

Evaluation and Ranking of Indicators which are Effective in Selection of Contractors Using Group AHP Technique (Case Study: TOSS Company and NISOC)

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ABSTRACT

Administration of an organization requires solving and operationalizing one's plans via planning and making organizing decisions and use of an acceptable combination of human force and material facilities. Contractors are inseparable and important element of implementation of service, operational and executive contracts. Evaluation and selection of contractors is an important area of decision-making in petroleum industry which has the conditions of multivariate decision-making. In this research, use of group AHP technique in contractor contracts was investigated in NISOC and TOSSC in Ahwaz City. After designing, the questionnaire was distributed among employees of the two aforementioned companies and then the most effective and most important indices for evaluation and selection of contractors were introduced. The results showed that technical and planning index and financial and credit power are the most effective indices in evaluation of contractors and good record and equipment capabilities have less values and importance than other indices. Finally, decision-making process was presented along with solutions for use of this method and some recommendations were made for future study.

KEYWORDS: AHP technique, contractor, employer, project, tender, ranking and selection

INTRODUCTION

Annually, thousands of billion Rials of national capital are spent on civil projects and creation of infrastructural installations in public and private sector, both directly and indirectly. Moreover, failure to manage projects properly wastes national investments. In a civil plan, the highest amount of investment is made in plan implementation stage and making mistakes in this stage is followed by wasting a large part of this investment. Necessity for proper and efficient planning in order to avoid money waste requires selection of appropriate contractors in tenders. Since the lowest tender offer is not necessarily the most economical long-term solution, identification of criteria for selection of contractors and also a logical evaluation method are main factors in selection of contractors such that the abilities of the selected contractor guarantees qualitative features and time and expenditure economy. Considering the fact that contractor plays an important role in every tender, selection of a good contractor is a key managerial decision. Therefore, identification and evaluation of a series of criteria for selection of contractors helps eliminate inefficient contractors from tender. Furthermore, due to diversity of contractors who have necessary conditions for taking part in tenders potentially, selection of the best contractor is an important issue. The criteria should be gathered and processed in order to maximize the selected contractors performance level and minimization of errors in satisfaction of social needs and organizational standards. It is obvious that qualitative and quantitative indices with different importance degrees be propounded in determination of competency of contractors. To this end, we should first evaluate and rank contractors and then select them to implement tender in the best manner.

Proper evaluation and selection of a contractor out of competent contractors can be a solution for this problem. Such decisions are usually complex and many qualitative and quantitative factors are used for evaluation in this regard. Ranking is a decision-making issue with multiple criteria. In many cases, numerous complicated criteria are used such that its constituting sub-criteria have interdependencies. Considering the model, the author tries to measure the influence of indices on evaluation and ranking of petroleum industry contractors like financial power, technical power, experience, managerial experience and contractors' equipment based upon multiple decision-making criteria. By using the results of this research which are mainly based upon participation of experts in decision-making, one can avoid biased decision-makings. Moreover, ranking of determining criteria in decision-making, selection of contractors and determination of logical and scientific documents provides us with a decision support system such that these criteria, standards and priorities remain effective regardless of promotion or delegation of managers.

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Research questions

1. What are indices for evaluation of contractors?
2. What are the importance of weight of criteria and sub-criteria for every index of contractors' evaluation?
3. How are the degrees of importance of indices in evaluation of contractors?

THEORETICAL LITERATURE

Project submission

Contractors receive projects from different manners the most important of which is taking part in tenders via invitation of executive departments. Operationalization of a project depends on different factors like recognition of necessity, primary studies, approximation of costs, economic features of the project, credit provision and finally assignment of budget for implementation of them. After passing the aforementioned stages and issuance of start license, the concerning departments identify qualified contractors via tenders and submit the project to the selected contractor after observing formalities of tender within the framework of regulations (Ettehad, 2007).

Tender

Tender is a method for selecting better quality and lower price and usually great public transactions are conducted by holding tenders. Tender is conducted using the following methods and its results are investigated in tender commission of executive departments.

