Risk Allocation Practices at the Bid Phase of the Construction Project: A Look at Factors that Impact Risk Premiums at the Bid Phase of the Construction Project

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Abstract

Exculpatory clauses are often used by owners in construction contracts to shift potential risks of construction to the contractor. Conversely, to mitigate those risks, contractors use a risk premium as part of their contingency plan to reduce the risks associated with accepting exculpatory clauses. The study identified five risks commonly used in construction contracts; namely, design errors, differing site conditions, construction errors, risks of payments, and damage for delays. The study examined the correlation among the contractor's years of experience, company size and percent of self-completed work and the contractor's risk premium for each identified risk. Results shown in the paper are based on real bids obtained from U.S. contractors. This will help contracting parties to better understand the effect of the concept of risk-sharing on controlling project cost

Introduction

Risk identification and management are inherent practices in the construction industry. Typically, risks are shifted from one party, who has the more bargaining power, to another through the use of exculpatory clauses [1]. However, for a project to be successful, risks must be correctly allocated between the contracting parties. As such, the party assuming the risk is expected to have the required expertise to mitigate its negative impact on the project [2]. Fisk and Reynolds mentioned "the principal guideline in determining whether a risk should be transferred to another is whether the party assuming the risk has both the competence to assess the risk and the expertise necessary to control or minimize it [3]."

Most owners in the construction industry utilize exculpatory clauses to assign identified risks to the contractor. By doing so, owners assume that such clauses provide more control on project cost and thus, protect them from unexpected additional expenditures on the project. Furthermore, owners assume that these clauses protect them against future litigations and related expenses [1].

According to Powell, owners who adopt a risk averse approach to manage and mitigate the effect of risk may use numerous forms of exculpatory clauses [4]. The clause may provide protection against any damages or delays. Furthermore, the exculpatory clause may state that the owner is not liable for unforeseen site conditions. Conversely, research in risk allocation and management in the construction industry, although scarce, shows that contractors apply risk premiums when they assume risks. Khazaeni el al. stated that the value of the premium used depends on the ability of the contractor to effectively manage and control the risk [2]. Haddad suggested that contractors use a risk premium of 23% as part of their contingency plan to alleviate the risks associated with accepting exculpatory clauses [5]. Correspondingly, Hartman stated the risk premiums varies between 9% and 19% [6].

Risk premiums are incorporated in the unit rates. Hence, the bid price not only reflects the cost, overhead and profit for the contractor, but also entails risk premiums. Eventually, premiums

become part of the contract value regardless of whether the risk materializes or not. According to Haddad, this will lead to a higher project cost to the owner than the original estimate due to improper risk allocation practices [7].

Exculpatory clauses

While owners use exculpatory clauses with the goal of reducing project total cost, they should recognize that this may result in unnecessary extra costs in the construction contract. The research in this field posits that these clauses may eventually negatively affect project finances [7]. According to Mohamed and Hartman, when the contractor encounters such clauses it is certain to use either hidden or explicit premiums in its bid price, which increase the value of the bid [8]. As such, the contractor has the upper hand in protecting themselves against the risk. Particularly, the added risk premiums are adequate to cover all related expenses. Conversely, if the risk premiums are not adequate to pay for all expenses of the risk, then the contractor has to cover the expenses from his or her own pocket.

In the event the risk does not occur, the risk premium converts into net profit to the contractor. For this reason, the owner is contractually obligated to pay the contractor the risk premium even though the risk never materialized. In some cases, the contractor may argue against accepting the cost of a particular risk that has materialized. The contracting parties may resort to go to court to make a judgment on the case. The litigation process is both expensive and time consuming for the contractor and the owner. Therefore, both parties lose.

Zack argued that the appropriate assigning of the risk among the contracting parties is an essential decision that may lead to the smooth execution and success of the construction project [9]. Further, Winch mentioned that risk is associated with uncertainty, which is generally defined as the lack of information or the lack of knowledge and experience at a time where a decision has to be made [10]. In order to minimize the uncertainty associated with a particular risk, the project team must effectively and efficiently evaluate, prevent and control risk. The project team has to establish a comprehensive understanding of the risk. The process of risk management typically involves the following functions: risk identification, impact analysis and response system. As in all management systems, the risk management system should be continuous and flexible to adjust to current events [4].

