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Factors Affecting Cost Contingency in International Projects

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Abstract
Contractors include a reasonable contingency amount as an allowance for potential risks in their bid, especially in international projects, in order to protect themselves against possible failures as the international construction environment is highly influenced by several complex factors such as intense competitiveness due to the existence of numerous competent rivals, unfamiliarity with the country, local conditions, and the client in question, uncertainties in the project environment, etc. The aim of this study is to identify the importance levels of the risk factors that may affect cost contingency amounts in international projects. Review of the literature indicated that there are 59 risk factors, and these factors are categorized into 6 groups, which include; bidding stage-related factors, construction-related factors, finance-related factors, country-related factors, company-related factors, and contract-related factors. Having identified and categorized these factors, a questionnaire was designed and data of 36 construction projects from 14 countries were collected for evaluation of these risk factors.

Keywords
Risk factors, International construction, Cost contingency, Questionnaire, Turkey.

1. Introduction

Construction companies, especially in developing countries, have begun to undertake international projects as a result of the globalization of construction markets. Generally, carrying out projects in international construction markets is riskier than carrying out projects in domestic markets as the international construction environment is highly influenced by several complex factors such as intense competitiveness due to the existence of numerous competent rivals, unfamiliarity with the host country conditions, project environment, the client in question, and unavailability of resources (e.g., materials, labourers, equipments, subcontractors, etc.) in the host country, etc. These factors may likely have an adverse impact on the project performance. Given this risky construction environment, contractors need to identify all potential risks inherent in international projects during the bidding stage, thoroughly assess them, determine the risk level of the project, and include a reasonable contingency amount as an allowance for potential risks in their bid in order to protect themselves against possible failures (Sonmez et al. (2007)).

Determination of the accurate contingency amount plays a critical role in not only obtaining the contract and but also achieving project goals. While low amounts of contingency may bring about significant losses in highly risky projects, high amounts of contingency may cause contractors to lose the job. This study aims to

identify the importance levels of the risk factors that may affect cost contingency amounts in international projects.

2. Turkish Contractors in International Markets

There are approximately 100,000 contractors registered with the Ministry of Public Works and Settlement in Turkey. If one considers unregistered companies, this number goes up to 200,000, which is greater than the total number of E.U. contractors (Yemar Report (2009)). Turkish contractors do not only undertake projects in the domestic market but also in international markets including the Commonwealth of Independent States, Africa, the Middle East, Europe, Asia, etc. Turkish contractors have been undertaking projects in international construction markets since the 1970s. They were participating in small-scaled projects as subcontractors in the beginning, yet they are now undertaking prestigious projects as prime contractors. Figure 1 shows the total values of the international projects won by Turkish contractors in the period between 2003 and 2008 (Yemar Report (2009)).

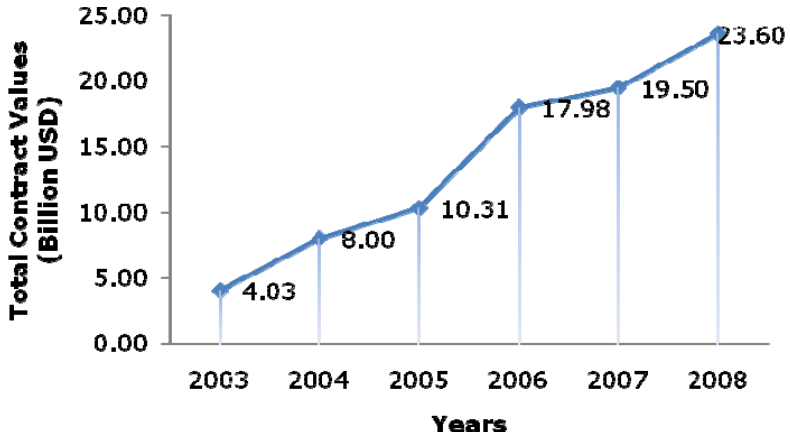

Fig 1: Total values of the international projects won by Turkish contractors

Indeed, Turkish contractors have won more than 3,500 projects with a total value of $84 billion in 65 different countries so far (Yemar Report (2009)). As a result of this success, Turkish contractors have ranked 2nd in 2009 in the Engineering News Record's (ENR) *Top 225 International Contractors* list. Table 1 shows the number of Turkish contractors and their rankings in the ENR's *Top 225 International Contractors* list in the period between 2005 and 2009.