1. free or public tender, 2. Restricted tender, 3. Tender formality leaving

Free or public tender

It is a kind of tender in which invitation is publicized via public notice.

Restricted tender

In large projects, only contractors which have required qualifications in ranging of Organization of Management and Planning can take part in such tenders. In this case, the executive department invites qualified contractors and advisors to take part and purchase tender documents after asking the Organization of Management and Planning and receiving the names and specifications of contractors and advisors (restricted tender). Every company is required to take part in tender or mention its reluctance reasons in a written form within a particular period of time before holding a tender. The employer can announce the reasons to Organization of Management and Planning in order to use in ranking of contractors (management of civil projects, 2003; 70).

Tender formality leaving

In this type of tender, qualified or special contractors are invited to take part in tenders after approval of authorities and the qualified contractor is selected in the regarding commission.

Definition of contractor in general conditions of pact

Article seven of general conditions of pact defines a contractor as follows: a contractor is a real or legal person who signs the other side of a pact and takes on implementation of pact subject based on documents and papers (representatives and legal agents of a contractor are the same as contractor). Clause ??? of article 14 of chapter 1 of classification of recognition of contractors' competency law states: " a contractor is a real or legal person who has received contractor qualification according to regulations and conditions of the law."

National Iranian south oil company

National Iranian South Oil Company (NISOC) is one of the Iranian national companies which is a subsidiary of National Iranian Petroleum Company. This company produces more than 80% of Iranian petroleum and more than 16% of Iranian natural gas such that it produces 3 millions of barrels of crude oil, 800 millions of cubic feet natural gas and 150000 barrels of gas condensates. It is the greatest Iranian petroleum-producing company and one of the greatest petroleum companies all over the world which is headquartered in Ahwaz City. After discovery of petroleum in Masjid-e-Soleiman City in 1908, Iranian petroleum industry was started in Masjid-e-Soleiman by administration of Britain experts. In the beginning of 1970s, petroleum and gas production activities and exploration and drilling operations were accelerated and "Iranian Special Petroleum Services Company" was established as the contractor company which signed a contract to take on all exploration activities, drilling operations planning, installation and launch of constructions and pipelines, study of fields and preparation of proposal for development and enhanced recovery programs and also preparation of budget for projects. Central office of this company was located in Abadan and besides this company, "non-industrial operation company" took on responsibility for all non-industrial activities. After Islamic Revolution in 1978 in Iran and start of Iran-Iraq war, the duties of the aforementioned companies were submitted to NISOC and the main office was also displaced from Abadan to Ahwaz. Before Islamic Revolution, NISOC was administered by two companies "Special Iranian Petroleum Services" and "non-industrial services". After revolution, NISOC took on responsibility for management of production in southern fields and this management changed its name to management of on-shore regions production and covered nationwide petroleum activities.

Eventually, organizational structure of NISOC was changed in 2000 and NISOC contained one headquarter and 9 subsidiary companies. This company manages more than 50 large and small hydrocarbon fields and is active across an area about 400000 square kilometers from Bushehr to northern Khuzestan and produces about 83% of Iranian Crude oil. Large oil fields like Ahwaz, Asmari, Gachsaran, Maroun, Karanj and Parsi lie in the area of activity of NISOC. This company has been formed from two main branches:

- Management and staff departments
- Subsidiaries

Management and staff departments include:

- Production management, non-industrial services management
- Technical affairs management
- Engineering and construction management
- Financial affairs management

Subsidiaries include: Karoun oil and Gas Production Company, Maroun oil and Gas Production Company, Gachsaran oil and Gas Production Company, Aghajari oil and Gas Production Company, Masjid-e-Soleiman oil and Gas Production Company, Drilling Services Company, South Turbine technical and engineering company, and TOSSC.

TOSSC

This company enjoys a widespread range of mobile and construction machinery and urban and off-road transport equipment and heavy transportation facilities for special drilling operations like rig movement, fuel transport and casing pipes for drilling rigs in operational, service and project sectors.

