



Comparative – Superlative Comparison of Contractor's Sufficiency in Various Types of International Contracts

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ABSTRACT

Nowadays, development of construction projects is among the vital and important plans in urban areas. The perspective of a city highly depends on its construction projects, and the way they have been managed. There are many construction projects that face with severe failures as the result of improper selection of their contractors. This study overviews a comparative-superlative comparison of contractors' efficiency in various types of international contracts. Choosing a competent contractor can significantly decrease the possibility of construction projects failures. The contractor selection includes three steps: contractor prequalification, tendering and selection. The data for this research was gathered using survey method. This paper investigates the current conditions of evaluating the contractors and comparing various methods of prequalification as well as comparing the contractor selection methods in three different countries of Hong Kong, USA and Australia. The questionnaires were circulated among a wide range of experts in this field of study, aiming to examine the most suitable technique for contractor selection and then, the obtained results were analyzed using inferential and descriptive statistics through the SPSS software. Based on the findings, the significance of this study lies in the point that the decision support systems are considered in assigning the contractors to fulfill the projects with respect to solving the problem of single and multiple criteria methods.

KEY WORDS: contractors' sufficiency, international contracts, decision support

1 INTRODUCTION

In the governmental sections, the project owners usually assign the construction and installation projects to the contractors. Therefore, the contractors play an important role in the projects and their selection process is a critical decision for the employers. The selection process should be designed in such a way that the selected contractors complete the project on time, with a reasonable cost and having proper quality. The purpose of the preliminary and final evaluations of the contractors is to select the qualified contractors out of all the voluntary contractors based on the criteria such as the financial and technical capacities, the organizational and management capability, their registered experiences, the health and work security, the environmental consideration, and their treatment to the loss claims (Hatush and Skitmore, 1997). Since the selection process accompanies with many risks for the employers, they always try to decrease the existing risk level (Hatush and Skitmore, 1997). During the recent years, there have been various problems to implement the projects led to high capital losses. Considering the statistics, about 10% of these problems relates to the contractors inefficiency. Due to the existing problems, the employers have not ever considered a trend which can solve such problems. The employers need a filter to prevent the unqualified contractors to participate in the tenders in order to solve the problems (Rajaii and Hazrati, 2008). The construction projects have four main contexts including preliminary studies, design, implementation, and exploitation/maintenance (Acar, et al. 2005). The main problem lies in the fact that inappropriate selection of contractors leads to lose huge capitals, but it is needless to say that disregarding the first and third stages are the prevailing reasons to end a construction project with high losses. The present study focuses on the problems in the project due to the inappropriate selection of the contractors. Late 1980s and early 1990s were the time of emergence of the main views and approaches regarding the contractors prequalification. Various types of determined models and methods were based on a series of simple decisions investigating the prequalification issue relying on the definition of some rules and parameters. Studies by Russel (1990), named as prequalification 1 and prequalification 2, consisted of definition of a series of criteria in different levels and some conditions for the criteria. The criteria and conditions created the algorithms which were a base to design a computer program for the prequalification. By reviewing the mathematical decision making models over the time, the researchers used the multi-criteria decision making models instead of the conventional ones. Therefore, the mathematical models such as SAW, AHP and TOPSIS have been greatly applied in the modern methods of prequalification.

On this matter, Lai et al. (2004) made use of SAW mathematic model for prequalification in which every criterion has a value and the contractors' criteria have specific scores determined by SAW method in this trend. However, Al-Subhi et al., (2001) applied AHP model to determine the contractors' sufficiency. To this purpose, the contractors capabilities were

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compared using AHP model based on the paired comparisons with respect to the prequalification criteria and the qualified persons were determined. Furthermore, Thomas and Skitmore (2001) introduced over 50 criteria for prequalification presented in 8-part questions. Also, Sing (2005) presented a fuzzy framework to select the contractors and suggested a fuzzy method for prequalification in 2007.

The present study is an applied study aiming to achieve a sufficient technique for determination of most proper contractors for the projects. This study aims to achieve the objectives through the following steps:

- Comparative – superlative comparison of contractors sufficiency in various international contracts
- Comparison of the contractors preliminary evaluation method in three different countries
- Comparison of various methods of prequalification
- Introduction of the most suitable method in assigning the projects to the contractors

2 LITERATURE REVIEW

The major amounts paid for projects are usually for the construction ones. The project failures cause irreparable human and financial losses for the country (like the recent failures in Pakistan). In most cases, technical and economic feasibility studies are needed to begin the projects. It also requires large scale of supervision. The project cannot be defined by the little preliminary information and time and cost is not definite (Parchami, 2009). The industrial projects are different from the construction ones. In industrial projects the major contract budget is paid for equipment; such as construction projects, failure of the project irreparable. The employer's general objectives is only needed to begin the project. It requires macro scale supervision. The project can be defined as estimated by very little information (Parchami, 2009). Today, various methods such as free tendering, limited tendering, preliminary evaluation, negotiation or a composition of different methods are applied to select the most suitable contractors. When the project needs high technology or a specific skill, the employer uses the limited tendering and only the contractors can participate in the tendering process that can satisfy the project needs. The preliminary evaluation system is used when the projects cannot be assigned to a contractor with the sufficiency lower than the minimum capacities considered by the employer. Once the contractor is very complex with unique technical and financial characteristics, the negotiation method is used. In many countries, the project is given to the contractor suggested the lowest cost. However, there are some terms for this criterion in some countries. For example, in Denmark, two highest and two lowest suggestions are eliminated and the suggested price closer to the average of the rest prices will be selected. The similar trend is in Italy, Portugal, Peru, and Southern Korea with the difference that only one of the highest and lowest suggestions is eliminated. In Canada and America, the lowest suggested price but with 10% of the project price is selected. In France, the abnormal low price is deleted. As evident, the suggested price is the only criterion to select the contractor in many countries. Considering the price as the only selection criterion is very risky and it will not be economic in long term since the contractor may have a poor performance during the project implementation (Mirfarhadi, 2005).