Years	Number of Turkish Contractors	Ranking
2005	14	4
2006	20	3
2007	22	3
2008	23	3
2009	31	2

Table 1: Number of Turkish contractors and their rankings in the ENR's Top 225 International Contractors list

Undoubtedly, the continuity of this success mostly depends on the extent to which Turkish construction companies include a reasonable cost contingency, which is determined by the risk level of the project, in their bid.

3. Research Methodology

3.1. Questionnaire Design

Review of the literature (Hayes et al. (1986), Gunhan and Arditi (2005a,b), Dikmen et al. (2007), Sonmez et al. (2007), Ozorhon et al. (2007), Bu-Qammaz et al. (2009)) indicated that there are 59 risk factors that may affect cost contingency amounts in international construction projects and these factors are categorized into 6 groups, which include; bidding stage-related factors, construction stage-related factors, finance-related factors, country-related factors, company-related factors, and contract-related factors. These 59 risk factors are shown in the first of column of Table 2.

Having identified and categorized these factors, a questionnaire, which consists of 69 questions, was designed. The questionnaire mainly included two sections. The first section involved 10 questions, which inquired about the context of the respondent company and the project characteristics including experience of the company in the construction industry, number of employees, total turnover in domestic and international markets, project type, project size, client profile, contract type, the host country, and contingency amount used for the project. The second section comprised 59 questions. These questions were meant to explore the importance level of the risk factors presented in Table 2 using a scale of 1-5, where "1" represents the best condition and "5" represents the worse condition.

3.2. Data Analysis Methods

In order to test the reliability of the questionnaire, reliability analysis using the internal consistency method was conducted using the statistical package SPSS®. Cronbach's alpha (α) is the most common measure of scale reliability (Field (2005)). The standardized Cronbach's alpha is calculated using Eq. 1.

$$\alpha = \frac{N}{(N-1)} \times \left(\frac{\sigma_x^{\,2} - \sum_{i=1}^{N} \sigma_{yi}^{\,2}}{\sigma_x^{\,2}} \right) \tag{1}$$

where N is the number of risk factors, σ_x^2 is the variance of the observed total test scores, and σ_{yi}^2 is the variance of risk factor *i*.

A value of at least 0.60 for Cronbach's alpha indicates that the scale is reliable in exploratory studies (Pallant (2005)). One or more of the variables defining the construct may have to be deleted if it helps to increase the value of Cronbach's alpha (Field (2005)).

Having conducted the reliability analysis, ranking analysis was performed to find the relative importance of risk factors based on the survey data. Since the ordinal data were collected in the questionnaire survey, parametric statistics would not produce meaningful results. Thus, severity index analysis was chosen to rank the

risk factors according to their relative importance (Chen et al. (2009)). Severity index is calculated using Eq. 2:

$$SeverityIndex(SI) = \left(\frac{\sum_{i=1}^{5} w_i \times (f_i / n)}{a} \right) \quad (2)$$

Where; i is the point given to each risk factor by the respondent, ranging from 1 to 5, w_i is the weight for each point, f_i is the frequency of the point i by all respondents, n is the total number of responses, and a is the highest weight, which is 5 in this study.

Five important levels are then transformed to SI values, which are: High (H) (0.8≤SI≤1), High-Medium (H-M) (0.6≤SI<0.8), Medium (M) (0.4≤SI<0.6), Medium-Low (M-L) (0.2≤SI<0.4), and Low (L) (0≤SI<0.2) (Chen et al. (2009)).

