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Critical Factors Influencing To Financial Risk In Construction Projects

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ABSTRACT

The process of cost modelling by risk analysis in construction projects is very critical to achieve the project success. The objective of this study is to present an analysis of the financial impact of risk factors that are caused in various construction projects and calculating the risk severity. The general methodology of this study relies largely on the survey questionnaire which was collected from various sources. Thorough literature review has been conducted to identify the risk factors that affect the performance of the construction industry as a whole. The questionnaire prepared for the pilot survey was formulated based on the relevant literatures in the area of construction risk management. The questionnaire has been sent to three hundred and twelve companies. One hundred and fifty responded. Thus the response rate is 48%, which is considered good in this type of survey. The purpose of this research seeks to identify and assess the risk and to develop a management framework which the investors/developers/contractors can adopt when contracting construction works. The data were analyzed by Descriptive Statistics and ANOVA.

Keywords: Financial Management Risk, Risk Analysis, Project Management risks, Financial Risks and Construction management.

1. INTRODUCTION

The construction industry is one of the high risk as compared to the other kind of business activity because of having the complexity in coordinating various activities.[1] Furthermore, each and every project is unique and often incorporated with new techniques and procedures. The core element for project success is to meet the time, cost, and quality as targeted. In order to achieve the goal, Risk may appear in several ways and could result in budget overruns, time overrun, financial disputes,

loss of life, environmental pollution, and many more failures.[2] Therefore RM includes maximizing the probability and consequences of positive events and minimizing the probability and consequences of adverse events to project objectives[3].

1.1 Risk Management

Risk management in a project encompasses identifying factors that could potentially negatively impact a project's cost, schedule or quality baselines; quantifying the associated potential impact of the identified risk; and implementing measures to manage and mitigate the potential impact [4-8]. The riskier the activity is, the costlier the consequences if the wrong decision is made. Businesses would like to quantify risk for many reasons [9-13]. Knowing how much risk is involved will help decide if costly measures to reduce the level of risk are justifiable. It can also help to decide if sharing the risk with an insurance company is justified [14]. Some risks, such as natural disasters, are virtually unavoidable and affect many people. All choices in life involve risk. Risks cannot be totally avoided, but the choice cans be made so that risk is minimized [15]

2. LITERATURE REVIEW

Hyun-Ho C.H.N Cho and J. W. Seo (2004) presented a risk assessment methodology for underground construction projects. A formalized procedure and associated tools were developed to assess and manage the risks involved in underground construction. The suggested risk assessment procedure is composed of four steps of identifying, analyzing, evaluating, and managing the risks inherent in construction projects. The main tool of the proposed risk assessment methodology is the risk analysis software. The risk analysis software is built upon an uncertainty model based on fuzzy concept. Other tools developed in this study include the survey sheets for collecting risk-related information and the detail check sheets for risk identification and analysis. They finally discussed a detailed case study of the developmental risk assessment methodology performed for a subway construction project in Korea.

Seung H. Han et.al (2004) focused on a financial portfolio risk management for international projects to integrate the risk hierarchy of both individual projects and at the corporate level, which applies a multi criteria decision making method to maximize the total value of firms. To demonstrate the approach, a case study was conducted based on real projects collected from a multinational general contractor. Finally, they presented lessons as well as guidelines for the application of lessons to future projects through a workshop with industry practitioners.

Terry Lyons and Martin Skitmore (2004) conducted a survey of senior management involved in the Queensland engineering construction industry, concerning the usage of risk management techniques. Their survey results are compared with four earlier surveys conducted around the world which indicates that: the use of risk management is moderate to high, with very little differences between the types, sizes and risk tolerance of the organizations, and experience and risk

tolerance of the individual respondents; risk management usage in the execution and planning stages of the project life cycle is higher than in the conceptual or termination phases; risk identification and risk assessment are the most often used risk management elements ahead of risk response and risk documentation; brainstorming is the most common risk identification technique used; qualitative methods of risk assessment are used most frequently; risk reduction is the most frequently used risk response method, with the use of contingencies and contractual transfer preferred over insurance; and project teams are the most frequent group used for risk analysis, ahead of in-house specialists and consultants.