This study focused on three factors that affect the aforementioned decision-making process; contractor years of experience, contractor company size, and contractor's percent of self-completed works. The study examined the effect of the these factors on determining risk premiums for five exculpatory clauses widely used in today's construction documents; namely, design errors, differing site conditions, construction errors, risks of payments, and no damage for delays.

Research questions and null hypothesis

The purpose of this study was to identify and quantify risk premiums added by the contractor to mitigate the risk associated with the use of the selected exculpatory clauses found in construction contracts. To address the purpose of this study, the following three research questions were developed. First, was there a relationship between the contractors' risk premium for each identified

risk and the estimators' years of experience? Second, was there a relationship between the contractors' risk premium for each identified risk and the contractor's company size? Third, was there a relationship between the contractors' risk premium for each identified risk and the contractors' percent of self-completed work?

To answer the above mentioned research questions, data for this study was collected from two groups of contractors. Group A included contractors who were presented a bid package with exculpatory clauses. Group B included contractors who were presented a bid package with a separate list of identified risks. During the analysis of the developed data the following null hypotheses were tested:

H_{o1}: There was no relationship between the contractors' risk premium for each identified risk and the contractors years of experience.
H_{o2}: There was no relationship between the contractors' risk premium for each identified risk and the contractors' company size.
H_{o3}: There was no relationship between the contractors' risk premium for each identified risk and the contractors' percent of self-completed work.

The study used Pearson's Correlation to test the first, second and third null hypotheses. Pearson's Correlation was also employed to determine the relationship between the contractor's risk premiums for each identified risk and the estimator's years of experience, company size and contractor's percent of self-performed work.

Industry survey

The study was based on the traditional project delivery method, the American Institute of Architects (AIA) document A201 and the five exculpatory clauses. Those clauses allocate risk for design errors, differing site conditions, construction errors, risks of payments, and no damage for delays.

A convenience store construction project was used in the study. The contractors were asked to submit a lump sum price for the construction of the project. The project documents were developed based upon AIA documents A201 and the contract language was completed to meet the requirements of the study. The project delivery method employed was design-bid-build. The project documents requested a scope of work to include excavation work, foundation work, steel structure work, and masonry work.

Population and Sample

The population for this research was general contractors with the following criteria:

1. Range of project values from $1 million to $700 million per year.
2. Participants were familiar with the competitive bid environment.
3. Estimators had at least three years of experience

The population for the experiment was developed from general contractors working in the U.S. The total number of participants was 92, of which 30 fully completed the survey instrument. This represents a 32% response rate. Five respondents did not complete all requirements of the instrument.

The study collected data from two groups of contractors who were presented with two different bid packages for the same project. The first package entailed embedded exculpatory clauses in the contract document. Conversely, the second bid package entailed a list of identified risks. Subsequently, both groups of contractors completed a questionnaire concerning the amount they added as risk premiums to accept the identified risks for the study. Contractors in the first group (group A) submitted a lump sum price for the project. The second group (group B) of contractors submitted a base bid price. The price did not include any premiums to accept the identified risks. Simultaneously, contractors provided their risk premiums for the identified risks, which were later added to calculate contractors' lump sum price.

The research examined the bid prices using the Pearson's Correlation to test the first, second and third null hypotheses. To eliminate bid price variation due to calculating project quantities and differences in overhead/profit, the study included project quantity take off and set a rate of 10% for overhead/profit for all participants.

Appendix A shows the raw data and descriptive statistics collected on participants' years of experience, annual project value and percent of self-completed work.

Results from null hypothesis 1

The first null hypothesis stated that there was no relationship between the contractors' risk premium for each identified risk and the contractor's years of experience. Table 1 shows Pearson Correlation coefficients for contractor's years of experience with risk premiums added for design errors, differing site conditions, construction errors, risk of payments and no damage for delays.

