Construction Risks in Developing Countries: A Vietnam Case Study

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Most construction projects in the developing countries are marred with delays, cost overruns and low satisfaction levels. This paper focuses on analysis of the data collected from a survey that include the twenty-three (23) common risk factors that cause non-performance in construction projects in developing countries. The factors were consolidated from an extensive literature review, and inputs were solicited from 103 construction practitioners in Vietnam. The study reveals the top five risk factors as the bureaucratic administrative system, financial difficulties of owner, slow payment of completed works, poor contractor performance, financial difficulties of contractor. Spearman’s rank-order correlation tests determined no significant differences between the participating groups. Factor analysis explored the correlations among the risks and yielded four outcomes – Lack of Site and Legal Information, Lack of Capable Managers, Poor Deliverables Quality, and Owner’s Financial Incapability. The findings lay the foundation for stakeholders in the developing countries’ construction industry to better plan and manage the risks for their projects and investment and develop innovative solutions to improve their construction project performances.

Keywords: Construction Industry Risks, Developing Countries, Construction Delay and Cost Overrun, Risk Importance Index, Factor Analysis, Vietnam

Introduction

A construction industry lays the foundation for both developing and developed economies as it provides the infrastructure for any nations. It contributes to economic growth, delivers jobs and provides critical infrastructure (e.g. healthcare facilities and transportation network) to support the growth and development of various economic sectors. Economic growth results in improving the quality of life of a country, where (only) well invested construction projects would alleviate people from poverty as more wealth is created. While the construction industry is one of the oldest industries in any civilizations, modern construction industry (even the ones in the developed countries) is still marred with inefficiencies and disputes that resulted in inefficient capital investment and utilization (Rivera et al., 2017). Investment in construction faces multiple scrutiny where many countries still face project delays, budget overrun, low stakeholders’ satisfaction, and in the worst cases, corruption, even though these are the essential elements to determine how successful a construction project truly is (Long et al., 2004).

The challenges that developing and developed countries face are different. This study would focus on Vietnam and thus deploy research only from similar countries, especially those rapidly
developing countries in Asia. The study also focuses on identify the risks that put construction project cost, schedule and quality at stake, particularly those that hinder construction project performance in the developing countries (Koushki et al., 2005; Sambasivan, 2007; Toor et al., 2008, Le-Hoai, 2008). Particular attention is given to the development of factor models for enhancing the construction project performance in the developing countries.

**Objectives of the Study**

The main research objective is to identify risk factors affecting construction project performance in developing countries, particularly Vietnam. The research would first identify the risk factors through extensive literature review for developing countries, and prior research in the field. The research would then rank and examine the frequency, relevance, severity and importance of the identified risk factors. After which, the research team would determine how different construction stakeholders rank the risk factors, and how they perceive their impacts. The analysis would finally identify and model the potential relationships between risks, and the results are simplified factors that would be used at the project pre-planning phase and throughout the project.

**Literature Review**

Extensive literature reviews, case analysis, and discussion with multiple construction stakeholders were conducted to identify the relevant construction risk factors for developing countries. Over 90 risk factors pertaining to construction projects were compiled for the studies from the following countries: Kuwait (Koushki et al., 2005), Malaysia (Sambasivan & Soon, 2007), Jordan (Sweis et al., 2008), Ghana (Frimpong et al., 2003), Nigeria (Aibinu et al., 2006), Vietnam (Le, 2017), Thailand (Toor & Ogunlana, 2008), Indonesia (Kaming et al., 1997), Lebanon (Mezher & Tawil, 1998), Zambia (Kaliba et al., 2009), India (Doloi, et al., 2012), Egypt (Aziz & Abdel-Hakam, 2016), Uganda (Alinaitwe et al., 2013), Gaza (Enshassi et al., 2009), Palestine (Mahamid et al., 2012), and Oman (Ruqaishi & Bashir, 2015). Summaries from some of the major studies include:

- Koushki et al. (2003) interviewed over 450 private residential owners and developers in Kuwait and identified the major factor contributing to projects’ time-delay and cost-increase to include inadequate budget and time allocated at the design phase. Other causes of delays and cost overruns included high number of change orders, financial constraints, owners’ lack of experience in construction, contractor-related problems, and material-related problems.
- Sambasivan & Soon (2006) conducted a survey on 150 owners, consultants, and contractors in Malaysia to identify the ten most impactful causes as contractor’s improper planning, contractor’s poor site management, inadequate contractor experience, inadequate client’s finance and payments for completed work, problems with subcontractors, shortage in material, labor supply, equipment availability and failure, lack of communication between parties, and mistakes during construction stage. The main effects of these causes were: time overrun, cost overrun, disputes, arbitration, litigation, and total abandonment.
- Sweis et al. (2007) collected data from 29 consultants, 36 contractors, and 26 clients on project delay in Jordan and found that poor planning of scheduling, financial difficulties, too many change orders, shortage of manpower (skilled, semi-skilled, unskilled labor), and
incompetent technical staff assigned to the project were the leading risk causes for delays. These causes were pertained to the internal environment of the supply chain, especially that of the contractor, while exogenous factors had relatively lesser impact on project delay.

- Frimpong et al. (2001) research using questionnaire surveys to identify and evaluate the relative importance risk factors pertaining to the non-performance if Ghana groundwater construction projects revealed that the major risk factors included monthly payment difficulties from agencies, poor contractor management, material procurement, poor technical performances, and escalation of material prices. Most of the identified problems originated from poor resources management (human, technical, and material).

- Toor and Ogunlana (2007) examined the causes of construction delays in Thailand and found that the most significant problems were the lack of standardization in design, lack of contractor’s experience and control over project, inadequate experience of staff, lack of competent subcontractors/supplies, unrealistic project schedule, lack of responsibility, contractor’s financial difficulties, poor contract management, poor site access or availability, and poor efficiency of supervisor or foreman.

- In particular to Vietnam, Le (2017) reviewed 100+ peer-reviewed manuscripts of the construction industry in Vietnam in the last 15 years and found 23 non-performance causes, out of which, the top five factors by appearance frequency included ineffective designs and frequent design changes, poor contractor performance, ineffective project management, financial difficulties of owner, and financial difficulties of contractor. Further, the authors also compared risks found in Vietnam to those occurred elsewhere in other developing countries and suggested that 91% of them are similar.