4. Findings and Discussion

4.1. Sample Characteristics

Questionnaires were sent to the randomly selected 50 contractors, which are registered to Turkish Contractors Association (TCA) and operate in international construction markets, and 20 contractors returned 36 duly completed questionnaires including data of 36 construction projects from 14 different countries. This corresponds to a response rate of 40%.

25% of the respondent contractors had more than 41 years of experience in the construction industry, 20% of them had experience between 31-40 years, and 20% of them had experience between 21-30 years, and 35% of them had experience between 10-20 years. While 60% of the respondents employed more than 1,500 workers, only 15% of them employed less than 100 employees. 45% of the respondent companies completed projects with a value of more than $750 million in Turkey and only 10% of the contractors completed projects, whose contract values are less than $50 million. Similarly, the majority of the respondent companies (55%) undertook international projects worth more than $750 million and only 10% of the contractors completed projects with a value of less than $50 million.

42% of the studied projects were institutional and commercial building construction, 40% of them infrastructure and heavy construction, 10% of them residential housing, and 8% of them specialized industrial construction. The contract values of the studied projects ranged between less than $50 million (25%) to more than $750 million (11%). While 40% of the projects were contracted with public sector clients, 42% of them were contracted with private sector clients. 58% of the contracts were lump sum and 42% of them unit price. The host countries of the studies projects include Libya (8 projects), Bulgaria (6 projects), Russia and Saudi Arabia (4 projects in each country), Turkmenistan (3 projects), Algeria and Oman (2 projects in each country), Azerbaijan, Georgia, Jordan, Kazakhstan, Pakistan, Poland, and Qatar (1 project in each country). Figure 2 shows the number of projects and the contingency amounts allocated for each project in percentage of contract value are shown in Figure 2.

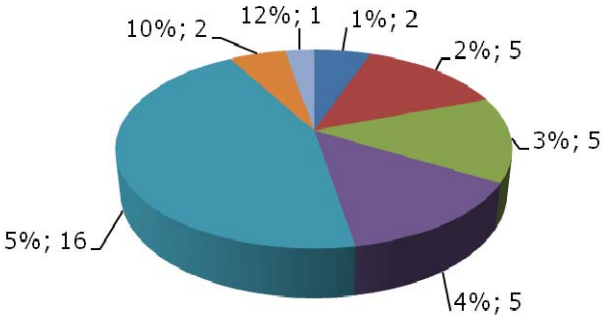

Fig 2: The number of projects and the contingency amounts allocated for each project in percentage of contract value

As seen in Figure 2, 5% of the contract values were allocated for contingency allowance in 16 out of 36 projects, which corresponds to 44% of the studied projects.

4.2. Reliability of the Questionnaire

With the help of SPSS 16.0, Cronbach's alpha was calculated to test the internal consistency reliability of the generated scale. Cronbach's alpha value is 0.831 for bidding stage-related factors, 0.797 for construction-related factors, 0.687 for finance-related factors, 0.870 for country-related factors, 0.921 for company-related factors, and 0.849 for contract-related factors. All alpha values are greater than 0.6, which indicate that all reliability coefficients are acceptable and the internal consistency of the risk factors included in the scale is high.

4.3. Ranking Analysis

Severity index values were calculated using the formula in Eq. 2. Based on the magnitude of the severity indices and average ratings of the risk factors, the ranking results for each risk factor category, namely bidding stage-related factors, construction stage-related factors, finance-related factors, country-related factors, company-related factors, and contract-related factors, and for all risk factors are presented in descending order in Table 2.

Based on the ranking results, 2 risk factors have "High" importance level for cost contingency amounts. These risk factors include "bureaucratic difficulties" and "unavailability of qualified workforce in the host country". Both of these factors are "country-related factors". This finding may result from the fact that Turkish contractors predominantly undertake projects in either developing or undeveloped countries. Since bureaucracy, unqualified workforce, low productivity, unavailability of resources, high inflation rates, etc. are commonly experienced in such countries; it is not surprising that Turkish contractors face problems resulting from the adverse conditions prevailing in the host countries.