Group		Design errors	Differing site conditions	Construction errors	Risk of payments	No damage for delays
Contractor's years of Experience						
	A	-0.003	0.127	0.136	0.003	0.454
	B	-0.100	0.008	-0.067	-0.019	0.020

Table 1 - Correlation results for contractors' years of experience with identified risks

Results indicated that for group A contractors, there was a moderately positive correlation between the contractor's years of experience and risk premiums added for no damage for delays (0.454). Furthermore, results indicated very little measured correlation between group A contractor's years of experience and risk premiums added for design errors, differing site conditions, construction errors and risk of payments (-0.003, 0.127, 0.136 and 0.003 respectively). In addition, results indicated that for group B contractors, there was very little measured correlation between the contractor's years of experience and risk premiums added for the identified risks for this study.

Results from null hypothesis 2

The second null hypothesis stated that there was no relationship between the contractors' risk premium for each identified risk and the contractors' company size. Table 2 presents results of contractor's annual project values correlations with risk premiums added for design errors, differing site conditions, construction errors, risk of payments and no damage for delays.

Results suggested that for group A contractors, there was a moderately positive correlation between the contractor's annual project value and risk premiums added for no damage for delays (0. 495). In addition, the results suggested that there was a weak correlation between group A contractor's annual project values and risk premiums added for design errors, differing site conditions, construction errors and risk of payments (0.190, 0.185, 0.031, -0.046).

Further, results indicated a moderate positive correlation between group B contractor's annual project value and risk premiums added for differing site conditions and design errors (0.488, 0.409). The results also indicated a weak correlation between group B contractor's annual project value and risk premiums added for construction errors, risk of payments and no damage for delays (-0.140, 0.321, and 0.061 respectively).

Group		Design errors	Differing site conditions	Construction errors	Risk of payments	No damage for delays
Contractor's annual project value						
	A	0.190	0.185	0.031	-0.046	0.495
	B	0.488	0.409	-0.140	0.321	0.061

Table 2 - Correlation results for contractors' annual project values with identified risks

Results from null hypothesis 3

The third null hypothesis stated that there was no relationship between the contractors' risk premium for each identified risk and the contractors' percent of self-completed work. Table 3 shows contractor's percent of self-completed work correlations with risk premiums added for design errors, differing site conditions, construction errors, risk of payments and no damage for delays.

Results indicated that for group A contractors, there was a moderately positive correlation between the contractor's percent of self-completed work and risk premiums added for no damage for delays (0. 317). Moreover, the results suggested that there was a moderately negative correlation between the contractor's percent of self-completed work and risk premiums added for differing site conditions and construction errors (-0.432 and -0.336). Further, there was a weak correlation between contractor's percent of self-completed work and risk premiums added for design errors and risk of payments (0.040 and -0.287).

Conversely, results suggested that for group B contractors, there was a moderate correlation between contractor's percent of self-completed work and risk premiums added for construction errors (0.329). Also, there was a weak correlation between contractor's percent of self-completed work and risk premiums added for design errors, differing site conditions, risk of payments and no damage for delays (-0.071, -0.240, 0.140, 0.170 respectively).

Finally, the results suggested a moderately positive correlation between group A contractors' annual project values and years of experience and the risk premium added for no damage for delays. The larger and more experienced the contractor was and the higher percent of self-completed work done, the higher risk premium was measured for assuming risks of no damage for delays.

Group	Design errors	Differing site conditions	Construction errors	Risk of payments	No damage for delays
Contractor's percent of self-performed work					
A	0.040	-0.432	-0.336	-0.287	0.317
B	-0.071	-0.240	0.329	0.140	0.170

Table 3 - Correlation results for contractors' percent of self-completed work with identified risks

Finding and Conclusion

The following are the findings for each research question based on the results of the statistical analyses.

Research Question 1: Was there a relationship between the contractors' risk premium for each identified risk and the estimators' years of experience?

Study Findings: The results indicate that the strength of association between the contractors' risk premium for each identified risk and the estimators' years of experience was low; therefore, not linear.

Research Question 2: Was there a relationship between the contractors' risk premium for each identified risk and the contractors' company size?

Study Findings: The results indicate that the strength of association between the contractors' risk premium for each identified risk and the contractor's company size was low; therefore, not linear.

Research Question 3: Was there a relationship between the contractors' risk premium for each identified risk and the contractors' percent of self-completed work?