Similar risk factors found in the literature review were grouped under one risk factor. For example, “Lack of design standardization” found in Toor and Ogunlana (2007) is grouped under “Ineffective Designs and Frequent Design Changes” as shown in Table 1. The reason for grouping them is to simplify the research process and analysis procedures while staying relevant to the research. The standardization process would allow the research team to focus on identify the factors first, before further studies would be conducted to better identify the details. The research grouped the risk factors into 23 common risk factors for developing countries as shown in Table 1. Literature review showed that the developing countries faced many common risk factors despite differences in socio-economic, cultural, and political aspects.
Table 1: Common Risk Factors that Cause Construction Non-Performance in Developing Countries.

| Risk Factors                                                                 | Kuwait | Jordan | Ghana | Nigeria | Vietnam | Thailand | Indonesia | Lebanon | Zambia | India | Egypt | Uganda | Gaza | Palestine | Oman |
|------------------------------------------------------------------------------|--------|--------|-------|---------|---------|----------|-----------|---------|--------|-------|-------|-------|------|-----------|------|
| Bureaucratic administrative system                                          | x      | x      | x      | x       | x       | x        | x         | x       |        |       |       |       |      |           |      |
| Corruption/Collusion                                                         | x      |        |        |         |         |          |            | x       |        |       |       |       |      |           |      |
| Defective works and reworks                                                 | x      | x      | x      | x       | x       | x        | x         | x       |        |       |       |       |      |           |      |
| Financial difficulties of contractor                                       | x      | x      | x      | x       | x       | x        | x         | x       |        |       |       |       |      |           |      |
| Financial difficulties of owner                                             | x      | x      | x      | x       | x       | x        | x         | x       |        |       |       |       |      |           |      |
| Improper planning and scheduling                                            | x      | x      | x      | x       | x       | x        | x         | x       |        |       |       |       |      |           |      |
| Inaccurate estimates                                                         | x      | x      | x      | x       | x       | x        | x         | x       |        |       |       |       |      |           |      |
| Inadequate legal framework                                                  | x      |        |        |         |         |          |            | x       |        |       |       |       |      |           |      |
| Ineffective designs and frequent design changes                             | x      | x      | x      | x       | x       | x        | x         | x       |        |       |       |       |      |           |      |
| Ineffective project management                                              | x      | x      | x      | x       | x       | x        | x         | x       |        |       |       |       |      |           |      |
| Interest and inflation rates                                                | x      | x      | x      | x       | x       | x        | x         | x       |        |       |       |       |      |           |      |
| Lack of accurate historical information                                      | x      | x      | x      | x       | x       | x        | x         | x       |        |       |       |       |      |           |      |
| Lack of capable owners                                                       | x      | x      | x      | x       | x       | x        | x         | x       |        |       |       |       |      |           |      |
| Lack of experience in complex projects                                       | x      | x      | x      | x       | x       | x        | x         | x       |        |       |       |       |      |           |      |
| Owners’ site clearance difficulties                                          | x      | x      | x      | x       | x       | x        | x         | x       |        |       |       |       |      |           |      |
| Poor contractor performance                                                 | x      | x      | x      | x       | x       | x        | x         | x       |        |       |       |       |      |           |      |
| Poor site management and supervision                                        | x      | x      | x      | x       | x       | x        | x         | x       |        |       |       |       |      |           |      |
| Poor subcontractor performance                                               | x      | x      | x      | x       | x       | x        | x         | x       |        |       |       |       |      |           |      |
| Poor tendering practices [Low bid practice]                                  | x      | x      | x      | x       | x       | x        | x         | x       |        |       |       |       |      |           |      |
| Shortages of materials                                                       | x      | x      | x      | x       | x       | x        | x         | x       |        |       |       |       |      |           |      |
| Slow payment of completed works                                             | x      | x      | x      | x       | x       | x        | x         | x       |        |       |       |       |      |           |      |
| Slow site handover                                                          | x      | x      | x      | x       | x       | x        | x         | x       |        |       |       |       |      |           |      |
| Unpredictable government policies and priorities                             | x      | x      | x      | x       | x       | x        | x         | x       |        |       |       |       |      |           |      |
| **Total Counts**                                                             | 9      | 12     | 12     | 12      | 23      | 15       | 6          | 11      | 11     | 17    | 12    | 13    | 16    | 15    | 15     |
Research Methodology

This research uses field survey as its key research method to collect data pertaining to the research objectives. The survey focuses on data collection from various construction stakeholders pertaining to the understanding of various risks that impact construction performances, particularly, schedule delay, cost overrun and client satisfaction. The survey was designed using the 23 common risk factors from the literature research (shown on Table 1) with a goal to quantify the construction project and industry performances pertaining to time, cost, and customer satisfaction. The survey also aimed to identify the relative impacts that those risk factors had on construction projects and industry. The five-point Likert scale of 0 to 4 measured the respondents’ experiences between the risk factors and their impacts on construction projects, based on their occurrences and severities. The numerical values assigned for the Likert Scale are as follow: ‘0 – Never Happen; 1 – Rarely; 2 – Sometimes; 3 – Often; 4 – Always’ for frequency, and ‘0 – No Influence, 1 – Mild, 2 – Moderate, 3 – Very, 4 – Extremely’ for severity. The respondents had the option to include additional risk factors they personally experienced but was not included in the 23 common risk factors.

The questionnaire/survey was validated before it was sent out to the experts. Four construction industry experts were identified and participated in the validation exercises. The experts included a civil engineering/construction engineering professor, a practicing contractor, and two owner representatives. These experts had at least 15 years of experience in the industry at the time of the validation test. The experts reviewed the structure and content of the questionnaire, and recommended changes to the originals. Their recommendations are incorporated into the final questionnaire. It was then sent to the selected survey participants in Vietnam. The stakeholders are divided into “Owners”, “Contractors” and “Consultants”, and they were either sent an email with a link connected to the survey or physical mail to their offices. The online survey was developed using Google Survey and printed copies of the survey forms were mailed out with return envelopes enclosed. Completed surveys were compiled online and physically from the returned mails. The surveys were returned within a month after they were mailed out.

The collected survey was quantitatively analyzed using IBM SPSS Statistics v25. The research team used the following techniques:

1. Cronbach’s alpha coefficients to test internal consistency of the results,
2. Risk factor analysis to rank the risk factors in terms of degree of frequency, severity and importance
3. Spearman’s rank-order correlation coefficient was then utilized to determine the degree of agreement of risk rankings between each responded group,
4. Factor analysis was used to derive interrelationships among the risk factors.

Data Collection

The survey was sent to over 300 construction professionals from the three stakeholder groups only in Vietnam. These professionals were selected from companies that faced the highest risk factors, such as the type, complexity and size of the construction projects their companies are involved in. The research team avoided the companies that were involved in low-risk projects,
such as renovation and structural repairs where cost and budget are less volatile. Large-size complex projects face increasing risks of budget, schedule and quality issues. They also faced greater scrutiny from the Vietnamese regulators and clients.

Nearly half of the surveys were returned (140 surveys were returned). Of the 140 surveys that were returned, incomplete surveys were also eliminated from the responses. There were 37 surveys removed from the analysis as a result. These numbers were consistent with previous studies (Le-Hoai, 2008; Sambasivan & Soon, 2007; Sweis et al., 2008; Frimpong et al., 2003; Toor et al., 2008). Table 2 describes the characteristics of the survey participants from those who responded. While the total response rate was around 48%, a total of 34.3% of the invited survey were used for the analysis. The survey period occurred in the first two quarters of 2018.

