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# DIFFERENCES IN CONSTRUCTION COMPANIES' PREFERENCES IN MAKING BID/NO BID DECISIONS

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In today's competitive business environment, bid/no bid decision is crucial for a construction company, as poorly made bidding decisions can have bad consequences. Given the fact that longevity of construction companies partly depends on how they make bidding decisions, determining the key factors for bid/no bid decisions has been the topic of research since mid-1950s. However, there is not much literature on how much value/weight different construction companies put on those factors, and more specifically if there are differences between different companies' valuation of those factors. The purpose of this study is to investigate how differently the construction companies in the United States (US) value the key factors that are commonly utilized to make bid/no bid decisions. For this purpose, first, 14 key factors were determined based on the literature. Then, a survey instrument was sent to the US construction companies with different demographics such as size, revenue, sector, etc. to gather data to determine the values/weights they assign to those factors. For this, Analytic Hierarchy Process (AHP) was used. AHP enabled pairwise comparisons to be made between the key factors that affect bidding decisions to deal with the complex relationships among those key factors. As a result of the AHP process, the weights for the key factors for bid/no bid decisions were determined for each company. The AHP results were combined with the demographic data of the construction companies and Kruskal-Wallis test was conducted to identify whether there is a statistically significant difference between the weight of importance of the key factors based on the contractor type, contractor sector and contractor size. The preliminary results showed that there is a statistically significant difference between the general contractors and subcontractors for weighing the importance of the owner identity key factor. Another significant difference was found within the contractor sector in the determination of the weight of importance of the project type key factor.

*Keywords:* Bidding, Key factors, Multi criteria decision-making, Analytic hierarchy process, AHP, Kruskal-Wallis test.

## 1 INTRODUCTION

In today's competitive business environment, bid/no bid decision is complex and crucial for construction companies. It is complex due to the consideration of many intangible and tangible factors in the decision-making process (Mohanty 1992). It is crucial because poorly made bidding decisions can have bad consequences. For example, not bidding a favorable project can result in a lost opportunity for a company to make profit and establish a potential long-term relationship with a new client. On the other hand, bidding a project that actually does not fit the company's priorities may

result in wasted time/effort (Ahmad 1990, Wanous *et al.* 2003). Moreover, the reputation of a company can be damaged by submitting many non-winning proposals and thus sometimes giving a "no bid" decision could be the right thing for companies (Gido & Clements 2009).

Given the fact that longevity of construction companies partly depends on how they make bidding decisions, determining the key factors for bid/no bid decisions has been the topic of research. However, there is not much literature on how much value/weight different construction companies put on those factors, and more specifically if there are differences between different companies' valuation of those factors. The overall purpose of this study is to investigate how differently the construction companies in the United States (US) value the key factors that are commonly utilized to make bid/no bid decisions.

## 2 BACKGROUND

The most influential factors for bidding decisions and bidding strategies have been extensively discussed in the literature since mid-1950s (Harris *et al.* 2006). Various key factors have been identified and ranked and numerous decision-making models have been developed to minimize the risks of complex comparison process.

The first known model was proposed by Friedman (1956), which investigated the issues related to the probability of winning and estimating the optimum bid amount by using probabilistic approaches. Since then, several bid/no bid decision support models have been introduced in the literature based on Friedman (1956)'s study (King & Mercer 1987, Whittaker 1981). Ahmad & Minkarah (1988) discussed inapplicability of the probability-based models by asserting the heuristic nature of the bidding environment. The authors conducted a survey among 400 general contrators in the USA and determined 31 factors that affect decision making process. The top three factors were listed as "Type of job", "Need for work" and "Owner". Since then, most of the research has been based on the factors determined in Ahmad & Minkarah's study.