Study Findings: The results indicate that the strength of association between the contractors' risk premium for each identified risk and the contractors' percent of self-completed work was low; therefore, not linear.

The relationship between group A contractor's years of experience and risk premiums added for design errors, differing site conditions, construction errors, risk of payments and no damage for delays were not statistically significant. However, the significant level for the relationship between contractor's years of experience and risk premiums added for design errors risk was 0.1, while not significant, it was comparably a high value. This correlation may be significant with a larger sample size. This result suggests that contractors' experience has no effect on risk premiums added to protect themselves against design errors.

The correlation between group A contractor's annual project values and risk premiums added for the identified risks were not statistically significant. However, the significant level for the relationship between contractor's annual project values and risk premiums added for design errors risk was 0.488, while not significant, it was a high value. This correlation may be significant with a larger sample size. This suggests that contractors with high annual project values realize that it is imperative to protect them against design errors; hence, they may use higher risk premiums.

The correlation between group B contractor's annual project values and risk premiums added for the identified risks were not statistically significant. However, the significant level for the relationship between contractor's annual project values and risk premiums added for construction errors risk was 0.329, while not significant, it was a high value. This correlation may be significant with a larger sample size. This suggests that when design errors risk is identified, contractors with high annual project values use higher risk premiums to protect them against construction errors risk.

Mohamed and Hartman posit that contractor approach towards risk determines the dollar value added as risk premium to accept identified risks in the contract [8]. Haddad stated that "contractors who are more risk averse will use higher risk premiums to minimize their exposure to risk at latter stages of the project. Contractors who are risk takers will use lower or no risk premiums when assuming particular risks [7]."

According to Haddad, this means by shifting risk to the general contractor, owners may pay up to 27% more for the project [5]. This is a high percentage for owners to pay extra on a project. Therefore, this study serves to support the notion that contractors add risk premiums when faced with exculpatory clauses. This will lead to a higher bid price; thus, a higher project cost that the owner will wind up paying for. Hence, it is imperative to accurately identify risk at an early stage of the project to minimize project uncertainties. Identifying the risk will aid contracting parties to better understand their liabilities and rights. In addition, it will promote adapting a risk sharing strategy that will enhance controlling project costs.

The risk sharing strategy can be implemented as follows:

- Owners must develop an understanding of risks associated with the project. This must be accomplished prior to the bid phase of the project.
- At the bid phase, owners must understand the consequences of allocating project risks to the contractor. Therefore, owners must ask all bidders to provide risk premiums for assuming the risks.
- Then, at the negotiation phase, owners must work with bidders to identify who is assuming each risk. Owners may choose to assume certain risks, while allocating other risks to the contractor. The goal here is to produce the most cost-effective contract price.
- The contract language must state that for the risk assumed by the contractor, the owner is only responsible to pay the associated risk premium in case the risk is materialized. For the risk assumed by the owner, the owner is responsible to pay the contractor the actual cost incurred plus a set percentage for overhead and profit.

The aforesaid risk sharing strategy encourages a healthy partnership between the owner and the contractor. The partnership is expected to minimize conflicts and misunderstanding of contract terms and project risk responsibility. Thus, it may reduce the probability for change orders and litigation costs.

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Appendix A

Raw Data and Descriptive Statistics for Participants' Years of Experience, Annual Project Value and Percent of Self Completed Work

Annual project value	Years of experience	Percent of self-completed work
40	10	25
30	17	15
400	25	0
20	38	15
45	15	25
30	20	40
125	26	15
7	8	20
130	17	20
220	11	15
80	27	10
12	20	30
300	3	0
700	38	55
40	13	40

Table 5 - Raw data for group A contractors' for annual project value, years of experience and percent of self-completed work

Annual project value	Years of experience	Percent of self-completed work
20	30	45
60	30	5
25	30	12.5
130	14	0
145	17	10
2.5	58	40
60	25	16
1	31	20
400	20	10
350	19	20
550	5	2
100	18	30
36	13	15
30	25	5
130	14	0

Table 6 - Raw data for group B contractors' for annual project value, years of experience and percent of self-completed work