Table 2: Characteristics of Questionnaire Respondents.

| Demographic Characteristics | Responses | %     |
|-----------------------------|-----------|-------|
| Groups                      |           |       |
| Owners                      | 45        | 43.7% |
| Contractors                  | 36        | 35.0% |
| Consultants                 | 22        | 21.4% |
| Industry Experience         |           |       |
| 0 - 5 years                 | 18        | 17.5% |
| 6 - 10 years                | 18        | 17.5% |
| 11 - 20 years               | 42        | 40.8% |
| Over 20 years               | 25        | 24.3% |
| Project Involvements        |           |       |
| Commercial / Residential    | 63        | 60.7% |
| Infrastructure / Heavy Civil| 22        | 21.4% |
| Industrial                  | 18        | 17.9% |
| Project Sizes               |           |       |
| < $1M                       | 22        | 21.4% |
| $1M - 5M                    | 46        | 44.6% |
| > $5M                       | 35        | 33.9% |

Characteristics of Respondents

Among the 103 returned questionnaire, 45 respondents worked for owners (43.7% of the responses), 36 for contractors (35%), and 22 for designers and/or consultants (21.4%). The participants held high level managerial positions, such as project managers, directors or associate directors. More than half of the respondents had over 15 years of experience. This ratio had improved from a similar past study (Le-Hoai, 2008) and reflected the growth in experience of industry participants in the last 10 years. The respondents’ mean years of relevant experience in the construction industry is around 18 years. Such highly experienced profile and the management roles of the respondents would likely translate into highly reliable results and thus enhance the quality of the findings. The majority of respondents were involved in Commercial / Residential projects (60.7%) which highlighted the abundance of building projects in Vietnam and made this study more applicable to building projects. The participants were asked to provide the projects’ performance metrics that they experienced over the past five years prior to the
survey, and these are documented in Table 3. The participants did not add new risks to the questionnaire and concluded that the 23 risk factors accurately describe most of the risks they faced.

Table 3: Projects Performance of Questionnaire Respondents.

| Performance Metrics              | Responses | %    |
|----------------------------------|-----------|------|
| Time                             |           |      |
| Delayed                          | 97        | 94.2%|
| On-Time                          | 6         | 5.8% |
| Average Time Extension           | -         | 30.0%|
| Cost                             |           |      |
| Over-budget                      | 84        | 81.6%|
| Under-budget                     | 19        | 18.4%|
| Average Cost Growth              | -         | 14.0%|
| Stakeholders’ Satisfaction       |           |      |
| Unsatisfied                      | 28        | 27.2%|
| Neutral                          | 56        | 54.5%|
| Satisfied                        | 19        | 18.4%|

Data Analysis

The research team used the following techniques:

Cronbach’s Alpha Coefficients

The Cronbach’s Alpha Coefficients of the internal consistency reliability tests for risk factors’ frequency and severity ratings of the survey results are 0.928 and 0.942 respectively. Litwin & Fink (1995) and Kog (2019) suggested that consistency is high when Cronbach’s alpha is above 0.7. This confirmed that there is high internal consistency among the answers.

Risk Factors Analysis

The survey results were analyzed using three indices that were previously used by Kaming et al. (1997), Le-Hoai (2008) and Doloi, et al. (2012). These indices are as following:

1. Frequency Index (FI): This index measures the frequency of occurrence for each risk factor. It is computed with the following formula:

\[ FI = \frac{\sum a_i n_i}{4N} \]

in which \( a = \) the weight assigned to each response (as in this research, a range of 0 for “Never Happen” to 4 for “Always”), \( n = \) frequency of occurrence for each response, and \( N = \) total number of responses.
2. Severity Index (SI): This index measures the severity of each risk factor to project performance. It is computed with the following formula:

\[ SI = \frac{\sum a_i n_i}{4N} \]

in which \( a \) = the weight assigned to each response (as in this research, a range of 0 for “No Influence” to 4 for “Extremely”), \( n \) = frequency of occurrence for each response, and \( N \) = total number of responses.

3. Relative Importance Index (RII): This index measures the relative importance of each risk factor pertaining to the frequency of occurrence and severity to project performance. It is computed with the following formula:

\[ RII = FI \times SI \]

The calculations of FI, SI, and RII and the rankings of the 23 risk factors identified in the questionnaire are presented in the Appendix, Table 4, 5, and 6. The following observations were made:

1. There are not many discrepancies between the FI, SI, and RII rankings. Seven out of top 10 importance factors (Appendix, Table 6) happened to be the top ten with regards to frequency (Appendix, Table 4) and severity (Appendix, Table 5).

2. Top risk - Bureaucracy: As shown in Appendix, Table 6, the top risk is “Bureaucratic administrative system” and associated with the administrative nature of how the construction industry operates. Bureaucracy, or better known as red tape, hinders project progress through high level barriers that increase risks of project delays, cost overrun and affecting project quality. This is also the most highly ranked risks among the owners, contractors, and consultants. Further investigation also found that ‘Bureaucratic administrative system’ has become an increasingly critical hindrance of construction project performance in Vietnam as government and clients are increasing the amount of unnecessary procedures (red tape).

3. Risks pertaining to finance and cash flow: The analysis showed that three of the top five issues are tied to issues surrounding project financing, like slow payment, financial difficulties of owners and contractors, and improper planning. Cash flow is critical for any construction projects as profit is often “razor thin”. Narrow profit margin forces contractors and owners to depend heavily on payment and financing every month. Contractors rely on monthly payment to pay their subcontractors and employees, and owners to secure financing to pay their contractors. Understanding cash flow is a critical knowledge especially in Vietnam.

4. Risks pertaining to experience and capability are also highly ranked risks: “Lack of experience in complex projects” and ‘Ineffective designs and frequent design changes’ were found to be critical risk factors surrounding the experience and capability of the construction professionals in Vietnam. The fast-paced development in Vietnam demand a significant number of construction workforce at all levels. This has resulted in the massive employment of professionals who may not have the necessary experience and skills in the first place. As a newly developing nation, Vietnam’s young workforce offers the vigor and energy but not the
experience and knowledge. Adding on to the lack of industry professional support, like the American Society for Civil Engineers (ASCE), the survey clearly indicated the lack of experience and capability to increase risks of the local projects. This has also caused frequent changes made to projects due to both inexperienced owners and professionals as they were unable to meet the exact requirements with their initial designs and plans. Frequent changes to projects are often costly and affect project quality and schedule.

5. Managerial and administrative risks: The ninth to sixteenth factors have an FI above 0.5 and an SI above 0.6 (Appendix, Table 6). These risk factors are closely associated with the managerial and administrative aspect of construction project performance, particularly to the ability to make reliable decisions on project, schedule, bids, handover, supervision and eliminate mistakes. The survey clearly indicated the lack of solid foundation for management. Owners found various issues to manage their projects effectively as they lack the right knowledge to submit accurate bids, determine the best approaches to manage projects, supervise workforce, ensure smooth handover, and manage their extremely ill-prepared subcontractors. They also highlighted that both contractors and consultants made frequent mistakes in their estimates and injected plenty of avoidable risks into their projects, and many of these mistakes are technical-related.