Shou Qing et.al (2004)identified twenty-eight critical risks associated with international construction projects in developing countries and categorized them into three hierarchy levels (Country, Market and Project), of which 22 were evaluated as Critical or Very Much Critical based on a 7-degree rating system. The top 11 critical risks are: Approval and Permit, Change in Law, Justice Reinforcement, Local Partner's Creditworthiness, Political Instability, Cost Overrun, Corruption, Inflation and Interest Rates, Government Policies, Government Influence on Disputes and Termination of JV. The risks at Country level are more critical than that at Market level and the latter are more critical than that in Project level. For each of the identified risks, practical mitigation measures were provided and evaluated. Almost all of the mitigation measures were perceived by the respondents to the survey as effective using a 7-degree rating system. It is suggested that when mitigating a specific risk, the measures with higher effectiveness should be given a higher priority. Taking into account the higher criticalities of higher risk hierarchy levels, the mitigation measures should also be prioritized by the higher risk hierarchy level, i.e. the risks at higher hierarchy level should be mitigated first with higher priority with their respective more effective mitigation measures. A risk model, named Alien Eyes' Risk Model, was proposed which shows the three risk hierarchy levels and the influence relationship among risks. This model will enable better categorizing of risks and representing the influence relationship among risks at different hierarchy levels as well as revealing the mitigating sequence/priority of risks.

El-Diraby.T. A and Gill S.M (2006) developed taxonomy for relevant concepts in the domain of privatized-infrastructure finance. The taxonomy is an attempt to create information interoperability between the construction and financial industries. The taxonomy models the concepts of a privatized-infrastructure finance into six main domains: processes, products, projects, actors, resources and technical topics (technical details and basic concepts). The taxonomy was designed to be consistent with Open Financial Exchange (OFX). It was developed through the analysis of 10 case studies and involvement in project development and interaction with industry experts. The taxonomy was validated through interviews with domain experts, and through the analysis of two independent case studies. A prototypical semantic web-based portal for communicating project risks was developed to in order to illustrate the use of the taxonomy.

Florence Yean Yng Ling and Linda Hoi (2006) studied the risks that Singapore-based architecture, engineering and construction (AEC) firms face when working in India and investigated the risk response techniques adopted by them. Data

were collected from Singaporean experts who were involved in AEC projects in India through in-depth interviews.

Besides the typical risks that a domestic project faces, the main risks that international AEC firms face in India include: political and social risks; high cost of financing fluctuating currency exchange rates; and huge cultural difference between foreigners and Indians. The risk response techniques include having adequate insurances and careful planning and management. It is recommended by them that the foreign firms operating in India should not try to change Indians way of working. Instead, foreigners should respect local culture and practices, and be flexible and extremely patient.

Hamimah Adnan et al., (2008) *explain* the Partnering concept is not a new way of doing business. The partnering process establishes the working relationship among the parties (stakeholders) through a mutually-developed, formal strategy of commitment and communication. It attempts to create an environment where trust and teamwork prevent disputes, co-operative bonds are fostered for everyone's benefit and the completion of successful project is facilitated. The Construction industry in Malaysia is suffering constraints in the processes of construction procurement. Thus, partnering is used as an approach in procurement that could lead toward improving performance of the construction industry in Malaysia. Organizations which have used partnering for construction projects are now reporting favorable results, which include the decreased costs, quality improvement and delivery of project to program. Partnering has reached many benefits in terms of project cost, time quality, build ability and etc. Despite the benefits in applying the partnering procurement method, there remains risks associated with this mode of construction. From the literature review it was found that the risk management process and partnering are critical to the success of the project. A questionnaire survey was conducted on the sample in order to examine the criticality of risk factors and to identify the effectiveness of risk mitigation measures applied in partnering. The opinions and techniques of risk mitigation were gathered through. It was found that the most critical construction partnering risk is the partner's financial resources, clients' problems and economic conditions and financial problems among one of the partner. It is hope that the risk management program will help to reduce the risks in the construction project in Malaysia.

3. OBJECTIVES OF STUDY

The risk management technique is used very less because of less knowledge and awareness among the people. The track record is also very poor in terms of coping up with risks in projects, resulting in the affection of project objectives. Risk management is adopted to contain the possible future risks proactively, rather than being reactive. It applies to any project to evaluate the most, major, and common risks which cause bad effect on the construction project to achieve its objectives. The risk management concept is very less popular technique in the construction industry, then it is necessary to spread awareness of the same.