2.1 The contractor selection process in three different countries

Housing authority in the Hong Kong keeps a list of registered contractors. The qualified contractors of the list should participate in the annual interview. Ministry of Urban Road and Development (MURD) also has a holistic performance assessment scoring system. Hence, it studies the functional levels of the contractors in progressing projects. The system includes the input and output evolutional components computing the scores of the output and input of each component and the composite score which is a base for the comparative score. The standard of the project is divided into three categories with two leveling lines which are the composite target quality score (CTQS) and the composite lower score threshold (CLST). The most opportunities are given to the contractors whose scores are more than the highest composite quality and the contractors whose scores are less than the lowest composite quality are not allowed to participate in the next stage of the tender (Misra, S. C. & Mondal, A. 2010). The government of Queensland in Australia has a system to evaluate the contractors called the Pre-Qualification Criteria (PQC). The name of all the volunteer contractors should be registered in the system to be able to participate in the tender related to the government construction projects with the contract value of 1,000,000 Australian Dollars. The contractors are evaluated based on the criteria such as technical capacities, management approach and personnel engagement in the pre-determined continuous organizational improvement. PQC systems have been designed in order to ensure the congruence between the size and complexity of the project with the contractor capability. The contractors have the validity up to 2 years in the system and are placed in one of the four following levels (Recker, J. 2012):

- Level one: with an effective functional performance
- Level two: with the commitment for the continuous improvement
- Level three: with the best performance in industry
- Level four: with the best performance in the world

The enterprise usually uses the selective or open method for the tenders of the construction projects (dependent on the project needs). The contractors are invited to cooperate through the public advertisements in the open tenders while the tender documents are available for the contractors who are qualified based on the system criteria. In the selective method, the contractors are invited to cooperate only based on the conformity between their capabilities and efficiency, and the project needs (the maximum of the project rate which can be given to the contractors is 33% of the annual turnover (Recker, J. 2012).

