Analysis of Subcontractor Selection on Financial Aspects and Information

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Abstract - *Subcontractor defaults on construction projects can be catastrophic, which makes selecting the right team of trade partners crucial. However, in a world where contractors make decisions both within the context of what they know about subcontractor candidates (hard data) and within the boundaries and limitations of their perceptions, worldview, and other biases, we see time and time again that, despite any empirical evidence to the contrary, our decision-making processes are strongly influenced by the human factor.*

***Key Words*: Subcontractor selection, Trade partners, Decision making process, Construction Management, Survey, Financial Aspects**

1. INTRODUCTION

Subcontractor defaults on construction projects can be catastrophic, which makes selecting the right team of trade partners crucial. However, in a world where contractors make decisions both within the context of what they know about subcontractor candidates (hard data) and within the boundaries and limitations of their perceptions, worldview, and other biases, we see time and time again that, despite any empirical evidence to the contrary, our decision-making processes are strongly influenced by the human factor.

Industry prequalification and subcontractor selection best practices exist to benefit and protect contractors. They help make a case for why a subcontractor should or shouldn't be awarded a project in an organized, methodical manner and allow us to proactively address inherent risks. The first step in risk reduction is being mindful of deviations from what you know to be best practices, lest you begin down the proverbial rabbit hole of project risk. Let's start by briefly outlining some industry best practices for subcontractor selection.

1.1 Financial Strength

Consider data points such as financial statements (audited preferred), with ratio calculations and year-over-year comparisons to reveal trends, credit, and payment history. Are there any liens or past due accounts? What are their

banking relationships like? Pull a Dun & Bradstreet report, and look into their surety bonding. Do they have any legal issues to be concerned about?

1.2 Operational Strength

Consider both their depth and current capacity. Look at their organizational structure, corporate culture, insurance limits and coverage, risk management, years in business, supply chain, etc. Find out their historical annual anticipated current year volume and projections for the next year. What's the largest project they've performed in recent years, their current work in progress, pipeline, backlog, projects out-to-bid, and available man power? What's their geographic strength, market segment, scope of work, level of complexity, and skilled man power for this project's unique features of work? Do they have current union/nonunion affiliations, regulatory or licensure requirements, etc?

1.3 Safety Practice

Do they have a full-time safety manager, appropriate support staff, and a formalized safety program? Look up their Occupational Safety and Health Administration (OSHA) 300 records, alcohol/drug testing, OSHA 30-hour trained personnel, and safety goals. Do they have 100 percent fall protection compliance? Does their safety culture align with yours? The complete set of pre requisite safety practices are required for the same.

1.4 Quality Practices

Do they have a corporate quality-management program and a field quality-management program in place? What are their preconstruction considerations? Will they engage in pre installation meetings? Do they build *functional* mock-ups and perform third-party testing and design reviews? Do they request progress inspections and have punch-list practices? Do they have commissioning, warranty management, and water intrusion protocols? Does their quality culture align with yours? So, the complete set of quality standards should be discussed and looked up depending on the project.

1.5 Reputation And Track Record

Touch points such as post bid/pre award interviews are important to establish. Externally, running reference checks and listening to the rumor mill are essential for picking up anything you may have missed. Lastly, your most valuable internal resource is post performance reviews from past projects with that subcontractor.

2. THEORITICAL FRAMEWORK

The theoretical framework has been developed to provide the key points necessary to develop a process model and an interview guide for qualitative research on the subcontractor selection process. It also attempts to address the main research questions in a systematic manner. The general nature of subcontracting is discussed first followed by the main characteristics of subcontractor selection starting with its position in the Van Weele (2009) purchasing process model, subcontractor prequalification criteria and subcontractor award selection criteria. The methods of subcontractor selection are discussed next which also incorporates the main statistical contractor evaluation and selection methodologies established to date; along with some other key methods that may be incorporated into subcontractor selection including partnering approaches, web-based subcontracting, case-based reasoning, bid shopping, and principal-agent theory. The chapter ends with the concept of value creation, value chains and supply chain management, through the application of the elements of the supply wheel model.