Shash (1993) modified the questionnaire by Ahmad & Minkarah (1988) and identified 55 factors affecting decision making process. Wanous, Boussabaine, & Lewis (2003) implemented a model by using artificial neural network (ANN) based on 157 real-life projects from Syrian construction companies in which 18 key factors were determined. Jarkas, Mubarak, & Kadri (2014) identified 43 factors based on the literature review and a survey conducted in the State of Qatar. Shash (1998) studied subcontractors' bidding decisions. Lowe & Parvar (2004) determined 21 factors based on the literature review and conducted correlation analysis between the factors and decisions to bid. Based on the results, a significant positive linear correlation was found for eight key factors and the contractors' decisions to bid on a project.

In Bageis & Fortune's (2009) study, 87 factors were identified and statistical approaches were used to determine the interrelations between contractor characteristics and the bidding decisions. Egemen & Mohamed (2007) investigated the factors that affect bidding and mark-up decisions of the 80 Northern Cyprus and Turkish construction firms. For the final model, 50 and 44 factors were included into the framework, respectively. The results showed that bidding and mark-up decisions of the small and medium sized companies were significantly different.

## 3 RESEARCH METHODOLOGY

This study identifies the differences in the contractors' valuation of the bid/no bid decision-making key factors by taking into the consideration the contractor type, contractor sector, and contractor size. For this purpose, first, 14 most-commonly identified and utilized factors were determined based on a comprehensive literature review and grouped under two as firm-related and project-related factors as shown in Table 1.

Table 1. The key factors that affect bid/no bid decision as determined from the literature review.

| Firm Related (Internal) Factors | Project Related (External) Factors |
|---|---|
| 1) Current workload | 8) Project size |
| 2) Experience in similar projects | 9) Project duration |
| 3) Availability of equipment, materials and human resources | 10) Location of the project |
| 4) Financial ability | 11) Project type |
| 5) Need for work | 12) Contract conditions and type of contract |
| 6) Technical knowhow | 13) Owner identity |
| 7) Compliance with the business plan | 14) Competition |

Then, to identify the weights of importance of (i.e., value given to) each of these factors, Analytic Hierarchy Process (AHP) was conducted. AHP is a multi-criteria decision-making method that utilizes pairwise comparison technique by providing a preference scale. It determines the relative importance of the factors based on the subjective preferences of the respondents (Saaty & Vargas 1991). Including the 14 sub-factors and 2 main factors, a pairwise comparison table in Excel format was created resulting in 43 pairwise comparisons. The respondents were asked to identify which factor is more important than the other and how much more important that factor is over the other one by indicating absolute numbers provided in the AHP comparison scale. The pairwise comparison tool was sent to approximately 900 construction professionals (includes different individuals from the same companies) who have a relationship with the Department of Construction Management at Colorado State University and consequently 48 responses were received. The demographics of the companies were also collected to be used in statistical analyses. The results of the one participant who did not provide demographic information and six participants whose consistency ratio (see Saaty & Vargas (1991) for an explanation of consistency ratio) highly exceeded the acceptable limit of 0.10 were eliminated; therefore 41 responses were included in the study.

Table 2. The revenue range and the corresponding company size based on the responses received.

| Revenue | Size |
|---|---|
| <=$39,500,000 | Small Size Construction Company |
| $39,500,000< <=$125,500,000 | Small-Medium Size Construction Company |
| $125,500,000< <=487,500,000 | Medium-Large Size Construction Company |
| >487,500,000 | Large Size Construction Company |

The weights of the key factors were estimated for each respondent using the AHP methodology as outlined in Saaty & Vargas (1991). Furthermore, the demographic data was sorted based on contractor type (general contractor vs. subcontractor), contractor primary sector (Residential, Commercial, Industrial, and Heavy/Highway), and contractor size which was determined based on the quartiles of revenue (see Table 2).

To determine whether the differences in the identified weights of the bid/no bid decision-making key factors (by taking into the consideration the contractor type, contractor sector, and contractor size) are statistically significant; several statistical approaches were utilized. By considering the non-normality of the collected data, Kruskal-Wallis test which is a non-parametric approach of the one-way Anova test was conducted (Stokes *et al.* 2000). To meet the independency assumption of the Kruskal-Wallis test, each factor was investigated separately. The analyses were conducted with a statistical computing program, SAS (SAS 2015).