2.2 The conceptual model of preliminary evaluation system

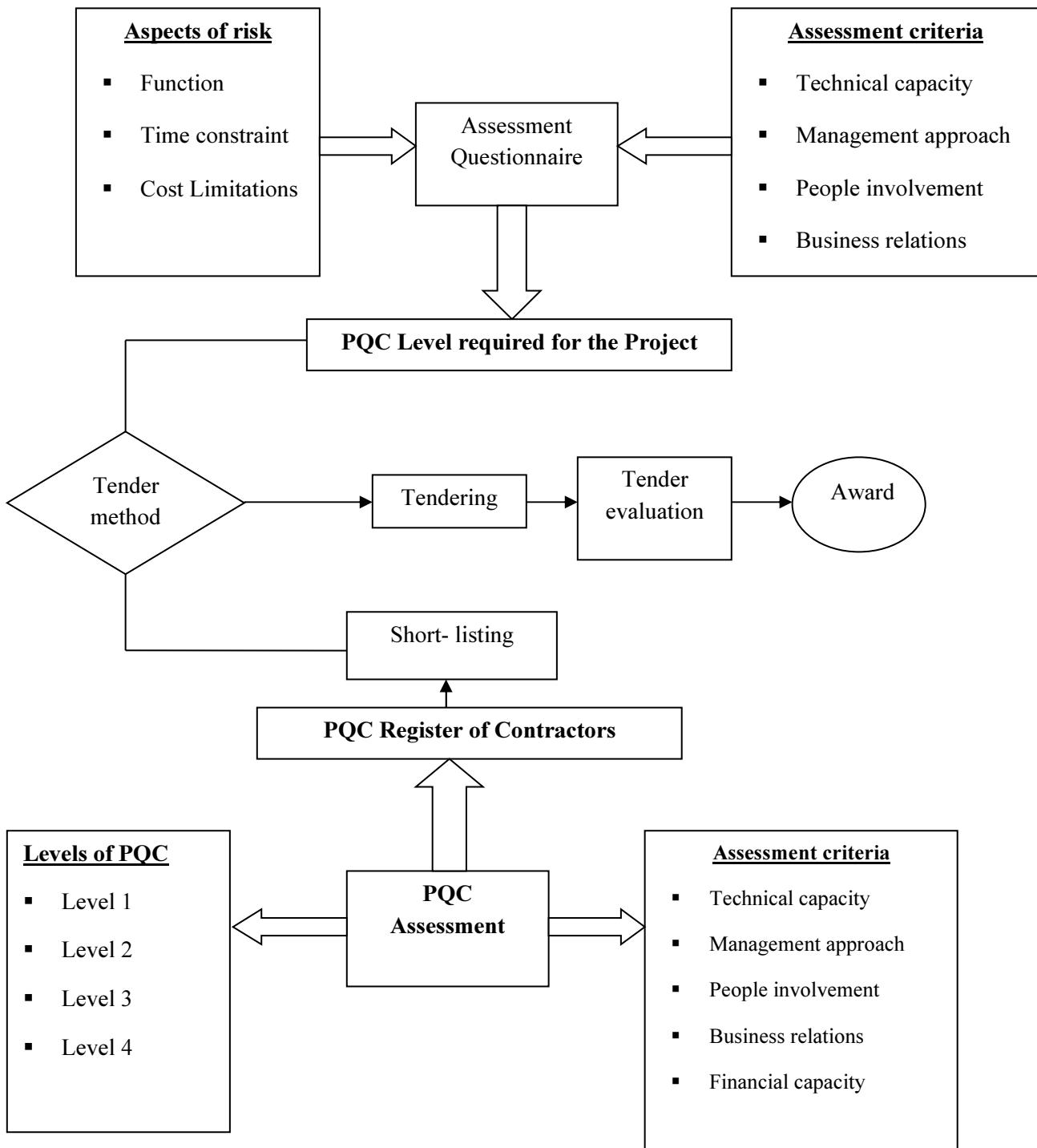


Figure 1- the conceptual model of preliminary evaluation system – Australia (Recker, J. 2012)

Many studies were conducted to improve and organize the contractors' evaluation in America (Rebecca and Brown, 2009, Schierholes, 2012). Many American governmental employers apply different evaluation rates. These rates are applied to define the parameters. For example, the maximum work value a contractor can suggest for a certain project, these rates, define

a base to create a dynamic and structures approach as well as more borders to select the qualified contractors, and the contractors are not limited to static and certain sets.

2.3 Types of prequalification methods

The conventional prequalification methods can be divided into filtering and ranking methods. The underlying parameters of decision making about the contractors are listed in the filtering method. The parameters may have some sub-parameters defined in different levels. There are some principles for each of these parameters or sub parameters usually stated as an algorithm. Thus, the contractors' characteristics with each parameter and principle are compared with the algorithm with respect to the available information. If the contractor could satisfy the first parameter with respect to the stated principles, the next parameter would be stated, otherwise the contractor would be disqualified and the trend would be ended. The contractors can satisfy all the indices which will be qualified and will be registered in the short list before holding the tender (Abbasnia et al., 2005).

Also, a series of the parameters may have a series of parameters in the second method. Each of these parameters is given a score with respect to the contractors' characteristics. A final score is given to the contractor considering the weights and their importance level relative to each other. The transient tender put a cut-score to accept with respect to these parameters. A contractor gains a score lower than the cut-score will be disqualified.

The proposed model of Palanceeswaran et al. (2001), is a filtering model presented in some institutions of Hong Kong, Australia and America after a series of prequalification models evaluation. Three filters are proposed in the model including personnel services building (PSB), radiation recorder controller (RRC) and workload. If the contractor is disqualified in any of these filters the trend will be ended. The contractors pass all three filters successfully will be registered in the short list of before holding the tender (Palanceeswaranet, al., 2001).

RRC filter introducing responsibility and sufficiency is the first and main filter and defines the general capabilities of the contractor regardless of a certain project. However, the contractor's confirmation or rejection depends on the implores objectives. RRC filter includes responsibility, sufficiency and accountability.

PSB filter introduces the specific project characteristics. Therefore, the contractor must satisfy the specific needs of the project if he/she is totally qualified. For instance, PSB filter involves the specific equipment, specific administrative methods, following specific standards, etc.

Workload filter controls the co-occurrence works of the contractor. In other words, the aim is that the contractors with a lot of mistakes due to their heavy volume of their workload are deleted ((Palanceeswaranet, al., 2001).

An instance of prequalification score models is the governing trend in the Mass Transient Railway Corporation (MTRC) of Hong Kong in such a way that the decision maker board specifically focus on the agreement with the contractor over the general needs. If the board, based on the questionnaires completed by the contractor conclude that the contractor have accepted all the general conditions, they will enter the next stage of prequalification. In this stage, there is a series of criteria or sub criteria defined by the union. The evaluation board allocates a score to each criterion with respect to the available information of each contractor and the contractor's final score is determined based on each criterion weights. The criteria weights are also determined by the evaluation board in each project. Finally, the contractors with the highest score are qualified. The prequalification parameters applied by the union are presented in figure 2 (Kumaraswamy, M., 1996).