6. External risks: The seventeenth to twenty-third risk factors (Appendix, Table 6) are mostly related to the external environment such as interest and inflation rates, legal framework, lack of accurate historical information, unpredictable government policies and priorities, and shortages of materials. The effects of these risks vary from countries to countries due to differences in socio-economic, cultural, and political aspects. The participants ranked the importance of these risks among the lowest. They found these factors were beyond their control. The participants rank the risks they were able to control higher than those they were unable to control.

7. “Not my problem” – An issue with personal accountability: The research also found an interesting phenomenon that the team identifies as “not my problem”. The analysis found that the three groups of stakeholders rank the risks from the opposing stakeholders higher than those affected by them. For example, ‘Financial difficulties of owner’, ‘Lack of capable owners’, and ‘Owners’ site clearance difficulties’ are lower ranked on the survey completed by the owners and higher on those completed by the contractors and consultants. Alternatively, the contractors ranked ‘Poor contractor performance’, ‘Financial difficulties of contractor’, ‘Inaccurate estimates’, ‘Poor tendering practices’ are ranked lower than the owners and consultants. ‘Lack of experience in complex projects’, ‘Ineffective design and frequent design changes’ were ranked lower by the consultants than owners and contractors at the same time. The survey found that the stakeholders often assumed their roles contributed to lower risks towards the projects. This might suggest self-accountability could be an issue.

Spearman’s Rank-Order Correlation

The Spearman’s Rank-Order Correlation (SRC) measures the implied degree of agreement on the ranking among groups of respondents. It is computed with the following formula:

$$\rho = 1 - \frac{6 \times \sum d^2}{n(n^2 - 1)}$$
in which $\rho = \text{level of consensus between two groups } (0 \leq \rho \leq 1)$; $d = \text{the difference in ranking of a risk factor, and } n = \text{number of ranking places}.$

Table 7 (see Appendix) shows the Spearman's Rank-Order Correlation among the survey returns from the stakeholders. The analysis shows that the owners and contractors generally agreed with each other on the types of risks affecting construction project performance with regards to the frequency (78%), severity (52%) and importance (67%). However, designers/consultants did not share similar sentiments as Table 7 (see Appendix) clearly indicates. The survey shows that the consultants did not generally agree with the owners and contractors. Owners and contractors commonly share more similar project goals (i.e. on-time, on-budget) and their perception on project quality is mostly similar (quality generally means focusing on visible quality). The goals of designers and consultants focus are mainly on the technical aspects of projects, such as structural design, aesthetics and functional performances. The designers/consultants are also involved at the design and planning phases of the projects, rather than the actual construction process.

Table 8 (see Appendix) shows Spearman's Rank-Order Correlation between the three stakeholder types and overall rankings by all of them. The analysis found that the contractors’ responses were highly correlated (92% on frequency, 90% on severity, and 94% on importance) with overall rankings. The results clearly indicate the contractors’ clear perceptions on project risks, and how their involvement throughout the construction project delivery process could have led to such clarity. Contractors work closely with both owners and designers/consultants, and they would have perceived and partake risks more comprehensively than other stakeholders.

**Factor Analysis**

The relationships between each risk factors were further investigated in order to identify the most significant ones. Factor analysis was used to, first, measure the multivariate interrelationships between and within the risk factors, and second, analyze the structure and correlations between the variables by defining a set of common underlying dimensions (also known as factors or components) (Hair et al., 1998). The Kaiser-Meyer Olkin (KMO) and Bartlett’s Test of Sphericity were conducted to verify the legitimacy of factor analysis. In this study, Bartlett’s test approximate of Chi-square is 1481.631 with 253 degrees of freedom, which is significant at the 0.05 level of significance, suggesting that the population correlation matrix is not an identity matrix. The KMO statistic of 0.899 is also greater than 0.5 which is satisfactory for the factor analysis.

The Principal Component method was utilized for factor extraction. The Oblimin rotations with Kaiser Normalization rotation method was selected for this analysis. Four components were identified with Eigenvalues to be greater than 1.00 (shown in Appendix, Table 9). These four components account for 64.5% of the variance in construction non-performance.

Table 10 shows the four component loadings extracted from the factor analysis and these exclude the factors with loading values of less than 0.5. The four components are labeled as follow:

1. Component 1 – Lack of Site and Legal Information
2. Component 2 – Lack of Capable Managers
3. Component 3 – Poor Deliverables Quality
4. Component 4 – Owner’s Financial Incapability

Table 10: Factor Analysis Loading Results.

| Components | Eigenvalue | Variance (%) | Risk Factors                                      | Factor Loading |
|------------|------------|--------------|--------------------------------------------------|----------------|
| 1          | 10.569     | 45.952       | Lack of accurate historical information          | 0.858          |
|            |            |              | Unpredictable government policies and priorities | 0.819          |
|            |            |              | Inadequate legal framework                       | 0.781          |
|            |            |              | Bureaucratic administrative system               | 0.592          |
|            |            |              | Interest and inflation rates                     | 0.553          |
|            |            |              | Corruption/Collusion                             | 0.508          |
| 2          | 1.670      | 7.260        | Ineffective designs and frequent design changes   | 0.823          |
|            |            |              | Inaccurate estimates                             | 0.604          |
|            |            |              | Ineffective project management                   | 0.598          |
|            |            |              | Poor site management and supervision             | 0.593          |
|            |            |              | Poor contractor performance                      | 0.571          |
|            |            |              | Improper planning and scheduling                 | 0.543          |
| 3          | 1.472      | 6.400        | Slow site handover                               | 0.855          |
|            |            |              | Defective works and reworks                      | 0.773          |
|            |            |              | Poor subcontractor performance                   | 0.578          |
|            |            |              | Shortages of materials                           | 0.564          |
|            |            |              | Financial difficulties of contractor             | 0.518          |
| 4          | 1.115      | 4.848        | Financial difficulties of owner                  | 0.764          |
|            |            |              | Slow payment of completed works                  | 0.724          |

Component 1: Lack of Site and Legal Information

Component 1 consists of ‘lack of accurate historical information’, ‘unpredictable government policies and priorities’, ‘inadequate legal framework’, ‘bureaucratic administrative system’, ‘interest and inflation rates’, and ‘corruption/collusion’. This component implies the construction participants’ lack of information on site conditions and government legal framework, leading to projects being delayed and sometimes affected by inflation and interest rates, and the use of fraudulent practices to fasten the process.