4. METHODOLOGY

In this paper, general focus has been made on the general concepts of risk management. Risk identification has been done with the study of literature. A questionnaire was developed after the identified factors affecting the success of projects. A risk assessment can be done with the aid of Statistical analysis; ANOVA analysis and t-test were used. Risk response could be planned on the basis of the outcome of the study. Risk control is the last step in the process of risk management. Remedial measures to be suggested and the present data to be recorded for future reference.

5. QUESTIONNAIRE STRUCTURE

The questionnaire was tested with a pilot survey for clarity, ease of use, and value of the information that could be gathered. The questionnaire survey is divided into two parts. The first part consists of general information like Role, Gender, type of construction, experience, nativity, project value etc... And the second part consists of the construction risk factors for Management risk.

6. RISK RATING

A Likert scale of 1-5 was used in the questionnaire where

1 represented “Very Low”,
2 “Low”,
3 “Moderate”,
4 “High”, and
5 “Very High.

A Likert scale is a type of psychometric response scale often used in questionnaires, and is the most widely used scale in survey research. When responding to a Likert questionnaire item, respondents specify their level of agreement to a statement. The scale is named after Rensis Likert, who published a report describing its use (Likert, 1932). The respondents’ were required to indicate the relative criticality/ effectiveness of each of the probability of risk factors and their impact to the management.

7. FINANCIAL RISK

The inflation rate is very high in India and increasing proportionately with time, this causes the increase in prices of materials like cement, steel which intern causes financial risk to the land developers and construction firms. Banks have also raised their interest rates for the loan given by them, this has affected the residential construction market hugely. Thus the financial part of risk is very is very higher than any other risk.

Factors are under Financial Risk (FR) given below:

FR1 - Bankruptcy of project partner
FR2 - Loss due to fluctuation of inflation rate
FR3 - Loss due to fluctuation of interest rate
FR4 - Loss due to fluctuation of exchange rate
FR5 - Loss due to rise in fuel price
FR6 - Change in bank formalities and regulations
FR7 - Insurance Risk

8. STATISTICAL TECHNIQUES USED

- Descriptive analysis (Mean, Standard Deviation),
- Differential analysis (t-test and ANOVA)

a) Mean (m)

The mean of a distribution is commonly understood as the arithmetic average. It is perhaps the most familiar, most frequently used and well understood average. The mean of a set of observations or scores is obtained by dividing the sum of all the values by the total number of values.

$$m = \frac{\sum X}{N}$$

Where,

m = population mean,
Σx = the sum of all the sample observations,
N = the number of sample observations.

b) Standard deviation (σ)

The average of squared deviations of the measures of scores from their mean is known as the variance. The standard deviations are the positive square root of variance.

$$\sigma = \sqrt{\frac{\sum x^2}{N}}$$

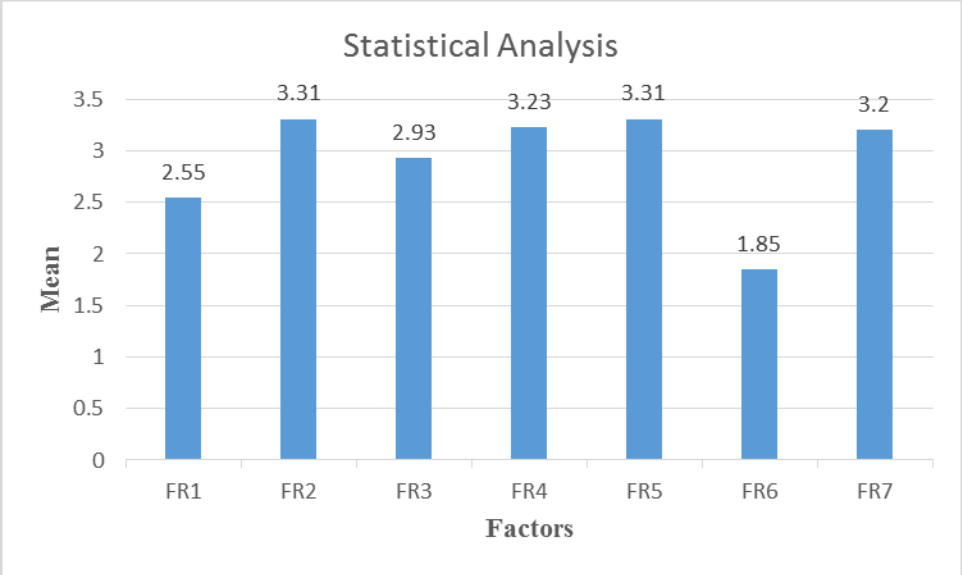
Where,

σ = standard deviation
Σx^2 = the sum of the squares of the difference between the Mean and each score
N= the number of scores