2.4 MTRC prequalification criteria

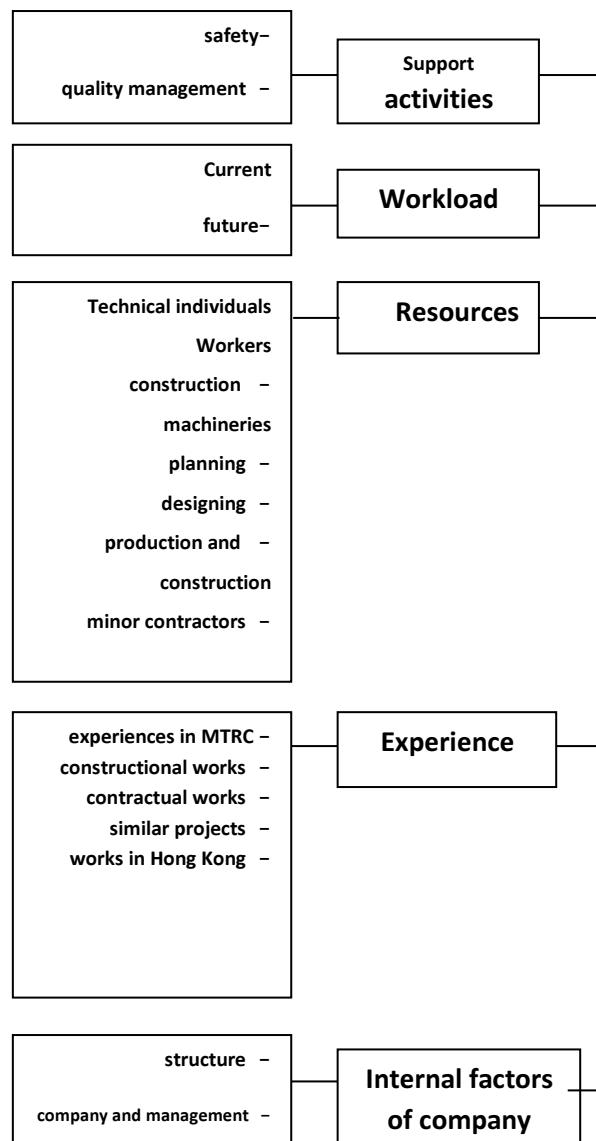


Figure 2- MTRC prequalification criteria (Vom Brocke, 2012)

The prequalification parameters applied by the union are presented in figure 2, that include support activities, workload, resources, experience and internal factors of company, which the first is composed of safety and quality management, second is composed of current and future, third is composed of technical individuals, workers, construction machineries, planning, designing, production and construction, , fourth is composed of experiences in Mass Transient Railway Corporation(MTRC), constructional works, contractual works, similar projects, works in Hong Kong, and the fifth composed of structure, company and management, relation.

2.5 Types of contractor selection systems

There are several systems and methods for selecting the contractors of construction project. In this section, we present some systems for the selection process which include:

- 1- Selection by minimum price method
- 2- Selection by first method of modifying cost method
- 3- Selection by second method of modifying cost method

2.5.1 The single criterion contractor selection system

- **The contractor selection by the minimum price method**

The conventional method is mostly used in Iran, and given this method, the contractor who suggests the lowest price is usually the first preference. Disregarding the parameters such as time, cost, and security are of disadvantages of this method. Further, contractors might agree to give the project to a certain contractor (Bidi, 2007, p.2).

- **Modifying cost method – the first method**

The modifying methods were innovated to modify the method of the minimum price and solve its problem in the single criteria systems. In one of these methods, the prices out of the determined range are deleted in such a way that if the estimation price of the consultant is A Rial, the prices out of the range of $A + B$ and $A - B$ will be deleted and the minimum price will be selected as the tender winner. The confidence range is determined by the consultant engineer with respect to the work type and price. Very low and very high prices are eliminated from the tender.

- **Modifying cost method – the second method**

The countries such as Italy and Portugal have invented a system to select the contractors using the cost criterion method which have solved the problems of the minimum price to some extent. In this method, the mean of the prices are determined first and are recorded as average price. All the prices higher and lower than 10% of the average price are eliminated and the average range of the rest prices are computed again. The first price which is lower than the computed average price is selected as the tender winner. Also, very low and very high prices are eliminated and the collusion possibility among the contractors is disappeared (Bidi, 2007).

2.6 The multi-parameters contractor selection system

The multi-parameter systems have been designed based on the effective factors other than the price in the contractor selection. The parameters include time, cost, quality, security, durability, and maintenance. The number of the parameters and their weight effect are selected based on the employer objectives and the project type. Unifying the units and changing the qualitative parameters into the measurable qualitative parameters are the most important points in the multi-parameter systems. In this method, the parameters usually are changed into the cost and are summed to the suggested price of the contractor. Finally, the obtained price is the sum of the changed prices (Lingard, Hughes and Chinyio, 1997).

2.7 The decision support systems for contractor selection

Decision support systems are a kind of development in the multi-parameter contractor selection. These systems have two inputs and one output:

- A. **Decision making criteria (input)** includes the defined criteria of the employer which are effective in the strategy and formula of the contractor selection.
- B. **The contractor information (input)** enters the contractor's characteristics to make decisions.
- C. **Decision making (output)** the final decision to invite the contractor.

An overview of the decision support systems for contractor selection as a kind of development in the multi-parameter contractor selection has both inputs and output. Considering the fact that decision making criteria, and the contractor information and the last decision making including the ultimate decision to invite the contractor are all effective for the next stage, all of aforementioned items mentioned in this study.

