IDENTIFYING KEY FACTORS INFLUENCING COST VARIATION OF CONSTRUCTION PROJECTS IN HO CHI MINH CITY

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ABSTRACT

Cost variation is one of the most concerns of the stakeholders in the construction projects, because it always presents in every construction projects, especially in Vietnam. However, the factors that make the project cost variation are not easy to identify. This study aimed to identify the key factors that influence to the project cost variation. A survey questionnaire was used to collect data from construction practitioners. The analysis results show that there are five groups of factors that influence to project cost variation: Government policies, nature, resources, fraud and theft, and ability of stakeholders. Recommendations are also mentioned to deal with the project cost variation.

Keywords: Construction projects, cost variation, factor analysis, influence, regression analysis.

1. INTRODUCTION

In practice, most of construction projects in Vietnam have faced to at least one of the problems such as poor quality, scope changed, accidents ... Especially, overrun budget (cost) and behind schedule (time) have been being the two critical issues that usually occur in construction projects in Vietnam. In previous studies, 93% of 148 surveyed projects have been exceeded budget from 5%-20% (Tran Viet Thanh, 2007); 89.4% of 162 surveyed projects have been exceeded greater than 10% budget (Nguyen Thi Minh Tam, 2008). The problem of project cost overrun, especially in the construction industry, is not only the situation in Vietnam but also on over the world. This causes a lot of conflict between clients and contractors. If this conflict is not properly handled, the project could be suspended or even canceled. This research aims to develop a suitable model for the evaluation of cost overrun during project execution.

2. BACKGROUND

2.1. Literature review

Stuart Anderson et. al. (2005) suggested three groups with 10 factors that affect to cost variation in construction projects. Group one related to the complexity of construction projects including documentation procedure, scopes of work and schedule. Group two was the economic group including inflation and marketing. Group three related to the ability of project management such as management skills, estimation skills and construction method statement.

According to User's Guide of The European Commission (2006), there are 10 other factors that affect to cost variation: Unexpected geological condition, design changes during construction, ability of project management team, inflation and price fluctuation, lack of material or man power, exchange rate, contractor, financial ability and unexpected natural disaster.

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Daniel Baloi and Andrew D.F, Price (2001) have listed seven factors with 37 represented variables that affect to cost variation in project. It included estimator for project, project characteristics, economic and political issues, competitors, fraud and theft, construction implementing.

Cliff J. Schexnayder et. al. (2003) indicated 11 factors influencing to cost variation: changing size of project, expanding the scopes of work, inflation, schedule of completion, miscalculation in estimation, technical and management skill, project delayed due to external impaction, corruption practices, unexpected natural condition and technical specifications.

Albert P. C. Chan, (2004) announced that there were five factors affecting to a successful construction project namely project-related factors, project procedures, project management actions, human-related factors, and external environment.

Tran Viet Thanh (2007) confirmed 12 similar factors affecting to cost performance such as: Compensation and design changed by owner; lack of experience and accountability, mistake in survey and mistake in design of consultant; mistake in construction, lack of capital ability, lack of experience in management, inadequate bidding price, inadequate bill of quantity from the contractor; and fluctuation of constructional material price and improper implementation time.

Luu Truong Van et. al. (2004) have confirmed that there are two main factors affecting to variation cost of construction project: Schedule for each scope of work and material price, basically steel and cement.

2.2. Proposed hypothesis

Based on the theoretical concepts, previous studies and Vietnam construction situations, variables representing to the factors and hypothesis are suggested as following:

Hypothesis H1 (factors related to government policy): The more stable and transparent of policy, the lesser the project cost variation. H1 includes the policy of Vietnamese construction law, the policy of urban planning, the salary and recruitment policy, and the documentation policy.

Hypothesis H2 (factors related to natural): The more stable of natural condition, the lesser the project cost variation. H2 includes weather, geological conditions, and disasters.

Hypothesis H3 (factors related to economic/financial): The more stable of economic and financial, the lesser the project cost variation. H3 includes inflation, construction material price, exchange rate, and interest rate.

Hypothesis H4 (factors related to fraud and theft): The higher the fraud and theft, the higher the project cost variation. H4 includes corruption, material stolen, and collusion.