9. ANALYSIS AND RESULTS

Table (1): Statistical Analysis

Factor Number and Name	Mean	Std. Deviation
FR1 - Bankruptcy of project partner	2.55	1.398
FR2 - Loss due to fluctuation of inflation rate	3.31	1.194
FR3 - Loss due to fluctuation of interest rate	2.93	0.682
FR4 - Loss due to fluctuation of exchange rate	3.23	1.064
FR5 - Loss due to rise in fuel price	3.31	1.483
FR6 - Change in bank formalities and regulations	1.85	1.189
FR7 - Insurance Risk	3.20	1.248

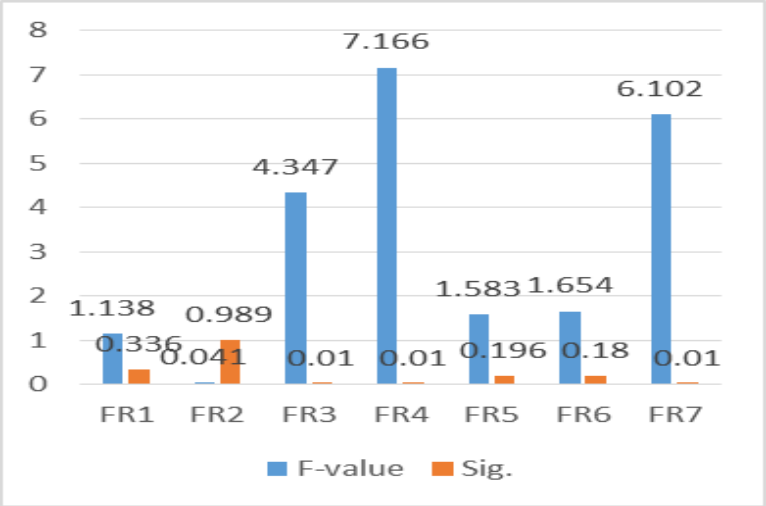


Graph (1) Factors vs Mean

In the case of Financial Risk, Loss due to rise in the fuel price group scored (3.31 (1.483) higher mean value than the other group. So, Loss due to rise in fuel price have a higher level of financial risk than the other groups.

Table (2): ANOVA for Background Information - Role in the Construction Field

Factor Number and Name	F-value	Sig.
FR1 - Bankruptcy of project partner	1.138	0.336
FR2 - Loss due to fluctuation of inflation rate	0.041	0.989
FR3 - Loss due to fluctuation of interest rate	4.347	0.01
FR4 - Loss due to fluctuation of exchange rate	7.166	0.01
FR5 - Loss due to rise in fuel price	1.583	0.196
FR6 - Change in bank formalities and regulations	1.654	0.180
FR7 - Insurance Risk	6.102	0.01