A number of significant authors with similar and different perspectives and recommendations are included in this chapter to promote some of the main ideas circulating on each research area. The reason a number of authors and perspectives are presented is to attempt to settle at a relatively conclusive evaluation of each key research area. This is in relation to the main criterion and methods not only agreed upon, but also that emerge as relevant and adaptable to multiple projects of differing scope.

2.1 Subcontracting

A general contractor is a contractor engaged by the client and is responsible for all work on a construction site including the engagement of subcontractors to complete part or all of the works involved. A subcontractor refers to any person or organization that performs a specific task or work for another organization as part of a larger project. A supplier is a commercial organization which stocks, produces or delivers material, components or products for a building project (Davies and Jokiniemi, 2012)

In construction projects, many general contractors only act as construction management agents and subcontract a large volume of their work to subcontractors (Shash 1998; Abbasianjahromi et.al., 2013). Subcontracting is a long-established practice in the construction industry and provides an essential element of flexibility in the overall construction supply chain (Luu and Sher, 2012). It refers to the process of entering into a contractual agreement with an outside person or company to perform a certain amount of work. Often, the general contractor will select to subcontract works when it is more economical to do so and for work that has a higher amount of risk in order to secure competitive advantages.

3. SUBCONTRACTOR SELECTION

Subcontractors directly influence the success of a project and the overall reputation of the general contractor in the eyes of future clients through the quality and timing of the work performed. As the selection of highly qualified subcontractors stimulates the overall quality of projects, the incorporation of value creation initiatives into the subcontractor selection model of an organization is paramount to achieving success for both the project and future of the company.

Subcontractor selection is plagued with uncertainty and ambiguity and these conditions are difficult to represent in a generalized set of rules. Decisions relating to the selection of subcontractors in the construction industry are usually based on the intuition and past experience of construction estimators (Luu and Sher, 2012). This point of view indicates that some of the knowledge relating to selecting an appropriate subcontractor is still tacit by nature. This could directly affect the formality of the selection criteria and process, potentially making it more difficult to cover all important issues.
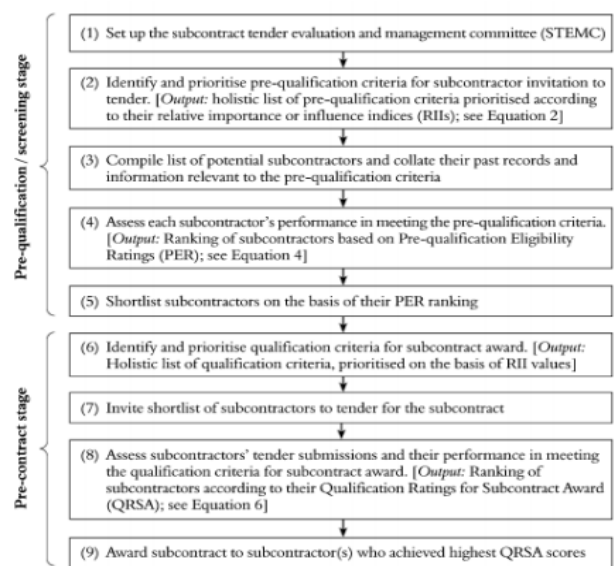

Fig -1: Subcontractor selection methodology flowchart

Likewise and as previously mentioned, Abbasianjahromi et.al. (2013) proposed a subcontractor selection method based on their research into a 'fuzzy preference selection index (PSI)' method in which each criterion selected is calculated in order of weight given using statistical and linguistic applications. It has three steps to the model: Step 1- the identification of subcontractors; Step 2- criteria identification; Step 3- the application of the FPSI method. The model is shown below in Figure 7. It is similar to the recommendations presented by authors earlier, however with a heightened focus on customer input and corporate strategy considerations. In an attempt to assess the validity of this model to the case company, the effect the customer and key stakeholders of the general contractor has on the selection process will be evaluated, along with whether the case company uses or has used some form of fuzzy set theory evaluation techniques.
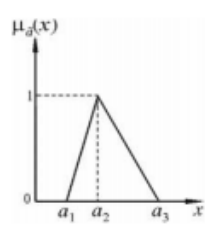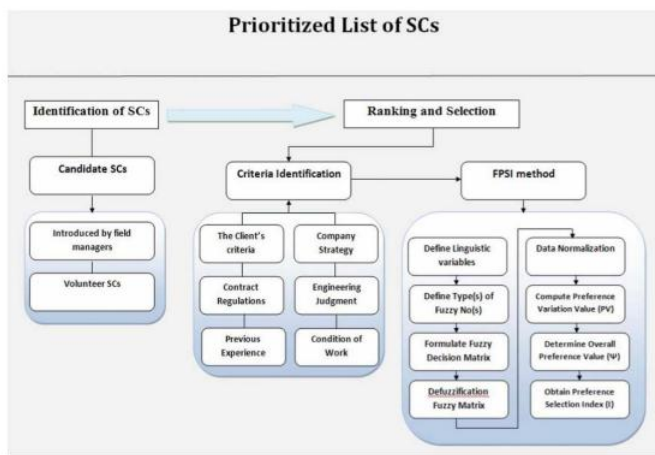