## 4 RESULTS

The hypotheses were constructed to test whether the given importance to the factors by various groups of contractors are significantly different or not. For this purpose, 14 different analyses were conducted for each demographic classification (i.e., Contractor Type, Contractor Sector and Contractor Size). The significance level was set at 0.05 and estimated p-values were compared to that. The estimated p-values as a result of implementing the Kruskal-Wallis test are provided in Table 3.

Table 3. Estimated p-values based on the analysis between the weights of the key factors and contractor classification.

| **Key Factor\ Contractor classification** | **Contractor Type** | **Contractor Sector** | **Contractor Size** |
|---|---|---|---|
| Current workload | 0.3513 | 0.0654 | 0.3089 |
| Experience in similar projects | 0.4449 | 0.3777 | 0.7436 |
| Availability of equipment, materials and human resources | 0.5681 | **0.0124** | 0.1595 |
| Financial ability | 0.9532 | 0.1171 | 0.0583 |
| Need for work | 0.5231 | 0.2155 | 0.4417 |
| Technical knowhow | 0.8839 | **0.0376** | 0.9177 |
| Compliance with the business plan | 0.1823 | 0.0899 | 0.1255 |
| Project size | 0.8984 | **0.0291** | 0.9395 |
| Project duration | 0.6001 | 0.3883 | 0.2151 |
| Location of the project | 0.178 | **0.0354** | 0.3281 |
| Project type | 0.5439 | **0.0015** | 0.644 |
| Contract conditions and type of contract | 0.8851 | 0.5 | 0.0906 |
| Owner identity | **0.0295** | 0.25 | 0.0849 |
| Competition | 0.2649 | **0.0227** | 0.8736 |

** The bold cells show the p-values that are less than 0.05.*

As can be seen in the results, the owner identity was found statistically significant for the "Contractor Type" classification. The p-value (0.0295) gives the information that there is enough evidence that we can conclude the weight of importance given to the owner identity factor by general contractors and subcontractors are statistically significantly different from each other.

The "Contractor Sector" classification includes six subgroups which were determined based on revenues: Residential, Commercial, Industrial, Heavy, Residential-Commercial, Commercial-Industrial. Based on the Kruskal Wallis test results, contractor sectors are significantly different from each other for the weights given to the following factors: availability of equipment, materials and human resources, technical knowhow, project size, location of the project, project type, and competition. To determine specifically which of the groups in the "Contractor Sector" differ from each other; the Bonferroni correction/adjustment multiple testing procedure was conducted. The results showed that Commercial-Industrial vs. Industrial, Commercial vs. Industrial, Heavy vs. Industrial, and Residential vs. Industrial contractor sector groups were found significantly different within each comparison in the valuation of the importance weighing of the project type key factor. It is important to note that even though availability of equipment, materials and human resources, technical knowhow, project size, location of the project, and competition key factors were found to be significantly different for "Contractor Sector" groups as indicated by the Kruskal Wallis test, those factors were not captured in subsequent testing by the adjusted multiple testing procedure because of the conservativeness of the Bonferroni correction method.

The "Contractor Size" was also investigated in the same manner. The respondents were divided into four groups as shown in Table 2. The results didn't provide enough evidence to support the hypothesis, which was at least one of the groups, is significantly different.

## 5 CONCLUSIONS

The results provide evidence that statistically significant differences exist in the weights of importance given to the bid/no bid decision-making key factors based on the contractor type and contractor sector. However, the results do not provide sufficient information if there is a significant difference based on the contractors' size on the valuation of the key factors. It should be stated that the limited sample size of this study might be influential on the results. Therefore, larger sample size might improve the results. However, even considering the small sample size, two significant relationships (contractor type and contractor sector) were identified that points out the need for further research. This study contributes to the construction engineering and management body of knowledge by advancing the current state of the knowledge on the topic from "factors that affect bid/no bid decisions" to "different weights/values given to the factors that affect bid/no bid decisions by construction companies with different demographics".

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