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Contractor's years of experience	30	3	58	21.2333	11.28528	127.357
Percent of self-performed work	30	0	55	18.5167	14.5095	210.526
Annual project value	30	1	700	140.6167	176.3622	31103.62

Table 7 - Descriptive statistics for contractors' years of experience, annual project values and percent of self-completed work

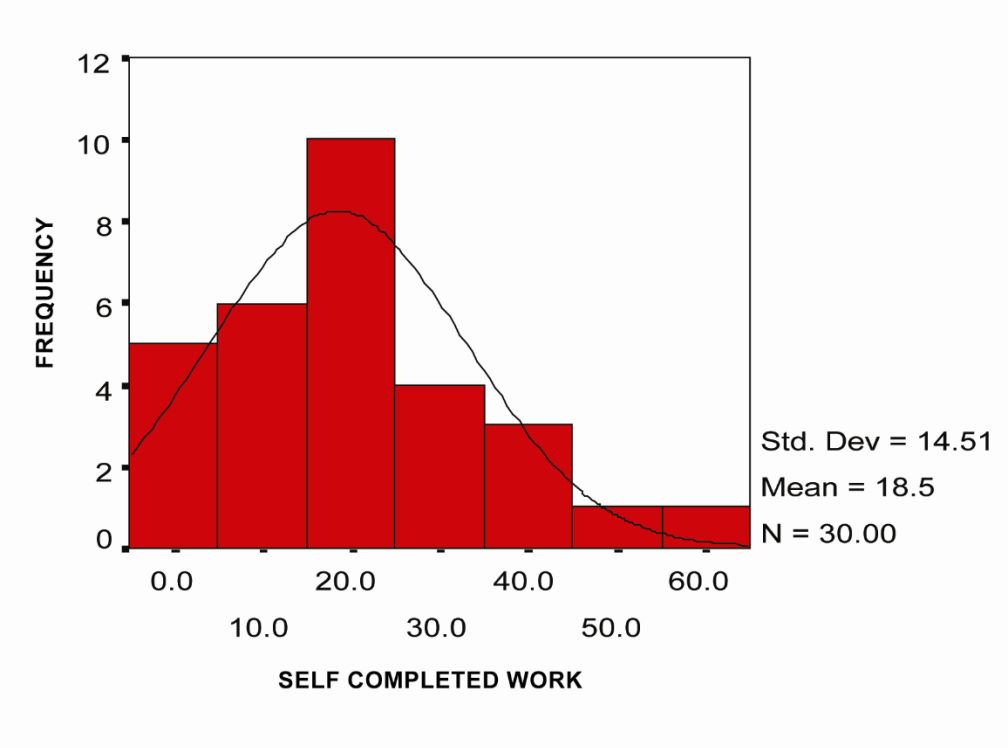

Figure 1 - Frequency of contractors' percent of self-completed work

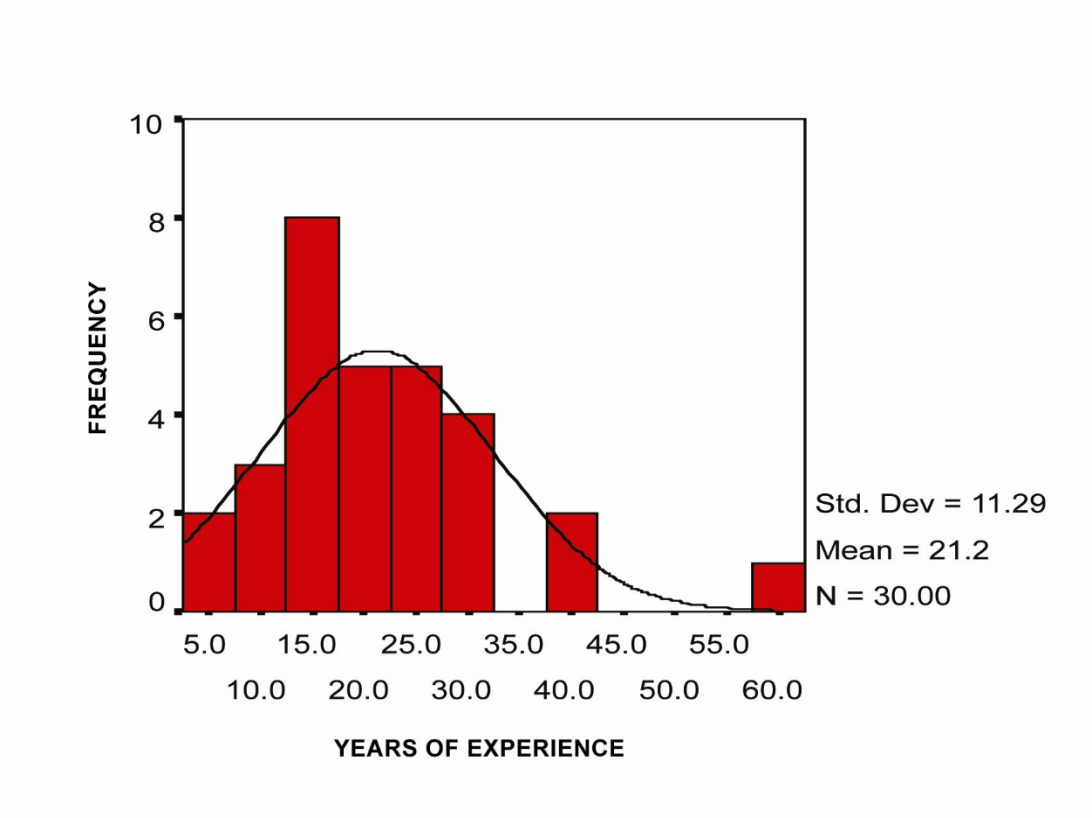

Figure 2 - Frequency of contractors' years of experience

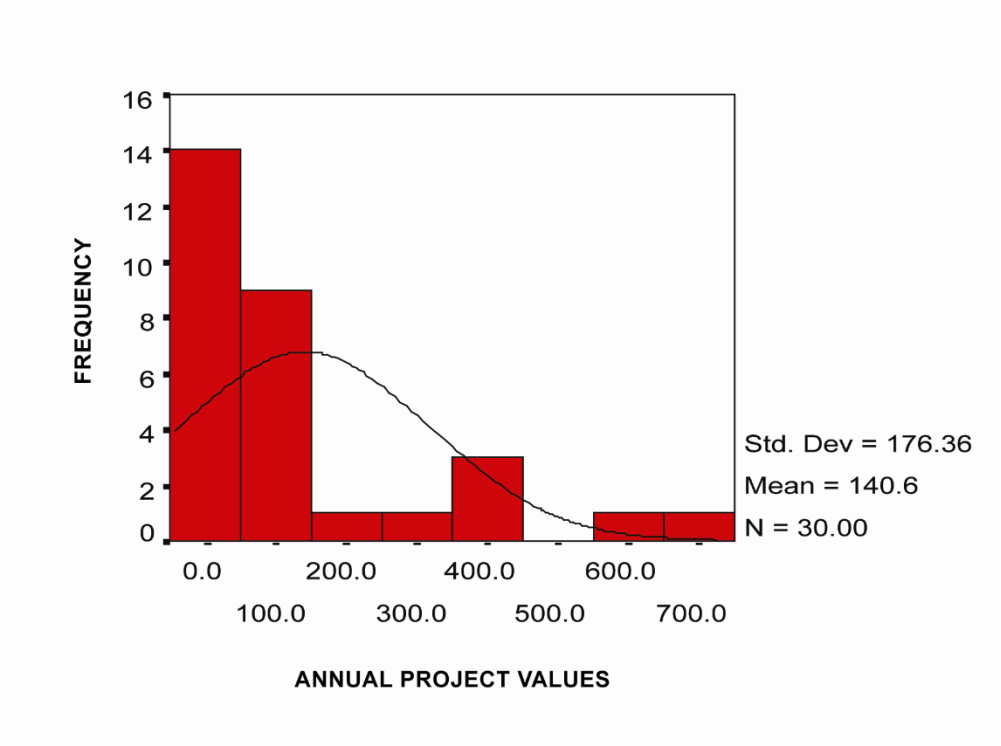

Figure 3 - Frequency of contractors' annual project value