2.8 Effective parameters in the contractor selection

- **The employer type:** being a private or governmental employer influences the contractor selection. The private employers are more inflexible compared to the governmental employers. In other words, the governmental employers are exposed under the governmental and legal conditions. Therefore, decision making will be different in this system.
- **The employer objectives:** every employer has some specific objectives affecting the contractor selection. The employer objectives are fallen into the general objectives, the project objectives and the contractor selection objectives. The general objective of the private employers is to maximize the profit while for the governmental employers is to provide the general facilities. The contractor selection objective of the governmental employers is to select the contractor with the minimum responsibility for the employer while private employers' objective is to select the qualified contractor.
- **The required resources:** the required resources include human, financial, equipment, resource as well as material. For example, the equipment criterion will be the most important if the project needs the machineries.
- **The contract strategy:** the contract strategies are the available policies to implement the project. The policies include the completion time of the project, the specific contractor selection and so forth. For instance, the contractors' ability to complete the previous projects is of importance to complete the works rapidly.
- **The implementation limitations:** the factors such as the governmental principles, the geographical place of the project and the accessibility of the resources are of the implementation limitations. As such, the contractor selection criterion to support the project in the place will be considered as the main criteria of decision making if the geographical place of the project is the mountain.

- **The work type:** the work type affects the criteria selection in terms of the needed amount of the credit, the implementation complexity and the work dimensions. For example, high financial ability of the contractor is the main criteria of decision making in the projects with high costs. (Langford and Male, 2008)

3 METHODOLOGY

This study is a descriptive survey study in terms of research aiming at make categorization. The data was gathered through both field and library review methods. In addition, 30 questionnaires were circulated among different experts of the aforementioned three countries to determine the contractors' sufficiency.

In a construction project, most of the budget is spent in the preliminary stage of the project and any mistake in this stage leads to high losses. Therefore, selecting the qualified contractor is very important in the construction projects in order to ensure that the risk of the resource loss in terms of the cost and time is minimized and the projects have the highest implementation quality and security beforehand and afterwards. Two solutions have been provided to this problem: changing the tenders holding trend and the contractors prequalification before holding the tender (Abbasnia et, al., 2005).

Considering that, this study investigates the current conditions of contractors' evaluation methods and compares various techniques of prequalification. Also, the preliminary evaluation methods are compared in three different countries of Hong Kong, America and Australia.

Population of a study is a collection of units which are sharing some points and the researcher tends to study their various features. The sample size of this study includes 30 experts (calculated form Morgan table) that have been selected out of the research population as the sample. The samples were selected through random selection process.

The first step in multi-criteria method of research is using a questionnaire. The respondents (which are the mentioned experts in this field) give different scores to the established criteria and sub-criteria.

4 Findings

The gathered data was analyzed using the descriptive and inferential statistics. The purpose of the descriptive statistics is to compute the population parameters using the census of all the elements of the population. Meanwhile, the inferential statistics intends to infer on the population through analyzing the information which is called the non-deterministic evaluation. The researcher computes the sample statistics and generalizes the findings to the population using the estimation or testing the statistical hypothesis. The data analysis and measurement of the significance level were done using SPSS software.

4.1 Frequency distribution (using single criterion method)

Table 1- frequency distribution based on the contractor selection using single criterion method

Variables	Frequency	Frequency percentage	Valid percentage	Median
Very weak	6	20%	20%	
Weak	12	40%	40%	
Average	12	40%	40%	
Strong	0	0%	0%	
Very strong	0	0%	0%	
Total	30	100%	100%	

According to table 1, 20% of the sample evaluates the contractor selection by the single criterion method as very weak, 40% of the sample evaluates it as average and 40% of the sample evaluates it as average. Also, the median (equals with 2) indicates that the average of the sample opinion is weak regarding the contractor selection using the single criterion method.

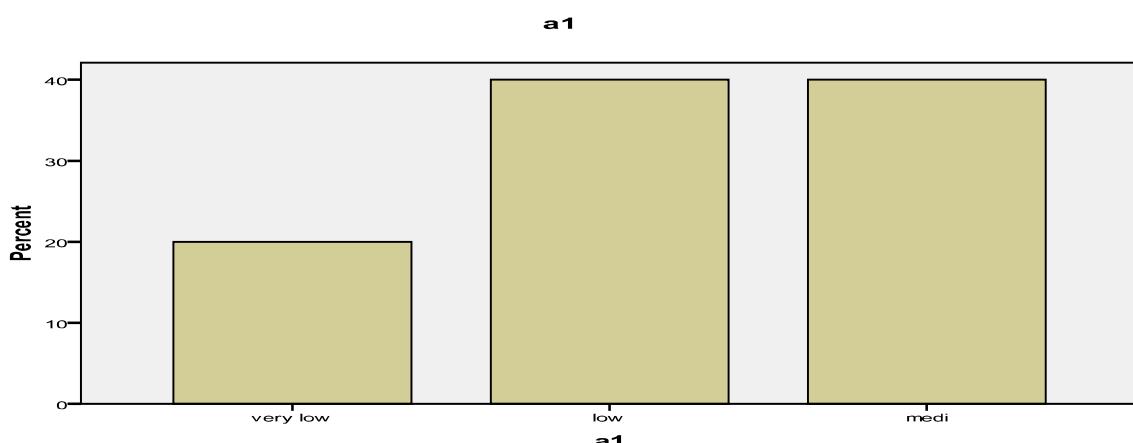


Figure 1- frequency distribution based on the contractor selection using single criterion method