‘Lack of accurate historical information’ has factor loading value of 0.858 (Table 10). Vietnam does not have accurate data on soil, weather, and traffic (Ling & Bui, 2010). The underground site condition in Vietnam is complex due to soft soil that change unexpectedly along the country (Le-Hoai et al., 2008). Despite inspection works strictly follow government standards, soil condition is always one of the biggest risks for most projects (Le-Hoai et al., 2013). Contractors also face the lack of accurate weather forecasts. As Vietnam is a tropical country, typhoons, heavy rain, and flood often occur and can lead to flooding on-site and subsequent remedial measures can lead to delay and cost overrun (Ling & Bui, 2010). On the other hand, designers rely on traffic volume provided by the government to design underpasses but sometimes the traffic information is found inaccurate only after construction began (Ling & Bui, 2010). As soil, weather, and traffic information are important input data for project activities, time and budget should be built into the master program to investigate site conditions during pre-construction.
phase (Ling & Bui, 2010). It is also necessary to consider the conditions of contract to adequately allocate risks between parties (Le-Hoai et al., 2008).

The legal system governing construction projects in Vietnam continues to change unexpectedly (‘unpredictable government policies and priorities’, Table 10, Factor loading value 0.819), is inconsistent on various levels (‘inadequate legal framework’, Table 10, Factor loading value 0.781), and requires excessive time and effort for approvals (‘bureaucracy administrative system, Table 10, Factor loading value 0.592). Research has found that government funded projects in developing countries tend to be political in nature (Luu et al., 2008). These projects face the risk of being terminated even after the design has been well developed. In Vietnam, and possibly other developing countries, due to high demand for infrastructure projects, it is possible that new government officials might abandon an ongoing project to channel funding elsewhere (Luu et al., 2008). Foreign firms in Vietnam have voiced their concerns of having to work in an environment where the legal code was inconsistent (Ling & Hoang, 2010). As building regulations are still primitive, there is no unified legal framework for the conduct of construction business. As shown in Table 1, Vietnam is not the only country that suffers from bureaucracy administrative system. Slow government permits, unstable regulatory framework, slow site clearance, unsatisfactory site compensation, incompetent staff of government regulatory agencies, unclear responsibility and power, relatively poor law implementation process, and complex approval procedures constitute into the bureaucracy administrative system that causes delays in Vietnam (Long et al., 2004; Thuyet et al., 2007). Master plans, zoning, and future plans for the land are frequently changed, or sometimes, even concealed by officials, making it difficult to plan for long-term development (Ling & Hoang, 2010). Not only this risk causes delays, it reduces Vietnam’s image in the eyes of foreign investors as total foreign investment capital into Vietnam has decreased (Thuyet et al., 2007). Vietnamese government requires a proof of financial status and a deposit which would be held for 1 – 2 years for firms to obtain project approvals (Ling & Hoang, 2010). This requirement makes it difficult for small, medium, and foreign firms to compete with big and established firms in Vietnam. The government recognized this and has been trying to institute administrative reforms and openness in the operations of state agencies (Ling & Hoang, 2010). To manage this risk, in addition to being in good relationship with government, environment authority, and NGO’s, construction owners and contractors should be familiar and conversant with approval processes and understand local laws and regulations. Building database of past projects approvals and forming templates of approval documentation are also recommended to reduce time and cost of project approval process (Long et al., 2004).

As bureaucracy is an issue, close and cooperative relations with local government and authorities are essential to obtain orders (Luu et al., 2008) and fraudulent practices (‘corruption/collusion, Table 10, Factor loading value 0.508) seem to be the fastest way to build relationships. It has been estimated that 20 – 40% of capital investment in construction is lost due to poor management for which bureaucracy and briberies are mainly responsible (Long et al., 2004). The Vietnamese government has been introducing anticorruption law and enacting relevant regulations to combat corruption. An anticorruption strategy, and project to monitor incomes of public employees and government officials are in the pipeline for 2020. On the company level, antigraft training should be provided to staff to lessen or eradicate corruption and wastefulness within the company (Ling & Hoang, 2010).
‘Interest and inflation rates’ has factor loading value of 0.553 (Table 10). Projects that are affected by this risk the most are those that require special, non-local materials which are not readily available in Vietnam, and those that take too long to obtain approvals due to bureaucracy. Interest and inflation rates in Vietnam fluctuate wildly (Ling & Hoang, 2010). The average inflation rate of Vietnam is currently at 4% which is more than half the profit of construction projects for contractors (6%) (Kim et al., 2016). Due to high inflationary trend, price fluctuation is difficult to predict and would cause materials and labor costs to increase during construction phase (Le-Hoai et al., 2008, Ling & Hoang, 2010). Several measures have been recommended to manage this risk: introducing fluctuation clause in the contract (contractor to bear risk of cost increase for the original scope, owner to bear risk of cost increase for change orders) (Ling & Hoang, 2010), designers to conduct market surveys before specifying non-local materials and consider alternative materials (Ling & Bui, 2010), alternative materials should follow quality standards, owner to make advance payments for materials to lock in their prices, contractors to purchase materials in bulk, or enter into exclusive agreement with suppliers to fix costs of materials (Ling & Hoang, 2010).

Component 2: Lack of Capable Managers

Component 2 consists of ‘ineffective designs and frequent design changes’, ‘inaccurate estimates’, ‘ineffective project management’, ‘poor site management and supervision’, ‘poor contractor performance’, and ‘improper planning and scheduling’. This component shows the lack of capable managers who can coordinate project activities from beginning to end using logical steps.

Managing projects is quickly becoming a critical function as construction projects become increasingly complex. Developing countries are increasing the number of complex projects as these countries are beginning to ramp up the development of critical infrastructure to support their economic growth. However, the professional workforce, owners and government in the developing countries still lack the required knowledge and experience, and coupled with unsupportive government policies, these countries continue to face challenges starting with the design phase (‘ineffective designs and frequent design changes’, Table 10, Factor loading value 0.823; ‘inaccurate estimates’, Table 10, Factor loading 0.604). Vietnamese designers have been criticized for their incompetence, outdated skills, and lack experience to make good designs (Le-Hoai et al., 2008; Yean et al., 2009). For that reason, there is a dominance of foreign designers in complex projects in Vietnam (Thuyet et al., 2007). Despite being more skilled and experienced, these foreign designers still stumble on design issues such as owner’s unclear scopes and unrealistic expectations, use of different standard design systems, poor inspection and approval of design process (Thuyet et al., 2007; Le-Hoai et al., 2008; Kim et al., 2016). Perhaps the lack of a management approach that could address and resolve the owners’ lack of experience and uncertainty in what they want is the main cause of design issues (Kashiwagi, 2018). As design problems increase, change orders and inaccurate estimates would likely happen along the way (Long et al., 2004). A number of management strategies have been proposed to improve the design phase: selecting designer should be based on past and relevant performance and utilizing the designer’s expertise, not owner’s, to come up with the design (Thuyet et al., 2007; Kashiwagi, 2018), owner’s ideas should be presented in simple, non-technical, and measurable metrics for the designer to translate into their own technical terms (Thuyet et al., 2007;
Kashiwagi (2018), the design office should establish a system to track and control changes with an effective risk management plan (Le-Hoai et al., 2008), conducting concurrent engineering activities to improve constructability (Thuyet et al., 2007), and employing expert consultants to evaluate the quality of designs and estimations (Thuyet et al., 2007; Long et al., 2004).