Hypothesis H5 (factors related to ability of stakeholders): The higher ability of stakeholders, the lesser the project cost variation. H5 includes the financial capacity of owner, contractor, and supplier, safety management, technical experience of contractor, project management ability, value engineering design from designer or consultant, man power, and material supply sources.

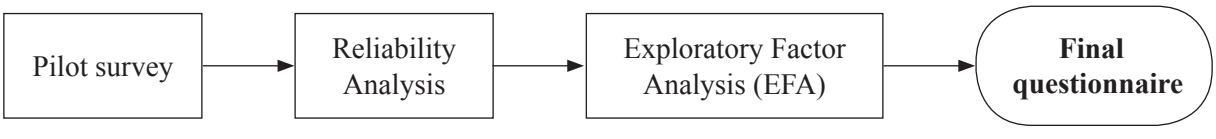
3. RESEARCH METHODOLOGY

The research design of this study consists of the following steps:

Step 1: Items generation

In this step, the interviews and discussions are conducted with the experienced people in construction industry such as owners, project directors, project managers, chief consultants, chief engineers, procurement managers, etc … to have different point of views about project cost variation and the factors affecting project cost variation under consideration based on the conceptual framework. After this, the initial questionnaire is formed for pilot survey.

Step 2: Pilot survey

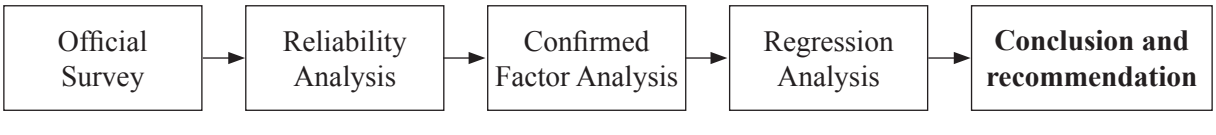


The purpose of this step is to test whether the initial questionnaire is suitable with conceptual frame work and hypothesis. The adjustment of questionnaire and proposed hypothesis may happen to reinforce the conceptual framework and to construct the official questionnaire for official survey. After this step, there are 06 factors that had been grouped from 19 variables have been discovered. These factors have been renamed as in Table 1:

Table 1: Revised hypothesis

Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Ability of Stakeholders	Government Policy	Economic / Financial	Construction Resources	Natural	Fraud and theft

Step 3: Official survey



The official questionnaire was sent out for the investigation in Ho Chi Minh area and the data from this survey was analyzed by using SPSS software for statistical purpose. The findings responded to the hypothesis whether the hypothesis is supported or not. And the findings also helped to recommend the solutions to minimize project cost variation.

4. DATA ANALYSIS

4.1. Sample size

After completing the official questionnaire, the final investigation was conducted by sending out the official questionnaire in Ho Chi Minh area. There were 127 replies in total of 400 sets of questionnaire sent out by email (77 answers – 60.6%) and face to face interview (50 answers – 39.4%).

The positions of interviewees in project include owners, project managers, supervisors, team leader, architect/ consultant, and others. And the types of projects include housing projects, high rise apartment, office building, and others.

There are some differences between planned budget and actual budget: In 127 projects surveyed, there were only 04 projects exceeded planned budget less than 10% equal to rate of 3.15%, 07 projects exceeded planned budget from 10% to 20% equal to rate of 5.5%, 26 projects exceeded planned budget from 21% to 30% equal to rate of 20.45%, 76 projects exceeded planned budget from 31% to 50% equal to rate of 59.9%, and 14 projects exceeded planned budget greater than 50% equal to rate of 11%.

4.2. Regression analysis and hypothesis testing

Regression has been analyzed two times. In the first time of regression analysis, the Sig. value of the economic/ financial factor is 0.276 and higher than 0.05. That means the effect of this factor to cost variation is not so much. Therefore, regression analysis must be tested again after this factor removed.

4.2.1. Regression analysis

As a result of revised model, $\mathbf{R^2 = 0.722}$ and adjusted $\mathbf{R^2 = 0.71}$. It states that 71% cost variation can be explained by 06 observation variables (see Table 2).

Table 2: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.850a	.722	.711	7.064
Predictors: (Constant), Ability of stakeholders, Economic/ financial, Government policy, Construction resource, Natural, Fraud and theft.				