4.2 Frequency distribution (using multi criterion method)

Table 2- frequency distribution based on the contractor selection using multi-criteria method

Variables	Frequency	Frequency percentage	Valid percentage	Median
Very weak	2	6.7%	6.7%	
Weak	5	16.7%	16.7%	
Average	18	60%	60%	
Strong	5	16.7%	16.7%	
Very strong	0	0%	0%	
Total	30	100%	100%	

According to table 2, 6.7% of the sample evaluates the contractor selection with the multi-criteria method as very weak, 16.7% of the sample evaluates it as average and 60% of the sample evaluates it as average, and 16.7% evaluate it as a strong method. Also, the median (equals with 3) indicates that the average of the sample opinion is average regarding the contractor selection using the multi-criteria method.

Frequency distribution based on the contractor selection

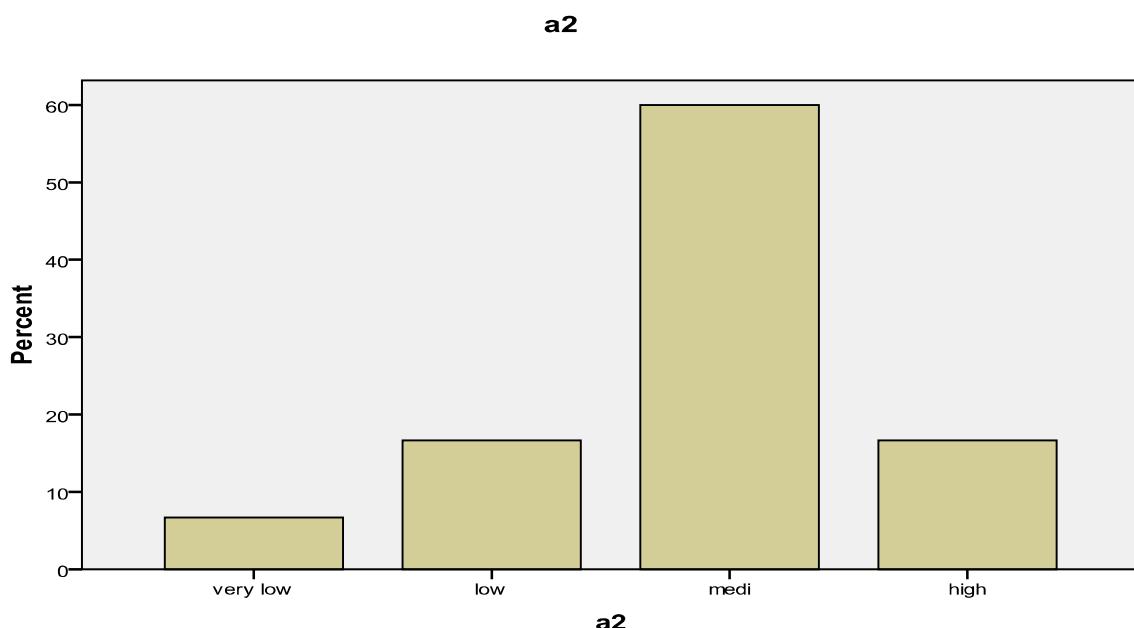


Figure 2- frequency distribution based on the contractor selection using multi-criteria method

4.3 Frequency distribution (using the decision support method)

Table 3- frequency distribution based on the contractor selection using the decision support method

Variables	Frequency	Frequency percentage	Valid percentage	Median
Very weak	0	0%	0%	
Weak	0	0%	0%	
Average	17	56%	56%	
Strong	12	40%	40%	
Very strong	1	3.3%	3.3%	
Total	30	100%	100%	

According to table 3, 56% of the sample evaluates the contractor selection with decision support method as average, 40% of the sample evaluates it as strong and 3.3% of the sample evaluates it as very strong method. Also, the median (equals with 3) indicates that the average of the sample opinion is average regarding the contractor selection using the decision support method.