Fig -2: A Subcontractor selection method

Finally, this model presents a ranked list of SCs, which facilitate GC's decision-making. Generally, the fuzzy decision making framework consists of the following steps:

1. Defining and specifying the types of fuzzy numbers and their membership functions to be used by decision makers;
2. Establishing the scale of preference structure to be used by decision makers.
3. Assigning the fuzzy values to attributes based on their performance on the decision criteria.
4. Aggregating fuzzy numbers among the decision makers;
5. Defuzzification.
6. Determination of global importance or overall value of each of the decision criterion.
7. Ranking of alternatives.

Some of them can be expressed as a crisp number and others can be stated based on linguistic terms. Because linguistic terms are used in the vague and unclear environment, for working with linguistic terms, the authors develop fuzzy PSI (FPSI) method. A combination of the PSI method and fuzzy

set theory in this paper is the main contribution of the authors

Table -1: Linguistic terms and fuzzy numbers

Linguistic term	Triangular Fuzzy Number	Triangular Fuzzy Number
Very Good (VG)	(7.5, 10, 10)	
Good (G)	(5, 7.5, 10)	
Medium (M)	(2.5, 5, 7.5)	
Poor (P)	(0, 2.5, 5)	
Very Poor (PL)	(0, 0, 2.5)	

4. RESEARCH METHODOLOGY

In some circumstances, decision makers are eager to eliminate the weighting criteria phase for some reasons such as conflict opinions, lack of time, inadequate information, lack of historical data. The proposed method eliminated the weighting criteria phase and the relative importance of each attribute is calculated based on decision maker's opinions on evaluation of alternatives by the FPSI method.

4.1 Research Approach

The research approach that was followed for the purpose of this research was Electronic Questionnaire-based. A semi-structured questionnaire was prepared, in line with the scope and objective of the research. In this approach, researchers come up with specific questions which can relate to draw conclusions from the research. The reasons for opting this approach was that it takes into account the context where research effort is active, while is also most appropriate for small samples that produce qualitative data. However, the main weakness of the inductive approach is that it produces generalized theories and conclusions based only on a small number of observations, thereby the reliability of research results being under question.

4.2 Scale

The questionnaire begins prompting the respondents to fill in their credentials (name, company, experience and importantly present position) followed by section that comprises questions based on several key factors reflecting variability on the prospects of sub- contractor selection in different ways.

Survey has Likert- based question for taking responses

1 - Always ⟶ **5 - Never**

## 4.2 Methodology chart for Thesis work

Fig -3: Methodology Chart

4.4 Data Collection

For gathering responses for questionnaire, Electronic self-completion questionnaire was used (Web-based Google Forms). In this approach, the questionnaire form is floated to the respondent by either sharing the hyperlink through e-mail or social media, subject to availability of internet connectivity, and the respondents are instructed to submit the questionnaire electronically. Upon collection of desired number of responses, the data points can then be exported to any worksheet software which can further be analyzed using statistical tools. The main advantage of electronic self-completion questionnaire is that the questionnaire can be easily floated to respondents so there is a higher chance of obtaining sample number, cost effective and less time taking