This company is a subsidiary to NISOC and members of board of managers of NISOC constitute its assembly and its managerial board chairman is managing director of NISOC. This company has six management sectors including operation management, overhaul and procurement support management, technical and engineering affairs management, human resource management, financial affairs management and commerce management. It has also four staff departments including legal affairs and contracts, public relations, safety and hygiene and environment and guarding.

Hierarchical analysis process (AHP)

It was proposed by an Iraqi person called Sa'ati in 1970s. this method analyzes issues like what is taken place in human brain. AHP enables decision-makers to specify mutual impacts of many complex and uncertain states. This process helps decision-makers with setting priorities based on their knowledge, targets and experience. In order to solve problems using AHP, we should define and specify the problem in detail and draw it in a hierarchical form. AHP is based upon three main principles:

a. drawing hierarchy tree, b. formulation and determination of priorities, c. logical compatibility of judgments

Research conceptual model

Research model was created by the author and is made up of three sections the first section includes criteria and sub-criteria mentioned in qualitative evaluation table of contractors for executive and service and operational works, which has been approved by Legal and Lawful Affairs Department of National Iranian Oil Company. These criteria are classified using employer strategies and then the most important factors which affect evaluation of performance of contractors are determined. Then, these criteria are evaluated and are classified by rank. The second and important section of the model involves past information and records of contractors which is obtained via copy of their contracts, number of satisfaction letters, asking for information from former employers, asking NIOC and other subsidiaries of Ministry of Petroleum. Further, information and specifications of the new tender can influence evaluation of contractors.

In the third and main section of the model which in fact constitutes the main body of the model we demonstrate the order of project implementation based on normal trend of doing tenders and determination of final winner. To this end, we first prepare the list of new contractors which want to take part in the tender and we conduct preliminary evaluation according to intended criteria by experts. Then, contractors are ranked. For instance, they are ranked in terms of financial power (1, 2, 3), in terms of experience and records and provision of product and services (4, 6, 7) and ... then, they the list of qualified contractors is prepared by following multivariate decision-making matrix. After this stage, qualified contractors take part in tender and prepare tender documents and after finalizing, their documents are given to tender commission and they wait for announcement of tender opening session. Then, the best qualified is selected by employer considering some criteria like price, time period.