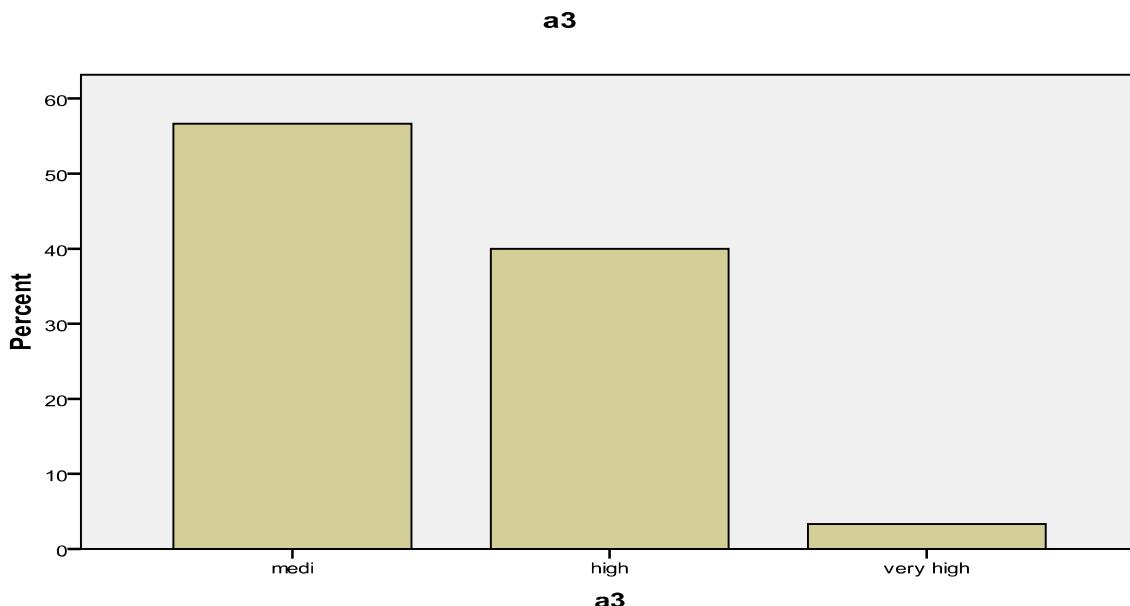


Figure 3- frequency distribution based on the contractor selection using the decision support method

According to table 4, the experts have evaluated the single criterion method with the mean of 2/20 as a weak method. Also, the mean of the multi-criterion method has been estimated equal with 2/87, indicating that it is a low average method. The mean of the decision support is 3/57 indicating that it is a high average method, close to strong method.

Table 4- estimation of the contractor selection methods mean

Variable	Mean	Standard deviation
Single criterion	2.20	0.761
Multi-criteria	2.87	0.776
Decision support	3.57	0.571

Therefore, it can be extracted that the decision support method with the highest mean has been welcomed by the experts more than the other methods. Multi-variable regression test has been used to evaluate the multiple effects of the contractor selection methods with the best selection criterion as well as determining the best method of the contractor selection.

Table 5- the entered and remover variables

Model	Entered variables	Removed variables	Regression method
First	Above independent variables	-	ENTER

According to table 5, all the variables under investigation have been entered into the model without any specific order.

Table 6- estimation of the regression model summary

Row	Model	Multiple correlation coefficients	Determination coefficient	Balanced determination coefficient
1	Above variables	0.824	0.680	0.643

Table 6 indicates the relationship between the independent variables (different contractor selection methods) with the variable (the contractor selection methods criteria). According to the table, the multiple correlation coefficients of the independent variables with the variable of the contractor selection methods' criteria equals with 0/824. The determination coefficient (effect and predication) of the independent variables equals with 0/680 and the balanced determination coefficient based on the degree of freedom of the variables equals with 0/643. In other words, the amount of the variable of the contractor selection methods criteria based on the above variables effects equals with 0/68 which is 0/64 with precise computation of degree of freedom (this value is the average coefficient indicating the relative efficiency of the model). Therefore, 64% of the variations of the best criterion of selection is predicted and determined by the above variables.

Table 7- ANOVA analysis and determining the significance level of the model

Model	Squares sum	Degree of freedom	Mean squares	F statistic	Sig
Determined (regression)	7.320	3	2.440	18.400	0.000
Residual	3.448	26	0.133		
Total	10.768	29			

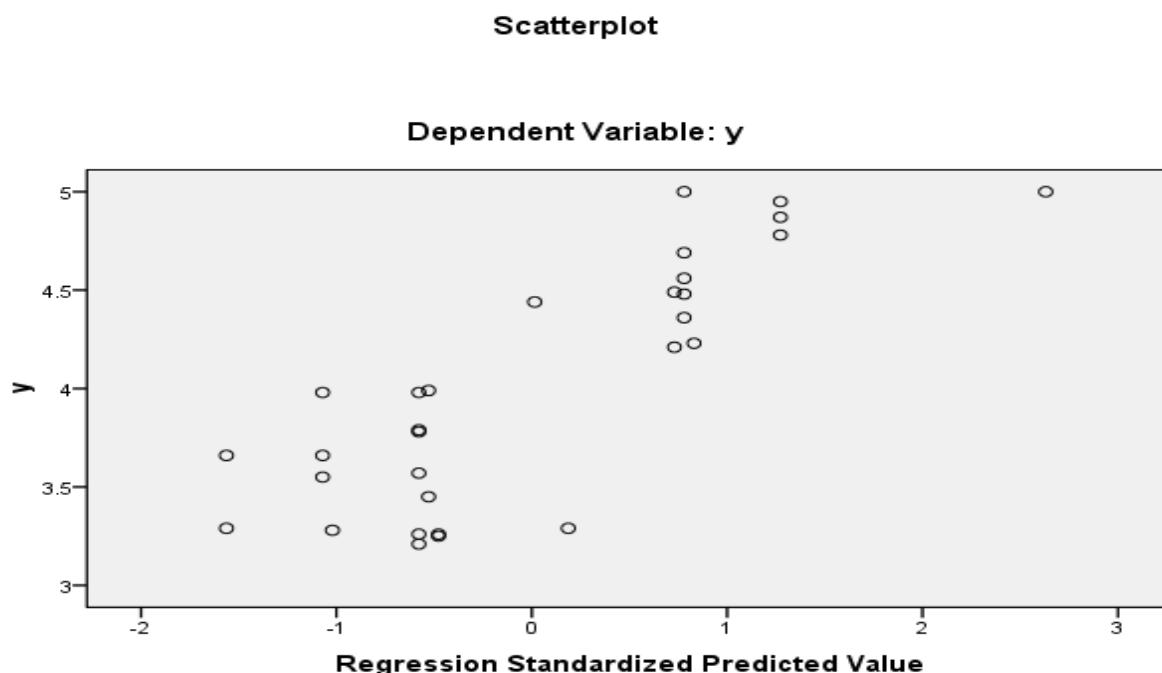
According to table 7 and considering the value of F statistic as well as the observed level of error (P-Value< 0/05), there is a correlation at the confidence level of 99%. In other words, there is a significant relation between the independent variables and the criteria of the contractor selection. Therefore, the null hypothesis is rejected and the alternative hypothesis is confirmed.