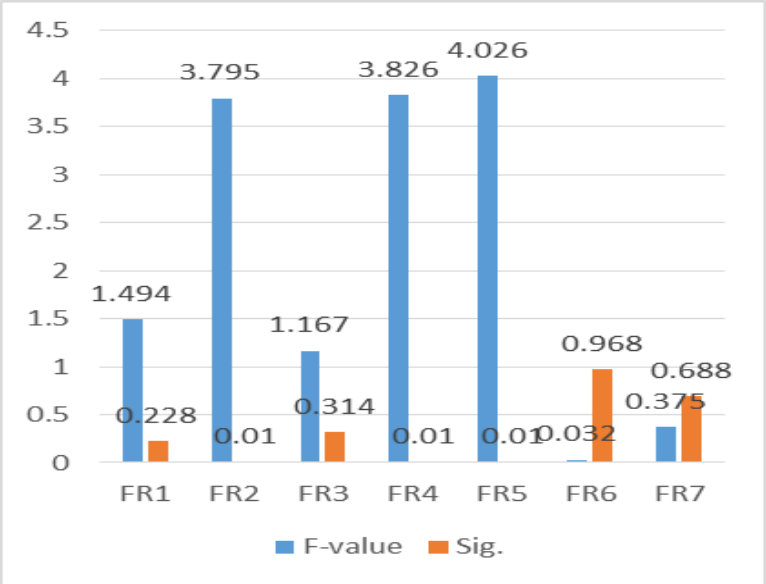


Graph (2) F-value vs Factors

Three factors were identified with less than 5% significance, to have been perceived differently by at least one group of the respondents based on their Role. These factors are FR 3, FR4, and FR7.

Table (3) ANOVA for Background Information - Type of Construction

Factor Number and Name	F-value	Sig.
FR1 - Bankruptcy of project partner	1.494	0.228
FR2 - Loss due to fluctuation of inflation rate	3.795	0.01
FR3 - Loss due to fluctuation of interest rate	1.167	0.314
FR4 - Loss due to fluctuation of exchange rate	3.826	0.01
FR5 - Loss due to rise in fuel price	4.026	0.01
FR6 - Change in bank formalities and regulations	0.032	0.968
FR7 - Insurance Risk	0.375	0.688

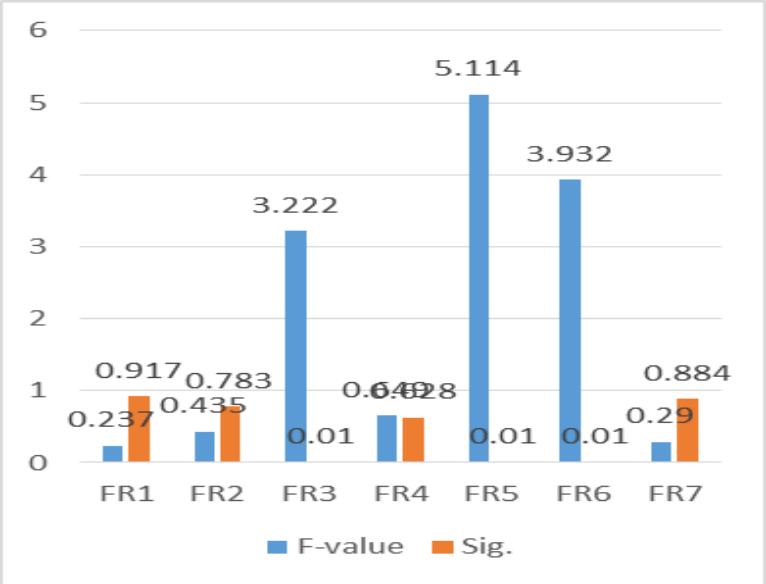


Graph (3) F-value vs Factors

Three factors were identified with less than 5% significance, to have been perceived differently by at least one group of the respondents based on their Type of Construction. These factors are FR2, FR4, and FR5.

Table (4) ANOVA for Background Information –Experience.

Factor Number and Name			F-value	Sig.
FR1	-	Bankruptcy of project partner	0.237	0.917
FR2	-	Loss due to fluctuation of inflation rate	0.435	0.783
FR3	-	Loss due to fluctuation of interest rate	3.222	0.01
FR4	-	Loss due to fluctuation of exchange rate	0.649	0.628
FR5	-	Loss due to rise in fuel price	5.114	0.01
FR6	-	Change in bank formalities and regulations	3.932	0.01
FR7	-	Insurance Risk	0.290	0.884