Construction phases also suffers from the lack of capable managers (‘ineffective project management’, Table 10, Factor loading value 0.598; ‘poor site management and supervision’, Table 10, Factor loading value 0.593; ‘improper planning and scheduling’, Table 10, Factor loading value 0.543). Strong project management capability is crucial in construction projects, though there has been a shortage of project managers who could handle large-scale projects in Vietnam (Yean et al., 2009). Despite project management has been professionalized, the works remain poor (Le-Hoai et al., 2013). Effective management and continuing professional development courses should be introduced at all levels (corporate, process, project, and activity) to improve performance (Yean et al., 2009). On the site level, poor site management and supervision has been a tough problem and emphasizing the weakness of contractors (‘poor contractor performance’, Table 10, Factor loading value 0.571). Contractors lack in skilled human resource, superintendents are often rated on years of experience not actual performance, the industry is not capable in adopt or adapt best practices already working in other countries are issues that should be addressed (Le-Hoai et al., 2008; Long et al., 2004). After the ‘Open Door’ policy has been applied, many foreign project management consultants and contractors have been joining the Vietnam construction market, so Vietnam is not lacking competent contractors (Le-Hoai et al., 2008). However, the right contractors still need to be identified and utilized for the right projects. Procurement and project delivery system have not been conducted properly (Long et al., 2004). Bidding processes have been criticized as being unfair, unhealthy, and costly due to excessive time required, even leading to contracts being awarded to incapable contractors (Long et al., 2004). Kashiwagi (2016) proposes the Best Value Approach that could accurately determine the qualification of contractors based on quantifiable past experience, risk management plan, and value-add. Contractors should be required to plan the project from start to finish and submit their high-level plan for review. The plan would provide enough details and shed lights on the potential success and failure of the project, thus allow stakeholders to better act and monitor risks through a project. The key challenge remains on how these ideas could be implemented and their effects could be observed in a developing country such as Vietnam without any prior knowledge.

**Component 3: Poor Deliverables Quality**

Component 3 consists of ‘slow site handover’, ‘defective works and reworks’, ‘poor subcontractor performance’, ‘shortage of materials’, and ‘financial difficulties of contractor’. This component resonates the effects of Component 1 and 2. The lack of information and capable managers to effectively look at projects from beginning to end, identify and manage risks, address the bureaucracy nature of the industry, select the right contractors, has resulted in poor deliverables from project team which emerge at the construction phase even though their causes are injected into the project much earlier.

Site handover is considered very serious and a big milestone in Vietnam (Luu et al., 2009). The Vietnamese Land Law separates the right of land use from land ownership. The government
owns the land while the people own the right of land use. Before starting projects, owners have to negotiate with the communities for compensation to the right of land use, and then must receive approvals from the local government (Luu et al., 2009). Due to bureaucratic approval process, major delays have been caused by complex procedure for issuance of land use certificates (Luu et al., 2009). This risk (‘slow site handover’, Table 10, Factor loading value 0.855) is often overlooked by inexperienced owners and consultants (Kim et al., 2016). In addition to topographical surveys and geotechnical surveys, other tasks should be implemented in the comprehensive site investigation program to prepare the site well before commencing construction or mobilization: informing affected people near the site about the project, offering satisfactory compensation, conducting environmental and social impact assessments. These measures reduce the risk of slow site handover and interruptions during construction phase (Long et al., 2004).

Defective works and reworks (Table 10, Factor loading value 0.773) also affect the quality of final deliverables. Even though incapable designers may cause this risk due to impractical designs and lack of involvement throughout the project’s life (Luu et al., 2009), contractors and subcontractors, especially, also share responsibilities (‘poor subcontractor performance’, Table 10, Factor loading value 0.578). Recently, the amount of subcontracting has increased through the use of specialist works and off-site production (Long et al., 2004). Vietnam has the advantage of a large population base that continuously supplies laborers at low cost. However, this advantage comes with low degree of mechanization, obsolete technology, and heavy reliance on unskilled workers observed in many subcontractors that ultimately cause defects and reworks (Yean et al., 2009). Defective works and reworks may cause of shortages of materials (Table 10, Factor loading value 0.564). Other causes of shortages of materials include high demand of fast development, price fluctuation, requirement of special materials (Le-Hoai et al., 2008, Ling & Bui, 2010). Consultants are recommended to conduct detailed market research on availability of materials, standard of quality, and suitable suppliers (Ling & Bui, 2010). Additional lead time should be built in the master program for imported materials, and suppliers should be evaluated on ability to deliver based on a specified time frame (Ling & Bui, 2010). Other measures to deal with materials price fluctuation have also been suggested in the ‘interest and inflation rates’ discussion in Component 1. As deliverables are not up to quality, contractors may encounter financial challenges (‘financial difficulties of contractors’, Table 10, Factor loading value 0.518) for having to pay for defects and reworks, extra materials, and time of subcontractors. Hence, financial capability of contractors should become one of the selection criteria during procurement phase.

Component 4: Owner’s Financial Incapability

Component 4 consists of ‘financial difficulties of owner’ (Table 10, Factor loading value 0.764), and ‘slow payment of completed works’ (Table 10, Factor loading value 0.724). This component highlights financial incapability from owners. Money and resources ensure construction projects run smoothly and are obvious imperatives to carry out projects (Long et al., 2004). Since the majority of owners in Vietnam are medium-sized developers, they tend to have financial difficulties originating from land use compensation and monthly payments to contractors (Luu et al., 2009). Public owners on large projects suffer from bureaucracy in approving completed works and make late payments (Yean et al., 2009). Management of financial issues require
efforts from both owner and contractor: owner should prepare an available fund for project and build financial plan to pay contractor as in contract agreement, contractor must prepare a detailed, feasible financial plan for project and it should be submitted and approved by owner before contract award (Le-Hoai et al., 2008; Kashiwagi, 2018).

Conclusions & Recommendations

Construction is a crucial industry for nearly every country. Despite being one of the oldest industries in human history, construction projects worldwide are still suffering from poor performance such as delays, cost overrun, and low satisfaction. It is crucial to identify new methodologies to improve construction performance because it highly impacts project participants, the community, and national development. Developing countries face different and unique challenges that developed countries do not.