Pie Chart -1: Experience of the Respondents
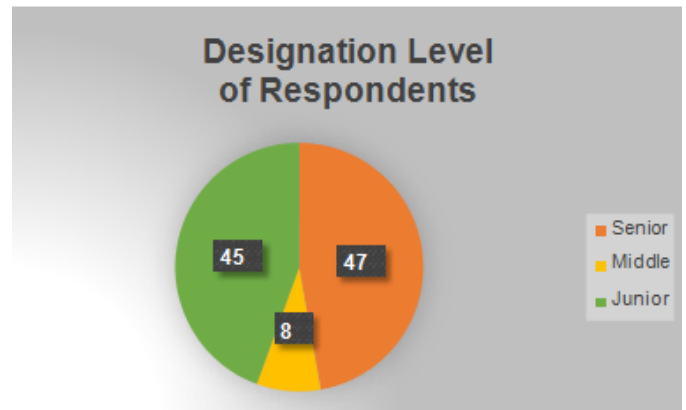
Pie Chart -1: Designation Level of the Respondents
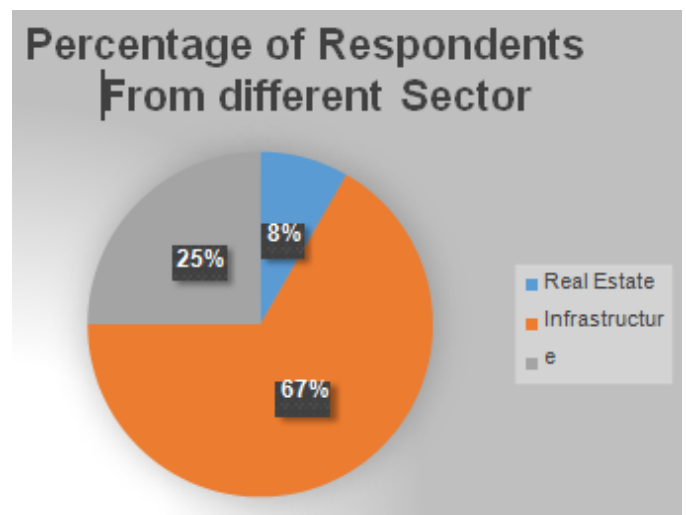
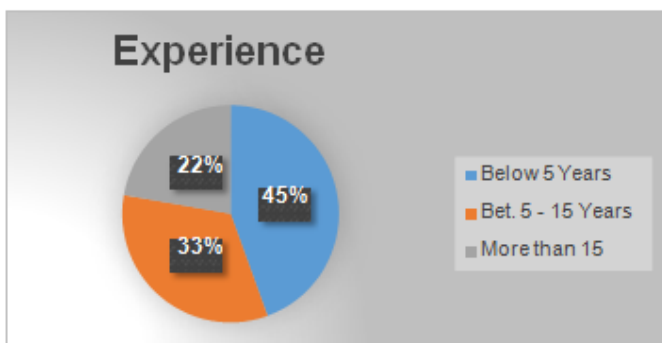**Pie Chart -3**: Percentage of Respondents from different Sectors

4.5 Statistical Tools

The following statistical tools were used for various attributes:

1. Quantitative Analysis
2. Factor Analysis
3. Linear Regression Analysis

5. CONCLUSION

In the present research, subcontractor selection criteria that can be considered in international construction projects were presented under a structured selection process with three phases. As a result of the survey conducted, it was found out that the short listing stage is composed of a total of ten criteria where past experience is the most important criterion. The negotiation stage was found to contain seven criteria where knowledge of project and reliability are the most significant two criteria. Finally, the final selection stage includes a total of seven criteria where price is in the first rank in terms of importance. Overall, this study can have some implications from the perspective of researchers,

industrial practitioners, and every kind of contractors in the construction industry.

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REFERENCES

[1] Zavadskas, E. K., Turskis, Z., & Tamošaitiene, J. (2008). Contractor selection of construction in a competitive environment. Journal of Business Economics and Management, 9(3), 181-187.

[2] Turskis, Z. (2008). Multi-attribute contractors ranking method by applying ordering of feasible alternatives of solutions in terms of prefer ability technique. Technological and Economic Development of Economy, 14(2), 224-239..

[3] Puri, D., & Tiwari, S. (2014). Evaluating the criteria for contractors' selection and bid evaluation. International journal of engineering science invention, 3(7), 44-48.

BIOGRAPHIES

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