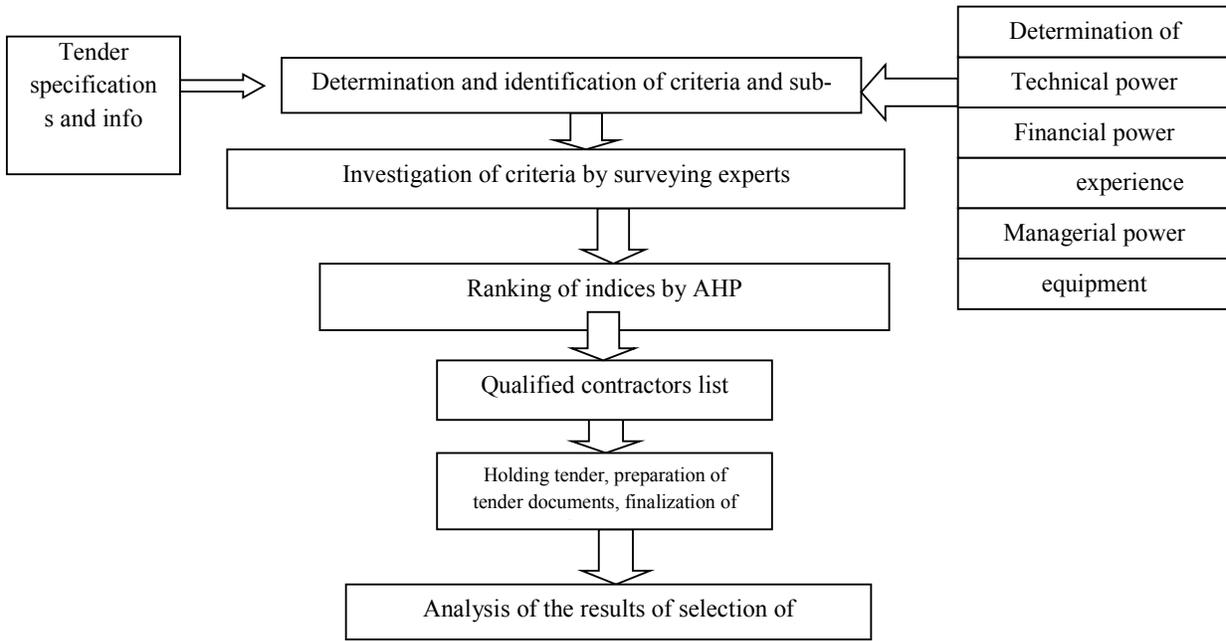


Figure 1.a proposed model extracted from Abbas Nia, 2005

METHODOLOGY

A survey was conducted to gather data in this study and it can be classified as a field study. Further, this research is an applied study because it was conducted in a real environment. because it describes and studies what is there, it is a descriptive study.

Statistical population studied in this study included all experts and experienced employees in legal affairs departments of the two aforementioned companies and a number of project executers who had evaluation licenses from upstream authorities. They were 48 people in number considering the type of expertise, education and qualification with a work experience of 15-20 years.

Individuals with evaluation license	NISOC	TOSSC	sum
manager	-	3	2
chairman	4	2	6
Master degree	16	3	19
Bachelor degree	12	8	20
sum	32	16	48

Sampling and sample size

Due to small size of statistical population, we did not picked samples and we used ideas of all members of the population.

Data gathering method and instrument

This study aims to acquire data on factors which are effective in evaluation of appropriate contractor in tenders and ranking of these factors. The author made respondents judge about the criteria and used the results to answer theresearch questions. Two researcher-made questionnaires (1 and 2) and interview with managers and experienced employees were methods for gathering data. low cost, absence of need for too many resources and many potential capabilities for gathering sample are factors which turn a questionnaire into an efficientinstrument for gathering ideas from respondents. A questionnaire containing 51 questions wasprepared based on paired comparisons and was distributed among respondents.

Therefore, all experts and executers of projects and contractors of NISOC and TOSSC were asked to express their ideas about criteria and their roles in evaluation and selection of contractors. In order to make sure that the questionnaire is valid enough, 48 respondents received questionnaires experimentally and after correction, the finalized questionnaire was designed. 45 questionnaires were returned and analyzed.

Questionnaire analysis

Doing comparisons in such a questionnaire is in rows and 51 questions had paired comparisons. Of this number, 21 primary questions are related to paired comparisons of main criteria and the subsequent 30 questions

concern determination of the ranks of sub-criteria, including 6 groups of main criteria which have been asked in paired comparisons of sub-criteria.

Table 1.Sa'ati's 9-point spectrum

criterion	similar preference														criterion			
	very high preference										very high preference							
criterionj	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Criterion i

In this spectrum, the decision-maker compares criteria in pairs and assigns a value to each option in comparison with other options based on the subsequent table.

Research validity and reliability

The validity of the questionnaire was verified by scholars. Internal consistency was used for investigation of reliability. In this research, Overall Inconsistency rate calculated for paired comparisons matrix has a mean value equal to 0.05 which indicates consistency among paired comparisons and verifies researcher's trust in the results.

Table 2.distribution of respondents in terms of work experience

row	Work experience	Freq.	percentage
1	Below 10 years	15	44
2	11-20 years	20	33
3	21-30 years	8	17.7
4	31 and above	2	4.4
6	sum	45	100

Data analysis

AHP process was used for data analysis. Expert Choice software was used for doing calculations.

Calculation of relative weights of indices

In this section, we use data i.e. paired comparisons matrices, main criteria with respect to target and paired comparisons matrices of subsidiary indices with respect to main indices in order to calculate final weight of main criteria with respect to target and relative weights of subsidiary criteria in relation to main criteria. Operation process was conducted by means of Expert Choice software. The results of analyses have been summarized in table 3.

