Delft University of Technology, The Netherlands. (2010).

[12] Odeyinka, H.A. An evaluation of the use of insurance in managing construction risks. Construction and Management and Economics, 18 (5), (2000) ,519-524.

[13] Moavenzadeh, F. and Rossow, J. Risks and risk analysis in construction Management. Proceeding of the C1B W65, Symposium on Organization and Management of Construction, US National Academy of Science, Washington DC, USA., (1976),19-20.

[14] Mason, G.E. A quantitative risk management approach to the selection of a construction contract provisions. Ph.D. Thesis, Department of Civil Engineering, Stanford University,.(1973).

[15] Akintoye, A.S., and MacLeod, M. J. Risk analysis and management in construction. International Journal of Project management, 15(1), (1997) ,31-38.

[16] McKim, R.A. Risk management - back to basics. Cost Engineering, 34 (12), (1992) 7-16.

[17] Flanagan, R., and Norman, G. (2003). Risk management and construction. Blackwell Publishing, UK.

[18] Zou, P.X.W., Zhang, G., and Wang, J. Identifying Key Risks in Construction Projects: Life Cycle and Stakeholder Perspectives, Proceedings of the 12th Pacific Rim Real Estate Society Conference, Auckland, New Zealand, (2006).

[19] A Guide to the Project Management Body of Knowledge (PMBOK) - Fourth edition., Chapter 11. Project Management Institute, Inc, USA, ISBN 978-1-933890-51-7.

[20] Peterson, R. (1994). A meta-analysis of Cronbach's coefficient Alpha. Journal of Consumer Research, 21(2) (2008), 281-391.

[21] Field, AP. Discovering statistics using SPSS (2nd edition). London: Sage, UK. (2005).

[22] Hair, J.F., Anderson, R.E., Tatham, R.L., and Black, W.C.. Multivariate Data Analysis (5rd ed.), Prentice-Hall International, Inc. (1998).

[23] Sakthi Ganesh. G, Rajesh. M, A Study on Identification of Causes and Effects of Accidents in Construction Industry - Indian Scenario, SSRG International Journal of Civil Engineering 4(6) (2017) 41-47.