The Sig. value of independent variables are smaller than 0.05 (<0.05), it means that all the factors affect to cost variation. Factors with standardized coefficients with negative value show negative relationship with cost variation (ability of stakeholders, government policy, and construction resources, natural). The other factor (fraud and theft) with positive value shows positive relationship with cost variation (see Table 3).

Table 3: Regression analysis results.

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	37.858	.627		60.400	.000		
Ability of stakeholders	-3.833	.629	-.292	-6.092	.000	1.000	1.000
Government Policy	-1.530	.629	-.117	-2.432	.016	1.000	1.000
Construction resources	-2.125	.629	-.162	-3.377	.001	1.000	1.000
Natural	-1.462	.629	-.111	-2.323	.022	1.000	1.000
Fraud and theft	10.040	.629	.765	15.955	.000	1.000	1.000

a. Dependent Variable: % of Cost variation

Linear regression:

VARIATION COST = 37.8 – 0.292*Ability stakeholders – 0.117*Government Policy - 0.162*Resource – 0.111*Natural + 0.765*Fraud and theft.

This model can explain 71.1 % of variable of cost-overruns in construction project are caused by independent variables: stakeholders, government policy, construction resource, natural, and fraud and theft. Remaining 28.9% variable of cost-overruns are caused by other factors that are out of scope of this study. It also shows that positive and negative effects of each factor to cost variation.

The most important is fraud and theft factor with beta = + 0.765. It means that when increasing 1 unit fraud and theft, project cost variation will increase 0.765. Secondly, the ability of stakeholder with beta = 0.292. The third is construction resources with beta = 0.162. Following is government policy (beta=0.117) and the last one is natural with beta = 0.111.

4.2.2. Hypothesis testing

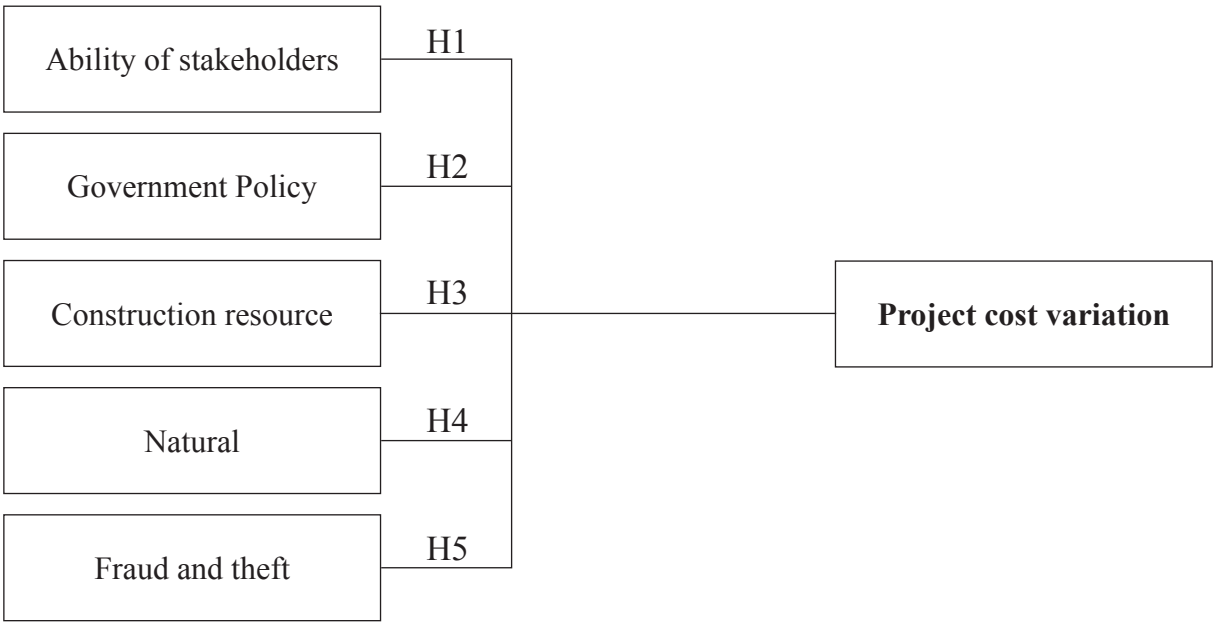
In Table 3, beta coefficients' values of ability of stakeholder, government policy, natural, construction resource factors had negative sign. It means that these factors have negative relationships with project cost variation with the level of significance less than 5% (or 1%). Thus, this proved that hypothesis H1, H2, H3 and H4 were supported.