Table 8- regression weight coefficients

Model factors	Non-standard B	Standard B	t value	Sig
Constant coefficient	1.006	-	2.315	0.029
Single criterion	0.025	0.032	0.253	0.802
Multiple criterion	0.273	0.347	2.516	0.018
Decision support	0.657	0.616	4.936	0.000

According to table 8, the value of the weight coefficients of each variable on the standardized and non-standardized independent variable (Beta), t test value and the observed error level of each variable with the dependent variable have been considered. Accordingly, the value of the standardized weight effects of the single criterion method is 0/032, the multi-criteria method is 0/347 and the decision support is 0/616. However, it can be understood that the decision support is the best method of the contractor selection. Also, considering these coefficients, the regression equation of the contractor selection criterion can be stated firstly and the amount of the effect of each independent variable can be predicted for each variation unit in the dependent variable. Additionally, the value of F statistic and the level of significance indicate the net and significant effect of the decision support method at the confidence level of 99% and indicate the net and significant effect of the multi-criterion method at the confidence level of 95%.

Furthermore, the scatter plot of the dependent variable based on the standardized value of the predictive variables will be as follow:



5 DISCUSSION AND RESULTS

Holding tenders is based on the law issued on the year 2003 by the national parliament of Iran. Using the decision support systems to select the contractors has been predicated. According to the act, the employers can qualitatively evaluate the contractors and invite them to cooperation in case of obtaining the necessary score. Based on this act, the contractor

offered the most appropriate price will be the tender winner. Moreover, the tenders in which the contractors must present technical offers in addition to the commercial offers it is allowed to balance the offered prices based on the obtained score (Bidi, 2007). There are several methods of tenders:

5.1 Open tendering

Open tendering allows anyone to submit a tender to supply the goods or services that are required. Generally an advert will be placed giving notice that the contract is being tendered, and offering an equal opportunity to any organization to submit a tender.

On larger projects, there may then be a pre-qualification process that produces a short-list of suitable suppliers who will be invited to prepare tenders. This sort of pre-qualification process is not the same as selective tendering (see below).

Open tendering has been criticized for attracting tenders / expressions of interest from large numbers of suppliers, some of whom may be entirely unsuitable for the contract and as a result it can waste a great deal of time, effort and money. However, open tendering offers the greatest competition and has the advantage of allowing new or emerging suppliers to try to secure work.

5.2 Selective tendering

Selective tendering only allows suppliers to submit tenders by invitation. A pre-selected list of possible suppliers is prepared that are known by their track record to be suitable for a contract of the size, nature and complexity required. Consultants or experienced clients may maintain 'approved' lists of prospective suppliers and then regularly review performance to assess whether suppliers should remain on the list.

Selective tendering can give clients greater confidence that their requirements will be satisfied and should reduce the wasted effort that can be involved in open tendering. It may be particularly appropriate for specialist or complex contracts, or contracts where there are only a few suitable firms. However, it can exclude smaller suppliers or those trying to establish themselves in a new market.

5.3 Negotiated tendering

Negotiating with a single supplier may be appropriate for highly specialist contracts, or for extending the scope of an existing contract. It can reduce the costs of tendering and allow early contractor involvement, but the competitive element is reduced, and unless the structure of the negotiation is clearly set out there is the potential for an adversarial atmosphere to develop, even before the contract has been awarded.

5.4 Serial tendering

Serial tendering involves the preparation of tenders based on a typical or notional bill of quantities or schedule of works. The rates submitted can then be used to value works over a series of similar projects, often for a fixed period of time following which the tendering procedure may be repeated.

Serial tendering can reduce tender costs, and may encourage suppliers to submit low rates to secure an ongoing program of work.

6 Conclusion

Considering the effect of the qualified contractor selection in the cost and quality of the project implementation, various methods of the contractor selection is of particular importance. Today, the decision support systems are highly considered in assigning the projects to the contractors with respect to solving disadvantages of the single criterion and multi-criteria so that the tender holding law takes them into consideration in Iran. But lack of proper knowledge about the systems in executive organizations and among the consultant engineers as well as the existing defects in tenders holding have caused the decision support systems not to apply appropriately. Based on the findings, the significance of this study lies in the point that the decision support systems are considered in assigning the contractors to fulfill the projects with respect to solving the problem of single and multiple criteria methods.

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