According to Table 2, a total of 9 risk factors, which consist of 1 bidding stage-related factor, 1 finance-related factor, 4 country-related factors, and 3 contract-related factors, were recorded to have "High-Medium" importance levels. As expected, 4 out of 9 risk factors of "High-Medium" importance are related to the adverse conditions prevailing in the host country. Moreover, the finance-related

factor, which has "High-Medium" importance level, namely high inflation rate in the host country, is related to the host country conditions to a large extent. 3 of these factors are related to the unsatisfactory contract conditions. This finding may result from that the majority of the studied projects (58%) were performed under lump sum contracts. While lump sum contracts protect the owner from increases in the price, it is very risky for the contractor if there are unfair, uncertain and incomplete clauses in the contract. The survey results indicated that most of the respondent contractors suffer from such clauses in contracts.

The survey results indicated that 35 out of the remaining 48 risk factors have "Medium" importance levels, and 13 of them have "Medium-Low" importance levels. None of the 59 risk factors has "Low" importance level.

Risk Factors	Ave. Rat.[2]	SI[3]	Rank. by Categ.	Overall Rank.	Imp. Level[2]
Bidding stage-related factors					
Design complexity	2.9	0.6	1	3	H-M
Inadequate site investigations	2.6	0.5	2	4	M
Incompatibilities between design documents and specifications	2.4	0.5	2	4	M
Insufficient time for bid preparation	2.1	0.4	3	5	M
Vagueness of the project scope	2.0	0.4	3	5	M
Inexperience of personnel working in the bidding department	1.9	0.4	3	5	M
Unfamiliarity with the specifications and standards prevailing in the host country	1.9	0.4	3	5	M
Inadequate market investigations	1.7	0.3	4	6	M-L
Unrealistic budget allocation for mobilization and overhead costs	1.7	0.3	4	6	M-L
Lack of site visits	1.7	0.3	4	6	M-L
Construction stage-related factors					
Poor performance of subcontractors	2.6	0.5	1	4	M
Adverse weather conditions	2.5	0.5	1	4	M
Difficulties in procuring materials and equipments that comply with the project requirements in the host country	2.4	0.5	1	4	M
Tight schedule	2.1	0.4	2	5	M
Inexperience of the company in obtaining the required construction permits in the host country	2.0	0.4	2	5	M
Unfamiliarity with the construction technique used in the project in question	2.0	0.4	2	5	M
Unavailability of subcontractors and suppliers	1.8	0.4	2	5	M
Poor planning	1.7	0.3	3	6	M-L
Unavailability of resources	1.5	0.3	3	6	M-L
Technical and technological complexities	1.3	0.3	3	6	M-L
Finance-related factors					
High inflation rate in the host country	2.8	0.6	1	3	H-M
High fluctuations in exchange rates	2.4	0.5	2	4	M
Delay in payments	2.2	0.5	2	4	M
Low % of advance payment	1.9	0.4	3	5	M
Difficulties in taking credits	1.7	0.4	3	5	M
Unfamiliarity with the tax system in the host country	1.5	0.3	4	6	M-L
Country-related factors					
Bureaucratic difficulties	3.9	0.8	1	1	H

[2] Average Rating on a Scale of 1-5: 1=Very Low, 2=Low, 3=Medium, 4=High, 5=Very High
[3] Severity Index: High (H) (0.8≤SI≤1), High-Medium (H-M) (0.6≤SI<0.8), Medium (M) (0.4≤SI<0.6), Medium-Low (M-L) (0.2≤SI<0.4), and Low (L) (0≤SI<0.2)