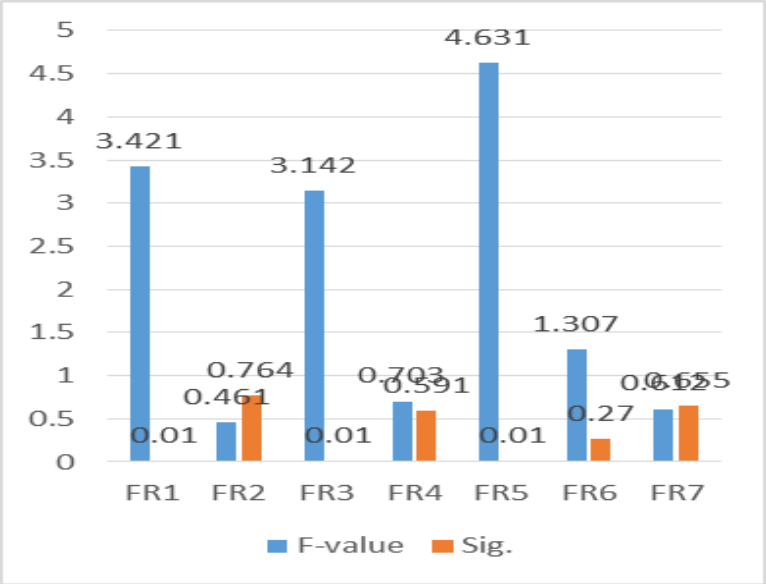


Graph (4) F-value vs Factors

Three factors were identified with less than 5% significance, to have been perceived differently by at least one group of the respondents based on their experience. These factors are FR3, FR5, and FR6.

Table (5) ANOVA for Background Information –Project Value

Factor Number and Name	**F-value**	**Sig.**
FR1 - Bankruptcy of project partner	3.421	0.01
FR2 - Loss due to fluctuation of inflation rate	0.461	0.764
FR3 - Loss due to fluctuation of interest rate	3.142	0.01
FR4 - Loss due to fluctuation of exchange rate	0.703	0.591
FR5 - Loss due to rise in fuel price	4.631	0.01
FR6 - Change in bank formalities and regulations	1.307	0.270
FR7 - Insurance Risk	0.612	0.655

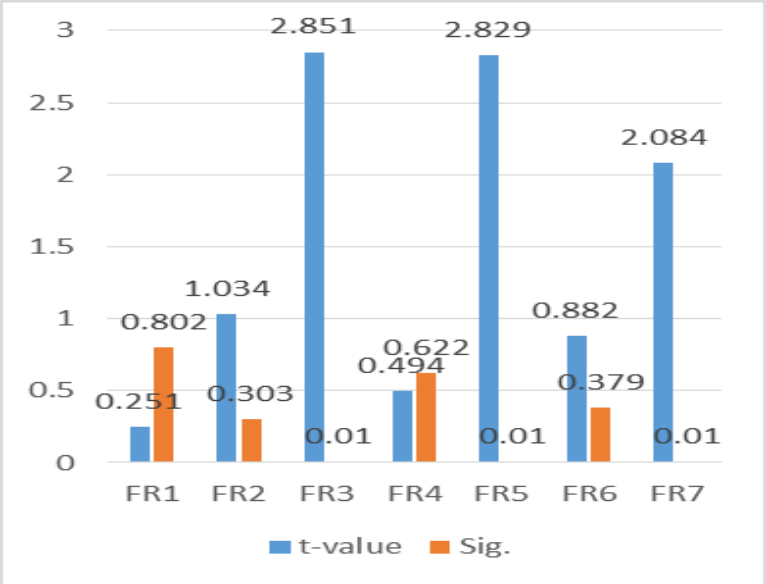


Graph (5) F-value vs Factors

Three factors were identified with less than 5% significance, to have been perceived differently by at least one group of the respondents based on their project value. These factors are FR1, FR3, and FR5.

Table (6) t-test for Background Information – Gender

Factor Number and Name	t-value	Sig.
FR1 - Bankruptcy of project partner	0.251	0.802
FR2 - Loss due to fluctuation of inflation rate	1.034	0.303
FR3 - Loss due to fluctuation of interest rate	2.851	0.01
FR4 - Loss due to fluctuation of exchange rate	0.494	0.622
FR5 - Loss due to rise in fuel price	2.829	0.01
FR6 - Change in bank formalities and regulations	0.882	0.379
FR7 - Insurance Risk	2.084	0.01