This paper identifies the future research into managing construction project risks in the developing countries by identifying the relationships and correlations between and among the twenty-three (23) risk factors. A questionnaire survey was developed, administered, and analyzed to assess current dominant risks with participants from the Vietnam Construction Industry. These risks were then ranked from the perspectives of three main project participating groups (owners, contractors, and consultants). ‘Bureaucratic administrative system’, ‘financial difficulties of owner’, ‘slow payment of completed works’, ‘poor contractor performance’, ‘financial difficulties of contractor’ were found to be the most dominant risks. There were no significant disagreements between each party in ranking these risks. Further analysis examines interrelationships among these risk factors and grouped them into four main components: ‘Lack of Site and Legal Information’, ‘Lack of Capable Managers’, ‘Poor Deliverables Quality’, and ‘Owner’s Financial Incapability’. Noticeable observations include:

- Vietnam, and possibly other developing countries, suffer from a continuously changing, inconsistent on different levels, and inefficient legal system governing construction projects, so construction participants should be aware of current processes to smoothly obtain approvals;
- Domestic designers have been criticized for design issues and changes, though the fact the foreign and experienced designers also encounter similar problems emphasize that it is probably the owner’s lack of experience and uncertainty in what they want are the main causes of design issues;
- Vietnam is not lacking capable contractors; however, the right contractors still need to be identified and utilized for the right projects. Current procurement and project delivery system have not been effective. Innovative ideas to improve the supply chain face challenges of implementation in the industry without any prior knowledge;
- Site handover risks should be seriously considered and studied to avoid slow site handover and interruptions during construction phase;
- Financial issues and slow payments are common and should be cooperatively planned for by both owner and contractor even before the contract is awarded.
The findings could help construction practitioners in developing countries improve their understanding of the root causes of poor performance. Project managers could make better plans accordingly in their current and future projects if they could understand how to manage these risk factors. In the long run, it is important to improve the capability of managers, and engineers working in developing countries. The current education of focusing on technical skills while leaving a gap in planning, managing, and forecasting knowledge needs to change. This study includes the views of both inexperienced and veteran construction participants which may not fully reflect the reality in the industry. The authors recommend an analysis to determine the difference in perspectives between those two parties. The authors also recommend the verification the findings in this study, development of management strategies for common risks, and feasibility of employing innovative ideas from developed countries that could help leveraging construction education and trainings in developing countries.

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Table 4: Frequency Index and Rankings.

| Risk Factors                                           | Overall | Owner | Contractor | Consultant |
|--------------------------------------------------------|---------|-------|------------|------------|
|                                                        | FI      | Rank  | FI         | Rank       |
| Bureaucratic administrative system                     | 0.711   | 1     | 0.711      | 1          |
| Slow payment of completed works                        | 0.617   | 2     | 0.572      | 3          | 0.674 | 3 | 0.614 | 2 |
| Ineffective designs and frequent design changes        | 0.609   | 3     | 0.580      | 2          | 0.681 | 2 | 0.548 | 7 |
| Corruption/Collusion                                   | 0.569   | 4     | 0.545      | 6          | 0.639 | 5 | 0.500 | 13 |
| Lack of experience in complex projects                 | 0.568   | 5     | 0.556      | 5          | 0.611 | 8 | 0.523 | 12 |
| Lack of accurate historical information                | 0.561   | 6     | 0.563      | 4          | 0.639 | 6 | 0.432 | 19 |
| Financial difficulties of owner                        | 0.559   | 7     | 0.506      | 14         | 0.646 | 4 | 0.523 | 11 |
| Financial difficulties of contractor                   | 0.558   | 8     | 0.528      | 9          | 0.604 | 10| 0.545 | 9 |
| Improper planning and scheduling                       | 0.554   | 9     | 0.534      | 8          | 0.576 | 15| 0.557 | 6 |
| Poor contractor performance                            | 0.551   | 10    | 0.517      | 12         | 0.569 | 16| 0.591 | 3 |
| Poor subcontractor performance                         | 0.546   | 11    | 0.472      | 19         | 0.625 | 7 | 0.568 | 4 |
| Slow site handover                                     | 0.544   | 12    | 0.506      | 16         | 0.586 | 13| 0.557 | 5 |
| Inaccurate estimates                                   | 0.541   | 13    | 0.522      | 10         | 0.596 | 12| 0.545 | 10 |
| Interest and inflation rates                           | 0.540   | 14    | 0.534      | 7          | 0.611 | 9 | 0.409 | 22 |
| Ineffective project management                         | 0.527   | 15    | 0.472      | 18         | 0.583 | 14| 0.545 | 8 |
| Poor site management and supervision                   | 0.527   | 16    | 0.517      | 13         | 0.604 | 11| 0.420 | 20 |
| Inadequate legal framework                             | 0.527   | 17    | 0.522      | 11         | 0.569 | 17| 0.466 | 17 |
| Poor tendering practices [Low bid practice]            | 0.525   | 18    | 0.506      | 15         | 0.563 | 19| 0.500 | 14 |
| Unpredictable government policies and priorities       | 0.493   | 19    | 0.483      | 17         | 0.549 | 20| 0.420 | 21 |
| Lack of capable owners                                 | 0.483   | 20    | 0.422      | 22         | 0.563 | 18| 0.477 | 15 |
| Owners’ site clearance difficulties                    | 0.473   | 21    | 0.433      | 21         | 0.521 | 21| 0.477 | 16 |
| Defective works and reworks                            | 0.465   | 22    | 0.455      | 20         | 0.486 | 22| 0.455 | 18 |
| Shortages of materials                                 | 0.392   | 23    | 0.372      | 23         | 0.429 | 23| 0.375 | 23 |

Table 5: Severity Index and Rankings.

| Risk Factors                                           | Overall | Owner | Contractor | Consultant |
|--------------------------------------------------------|---------|-------|------------|------------|
|                                                        | SI      | Rank  | SI         | Rank       |
| Financial difficulties of owner                        | 0.740   | 1     | 0.611      | 12         | 0.854 | 1 | 0.670 | 2 |
| Poor contractor performance                            | 0.694   | 2     | 0.661      | 2          | 0.757 | 2 | 0.655 | 4 |
| Financial difficulties of contractor                   | 0.680   | 3     | 0.656      | 3          | 0.701 | 5 | 0.693 | 1 |
| Corruption/Collusion                                   | 0.659   | 4     | 0.683      | 1          | 0.694 | 7 | 0.352 | 23 |
| Lack of experience in complex projects                 | 0.658   | 5     | 0.656      | 4          | 0.736 | 3 | 0.580 | 9 |
| Ineffective project management                         | 0.657   | 6     | 0.633      | 7          | 0.722 | 4 | 0.523 | 17 |
| Slow payment of completed works                        | 0.636   | 7     | 0.648      | 5          | 0.674 | 11| 0.670 | 3 |
| Lack of capable owners                                 | 0.633   | 8     | 0.633      | 8          | 0.681 | 10| 0.591 | 7 |
| Bureaucratic administrative system                     | 0.631   | 9     | 0.589      | 13         | 0.660 | 12| 0.568 | 12 |
| Poor site management and supervision                   | 0.624   | 10    | 0.639      | 6          | 0.653 | 13| 0.557 | 14 |
| Poor subcontractor performance                         | 0.621   | 11    | 0.533      | 22         | 0.688 | 9 | 0.591 | 6 |
| Defective works and reworks                            | 0.621   | 12    | 0.561      | 18         | 0.653 | 14| 0.568 | 13 |
| Improper planning and scheduling                       | 0.621   | 13    | 0.544      | 21         | 0.653 | 15| 0.580 | 10 |
Ineffective designs and frequent design changes 0.612 14 0.583 15 0.694 6 0.477 19
Shortages of materials 0.609 15 0.550 20 0.694 8 0.477 21
Poor tendering practices [Low bid practice] 0.604 16 0.622 10 0.639 16 0.591 8
Slow site handover 0.595 17 0.617 11 0.632 17 0.625 5
Inaccurate estimates 0.587 18 0.631 9 0.590 19 0.580 11
Inadequate legal framework 0.578 19 0.589 14 0.611 18 0.466 22
Unpredictable government policies and priorities 0.568 20 0.583 16 0.403 23 0.523 18
Interest and inflation rates 0.566 21 0.583 17 0.507 22 0.536 16
Lack of accurate historical information 0.527 22 0.489 23 0.549 21 0.477 20
Owners’ site clearance difficulties 0.525 23 0.561 19 0.563 20 0.538 15