Unavailability of qualified workforce in the host country	3.7	0.8	1	1	H
Difficulties in obtaining visa for the employees	3.4	0.7	2	2	H-M
Poor productivity of labourers in the host country	2.9	0.6	3	3	H-M
Difficulties in transporting materials and equipments to the host country	2.8	0.6	3	3	H-M
Bribery	2.7	0.6	3	3	H-M
Inadequate banking system and difficulties in money transfers	2.5	0.5	4	4	M
Security problems (e.g., theft, public disorder)	2.5	0.5	4	4	M
High commissions for construction permits	2.4	0.5	4	4	M
Instability of economical conditions	2.4	0.5	4	4	M
Poor attitude of host country	2.4	0.5	4	4	M
High wages of qualified workforce in the host country	2.2	0.5	4	4	M
Change of regulations and laws	1.9	0.4	5	5	M
Poor attitude towards the project	1.5	0.3	6	6	M-L
Company-related factors					
Poor productivity due to high turnover of the employees	1.9	0.4	1	5	M
Poor managerial capabilities	1.8	0.4	1	5	M
Difficulties in keeping records	1.7	0.3	2	6	M-L
Poor motivation of the employees	1.7	0.3	2	6	M-L
Poor health and safety conditions	1.3	0.3	2	6	M-L
Contract-related factors					
Vagueness of contract conditions regarding claims due to delays in payments	2.9	0.6	1	3	H-M
Strict contract conditions regarding delays and cost overruns resulting from design and site conditions	2.8	0.6	1	3	H-M
Unsatisfactory contract conditions regarding claims due to design changes and additional works	2.8	0.6	1	3	H-M
Unsatisfactory contract conditions regarding delays in designs	2.6	0.5	2	4	M
Unsatisfactory contract conditions regarding escalations	2.5	0.5	2	4	M
High % of retention money	2.4	0.5	2	4	M
Long guarantee period	2.3	0.5	2	4	M
Unsatisfactory contract conditions regarding fluctuations in exchange rates	2.3	0.5	2	4	M
Poor contract conditions that do not comply with international standards	2.2	0.5	2	4	M
High penalties	2.2	0.5	2	4	M
Inadequate definition of force majors	2.1	0.4	3	5	M
Unsatisfactory contract conditions regarding the dispute resolution method	1.9	0.4	3	5	M
Unclear contract conditions regarding the rights and responsibilities of the parties	1.7	0.3	4	6	M-L
Vagueness of contract conditions regarding the situations for which penalties will apply	1.5	0.3	4	6	M-L

Table 2: Rank of risk factors affecting cost contingency amounts

5. Conclusions

Allocation of the accurate contingency amount for the bid prices in international projects plays a significant role in the project success. Review of the literature indicated that there are 59 risk factors that may affect cost contingency amounts in international construction projects. These factors are categorized into 6 groups, which include; bidding stage-related factors, construction-related factors, finance-related factors, country-related factors, company-related factors, and contract-related factors. Data of 36 construction projects completed by 20 Turkish contractors in 14 different countries were collected via a questionnaire survey, which consists of 69 questions. Reliability and ranking analyses were carried out in order to test the reliability of the questionnaire and find the relative importance of risk factors based on the survey data, respectively. The ranking results revealed that 2 out of 59 risk factors have "High", 9 have "High-Medium", 35 have "Medium", and 13 have "Medium-Low" importance levels. None of these 59 risk factors has "Low" importance level. Most of the risk factors, which have "High" or "High-Medium" importance levels, are "country-related factors". This finding may result from the fact that Turkish contractors predominantly undertake projects in either developing or undeveloped countries and adverse conditions such as low productivity, unavailability of resources, bureaucracy, high inflation rates, etc. commonly prevail in such countries. Thus, it is highly expected that Turkish contractors face problems resulting from such adverse conditions prevailing in the host countries. This study identifies the importance levels of the risk factors that may affect cost contingency amounts in international projects and establishes the framework for further studies, which aim to investigate the relationships between the importance levels of the risk factors and contingency amounts, and propose a multi-criteria-decision-making tool for predicting the contingency amount considering the importance levels of the risk factors.

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