In contrary, beta coefficient's values of fraud and theft factor had positive sign. It means that the variables related to fraud and theft had positive relationships with project cost variation. This proved that hypothesis H5 was supported. The results of testing are depicted in Table 4 and the revised conceptual framework is shown on Figure 1.

Table 4: Results of hypothesis testing

Hypothesis	Description	Result
H1	*In a project, the higher Ability of stakeholders, the lesser the variation cost of project*	Supported P = .000
H2	*In a project, the more stable the Government policy, the lesser the variation cost of project*	Supported P = .016
H3	*In a project, the more stable the construction resource, the lesser the variation cost of project*	Supported P = .001
H4	*In a project, the more stable the nature, the lesser the variation cost of project*	Supported P = .022
H5	*In a project, the higher the Fraud and theft, the higher the variation cost of project*	Supported P = .000

Figure 1. Modifying Conceptual framework



5. CONCLUSION AND RECOMMENDATION

5.1. Conclusion

As results of this study, the five factors that affect to cost variation including ability of stakeholders, government policy, construction resource, natural environment, fraud and theft are significant influences to the project cost variation. According to multi-variable regression analysis results, the strength of relationships between the five factors and variation cost of projects was specifically determined via the beta coefficients. The results also confirmed that all hypotheses in the study were supported.

5.2. Recommendation

Based on the analysis results and discussions above, recommendations are made in an effort to minimize cost variation in construction project, especially in housing construction.

Firstly, a common set of contractor's ability criteria must be considered at the beginning of project by owners in terms of "engineering/construction", "procurement/ contract", "project managers", "human resources", "quality management systems", "health and safety", "plant/equipment", "financial strength" and "public relations" (Pong Peng J, 2003).

Secondly, the results showed that the higher competencies of the management team, the lesser the project cost variation. Thus, it is strongly recommended that the management skills of management team should be enhanced by focusing in highlighting the role of the top managers in the project, reinforcing interpersonal skills among the managers and subordinates, building the standard in recruiting staffs as well as good policies to encourage the loyalty of staffs.

Thirdly, the management team is not only to focus on project management, but also to review all the drawings/ technical specifications from architect and consultant before implementation. This step is very important, called "value engineering". It helps the clients choose the right material or method before implementation on site for cost saving and reducing the cost variation. Good experienced designers help owner to recognize what appropriate provisions are. Any change in design during

construction phase shall significantly affect the project budget.

Fourthly, Vietnamese laws and regulations are still complicated. These make a lot of difficulties and potential risk to investors. Government is striving to make a change with simplifying administrative procedures in offering and approving the project formulation and construction permit. These changes are necessary to reduce the project implementation time. Local authorities should also pay attention to make conveniences for the investors to approach the projects.

Fifthly, construction material in Vietnam is mainly cement, steel and brick. Steel prices in Vietnam will continue to fluctuate because of the change of steel ingot, power and fuel price. Another reason that makes steel price increase is traders' storing up steel (because they estimate the steel price will increase more). Similarly, in future the price of brick will be increased significantly because clay will be banned to be exploited for making brick in long term strategy. So, alternative material is one of many options to minimize cost of project.

Sixthly, security of construction site during constructing is significantly affecting cost variation. The result of this research shows the strength relationship between fraud and theft with variation cost. Certainly, security matter is the most concern of owners during their houses constructed. However, they do not control it and they pass this responsibility to main contractor. In large projects, security is hired from security services of company, who signs contract with main responsibility to secure site and minimize fraud and theft on site.

Lastly, the recommendation to deal with the natural factors is to focus carefully on geological survey and soil testing before starting construction. However, flooding due to rains at certain area in the city is also another concern. The old structure of neighbor buildings is also a big concern when projects are under construction. Recommendation is to survey and record actual condition of surrounding buildings before starting project. These documents shall be used as evidences to justify the damage if any.

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