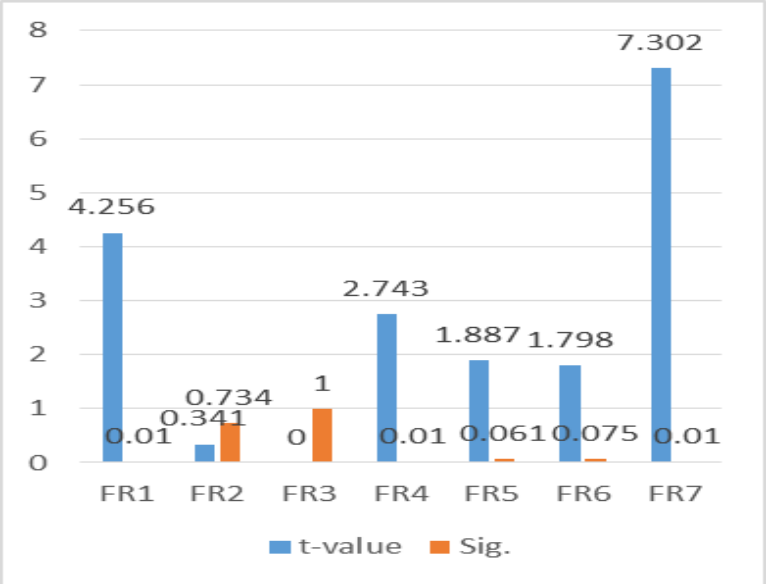


Graph (6) t-value vs Factors

Three factors were identified with less than 5% significance, to have been perceived differently by at least one group of the respondents based on their gender. These factors are FR3, FR5, and FR7.

Table (7) t-test for Background Information – Nativity of respondents

Factor Number and Name	t-value	Sig.
FR1 - Bankruptcy of project partner	4.256	0.01
FR2 - Loss due to fluctuation of inflation rate	0.341	0.734
FR3 - Loss due to fluctuation of interest rate	0.000	1.000
FR4 - Loss due to fluctuation of exchange rate	2.743	0.01
FR5 - Loss due to rise in fuel price	1.887	0.061
FR6 - Change in bank formalities and regulations	1.798	0.075
FR7 - Insurance Risk	7.302	0.01



Graph (7) t-value vs Factors

Three factors were identified with less than 5% significance, to have been perceived differently by at least one group of the respondents based on their nativity. These factors are FR1, FR4, and FR7.

10. CONCLUSION

- ✓ In the case of Financial Risk, **Loss due to rise in the fuel price group** scored (3.31 (1.483) higher mean value than the other group. So, Loss due to rise in fuel price have a higher level of financial risk than the other groups.
- ✓ Three factors were identified with less than 5% significance, to have been perceived differently by at least one group of the respondents based on their **Role in the construction field**. These factors are **FR 3, FR4, and FR7**.
- ✓ Three factors were identified with less than 5% significance, to have been perceived differently by at least one group of the respondents based on their **Type of Construction**. These factors are **FR2, FR4, and FR5.**
- ✓ Three factors were identified with less than 5% significance, to have been perceived differently by at least one group of the respondents based on their **Experience.** These factors are **FR3, FR5, and FR6**.
- ✓ Three factors were identified with less than 5% significance, to have been perceived differently by at least one group of the respondents based on the **Project value.** These factors are **FR1, FR3, and FR5**.
- ✓ Three factors were identified with less than 5% significance, to have been perceived differently by at least one group of the respondents based on the **Gender.** These factors are **FR3, FR5, and FR7.**

- ✓ Three factors were identified with less than 5% significance, to have been perceived differently by at least one group of the respondents based on their **Nativity.** These factors are **FR1, FR4, and FR7.**

11. SUGGESTION

- Risk management should be considered a primary tool to assess the project. From the survey we can understand that risk management is not followed in most of the companies as such, but if followed also it is not done systematically. Immediate mitigation measures are not in place if a risk event happens.
- Higher gas prices will increase material acquisition and material delivery cost will be higher. Sudden increasing gas prices signifies problems when trying to figure out a good estimate for a future project.
- Financial part of the risk is a global phenomenon and this risk should be handled carefully using financial consultants since this cannot be handled by engineers alone
- Most of the company's management follows Top to down approach which is a traditional approach, but Down to top approach should be followed so that the employees' voices are heard

12. SCOPE FOR FUTURE STUDY

The factors identified to be critical in this study are not exhaustive. The other factors are the field problems faced by the contractors, consultants. Project managers, project engineers and the field engineers. These factors are on the whole influencing a project. Work Break Down may be done at the micro level and critical factors for each every activity may be identified. So that, the critical factors affecting the project performance can be studied by conducting micro scheduling.

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