Table 6: Risk Importance Index and Rankings.

| Risk Factors                                      | Overall RII | Rank | Owner RII | Rank | Contractor RII | Rank | Consultant RII | Rank |
|--------------------------------------------------|-------------|------|-----------|------|----------------|------|----------------|------|
| Bureaucratic administrative system               | 0.449       | 1    | 0.419     | 1    | 0.476          | 2    | 0.394          | 2    |
| Financial difficulties of owner                  | 0.414       | 2    | 0.309     | 13   | 0.552          | 1    | 0.350          | 5    |
| Slow payment of completed works                   | 0.392       | 3    | 0.371     | 3    | 0.454          | 4    | 0.411          | 1    |
| Poor contractor performance                       | 0.382       | 4    | 0.342     | 6    | 0.431          | 7    | 0.387          | 3    |
| Financial difficulties of contractor              | 0.379       | 5    | 0.346     | 5    | 0.424          | 9    | 0.378          | 4    |
| Corruption/Collusion                              | 0.375       | 6    | 0.373     | 2    | 0.444          | 6    | 0.176          | 23   |
| Lack of experience in complex projects            | 0.374       | 7    | 0.364     | 4    | 0.450          | 5    | 0.303          | 10   |
| Ineffective designs and frequent design changes   | 0.372       | 8    | 0.338     | 7    | 0.473          | 3    | 0.261          | 14   |
| Ineffective project management                    | 0.346       | 9    | 0.299     | 15   | 0.421          | 10   | 0.285          | 12   |
| Improper planning and scheduling                  | 0.344       | 10   | 0.291     | 16   | 0.376          | 13   | 0.323          | 8    |
| Poor subcontractor performance                    | 0.339       | 11   | 0.252     | 21   | 0.430          | 8    | 0.336          | 7    |
| Poor site management and supervision              | 0.329       | 12   | 0.330     | 8    | 0.394          | 11   | 0.234          | 17   |
| Slow site handover                                | 0.324       | 13   | 0.312     | 11   | 0.370          | 14   | 0.348          | 6    |
| Inaccurate estimates                              | 0.318       | 14   | 0.329     | 9    | 0.352          | 16   | 0.316          | 9    |
| Poor tendering practices [Low bid practice]       | 0.317       | 15   | 0.315     | 10   | 0.359          | 15   | 0.295          | 11   |
| Lack of capable owners                            | 0.306       | 16   | 0.267     | 19   | 0.383          | 12   | 0.282          | 13   |
| Interest and inflation rates                      | 0.306       | 17   | 0.312     | 12   | 0.310          | 20   | 0.219          | 19   |
| Inadequate legal framework                        | 0.304       | 18   | 0.308     | 14   | 0.348          | 18   | 0.217          | 20   |
| Lack of accurate historical information           | 0.296       | 19   | 0.275     | 18   | 0.351          | 17   | 0.206          | 21   |
| Defective works and reworks                       | 0.289       | 20   | 0.255     | 20   | 0.317          | 19   | 0.258          | 15   |
| Unpredictable government policies and priorities  | 0.280       | 21   | 0.282     | 17   | 0.221          | 23   | 0.220          | 18   |
| Owners’ site clearance difficulties               | 0.248       | 22   | 0.243     | 22   | 0.293          | 22   | 0.257          | 16   |
| Shortages of materials                            | 0.239       | 23   | 0.205     | 23   | 0.298          | 21   | 0.179          | 22   |

Table 7: Spearman’s Rank-Order Correlation Among Parties – Differences between Groups.

| Groups                        | Frequency Index SRC | Sig. level | Severity Index SRC | Sig. level | Importance Index SRC | Sig. level |
|-------------------------------|---------------------|------------|--------------------|------------|----------------------|------------|
| Owners - Contractors          | 0.782               | 0.001      | 0.519              | 0.011      | 0.673                | 0.001      |
| Contractors - Consultants     | 0.499               | 0.015      | 0.356              | 0.096      | 0.607                | 0.002      |
| Owners - Consultants          | 0.361               | 0.001      | 0.336              | 0.117      | 0.42                 | 0.046      |
Table 8: Spearman’s Rank-Order Correlation Between Each Party and Overall Rankings – Differences within Group.

| Groups          | Frequency Index SRC | Frequency Index Sig. level | Severity Index SRC | Severity Index Sig. level | Importance Index SRC | Importance Index Sig. level |
|-----------------|---------------------|---------------------------|-------------------|---------------------------|-----------------------|----------------------------|
| Overall - Owners| 0.863               | 0.001                     | 0.683             | 0.001                     | 0.773                 | 0.001                      |
| Overall - Contractors| 0.915            | 0.001                     | 0.898             | 0.001                     | 0.941                 | 0.001                      |
| Overall - Consultants| 0.648             | 0.001                     | 0.502             | 0.015                     | 0.71                  | 0.001                      |

Table 9: Total Variance Explained.

| Component | Initial Eigenvalues | Extraction Sums of Squared Loadings | Rotation Sums of Squared Loadings |
|-----------|---------------------|-------------------------------------|----------------------------------|
|           | % of Variance | Cumulative % | Total | % of Variance | Cumulative % | Total |
| 1         | 10.569        | 45.952        | 45.952 | 10.569        | 45.952        | 45.952 | 7.251 |
| 2         | 1.670         | 7.260         | 53.212 | 1.670         | 7.260         | 53.212 | 6.097 |
| 3         | 1.472         | 6.400         | 59.611 | 1.472         | 6.400         | 59.611 | 6.203 |
| 4         | 1.115         | 4.848         | 64.459 | 1.115         | 4.848         | 64.459 | 5.234 |