Table 3. final ranking of indices based on calculated weights

Ranking of criteria for evaluation of contractors using distributional method		
Rank of criteria	criteria	Final weight of criterion
1	C-2)0.079	
2	A-3)0.072	
3	C-3)0.069	
4	D-1)0.062	
5	D-2)0.062	
6	B-1)0.060	
7	A-1)0.056	
8	G-3)0.055	
9	G-1)0.051	
10	A-2)0.047	
11	F-2)0.044	
12	B-4)0.042	
13	E-1)0.036	
14	D-3)0.031	
15	C-1)0.030	
16	B-2)0.030	
17	G-2)0.030	
18	F-2)0.027	
19	A-4)0.024	
20	E-2)0.023	
21	B-3)0.021	
22	G-4)0.019	
23	F-1)0.017	
24	E-3)0.014	

Conclusion

Analysis of research results on the first question

This study identifies factors which are effective in evaluation and ranking of contractors.

The main target of this study is to implement evaluation and ranking of criteria in order to achieve the main question of the research based on AHP technique. Therefore, combinational application of this criterion was identified as an appropriate model for evaluation of contractors in tenders. The results of this study have similar results as studies conducted by Pour Muhammad (2014), Heidari (2011), and Bahatesh and Skitmor (1997).

Research findings analysis on the second question

7 criteria which are effective in evaluation of capabilities of contractors in doing tenders have been identified by Delphi Group as follows:

Experience, good records, financial and credit power, technical and planning power, equipment power, managerial power and specialized group, resource and product procurement power

The selected indices have some sub-criteria therefore tree-like structure of the weights of indices and sub-indices have been mentioned in subsequent table along with weight of each one.

As it can be seen, criteria like work capacity and the number of works under implementation and rank of the company, ethical characteristics of the contractor, being local and ... are not placed in the above classification because it is assumed that those contractors take part in tenders who have minimum qualifications and acquire appropriate ranking based on dimensions and size of tender. It is obvious that if a contractor aims to offend and takes part in a tender not really qualified for, it is not only eliminated from the list of qualified contractors but also will be fined.

It must be mentioned that a general unanimity was reached on these classifications although it is possible to have other classifications or criteria in different tenders. This research indicates the appropriate model for using AHP technique aiming at evaluation and ranking of criteria effective in evaluation of contractors. The fact that whether the classification of final weight obtained for indices is appropriate for all kinds of tenders is not the subject of the present study because management and officials of a tender determine these factors based on conditions of project and with group decision-making and according to the presented method, existing regulations and organizational directions.

The results of this research has similar results as studies conducted by Pour Muhammad (2014), Heidari (2011), Eshtehardian (2005) and Bahatesh and Eskitmore (1997) in terms of identification of contractors' evaluation criteria.

Table 4. tree-like structure of weights of criteria and sub-criteria

Weight fraction	Sub-criteria	Criterion/weight fraction
6	Working experience in that field	a. experience 15.4
3	Records equal to relationship with contract amount	
2.1	Records as contract implementation time period	
4.2	Quality of implementation and final score of employer evaluation	b. good records 8
1.7	Receiving rewards and formal appreciations	
4.4	Having satisfactory evaluation background in ending work	c. credit and financial power 17.8
2.7	Identification of competencies and qualifications from different organizations	
3	Presenting tax and insurance settlement documents	d. technical and planning power 19.8
7.9	Corporate capital level	
6.9	Corporate credit for receiving letter of guarantee	
7.2	Quality of project implementation in terms of time and cost and ...	equipment power 7.2
5.6	Having a comprehensive planning system	
4.7	Way of observing technical standards and technical specifications	f. managerial power and specialized employees 15.4
2.4	Observation of safety and protection guidelines	
3.6	Having stand-by equipment and machinery	
2.3	The type of ownership of special machinery	g. resource and product preparation 16.4
1.4	Having work-related software	
6.2	Specifications of members of board of managers	
6.2	Licenses received by members	sum
3.1	Having quality management system(ISO)	
6.2	Having knowledge and skill in product and resource procurement	
6.2	Quality system and way of product and service guarantee	
1.4	Having financial records in the field of supplying	
2.6	Having insurance records in the field of supplying	
100		

- Technical and planning criteria have the maximum impact on evaluation of contractors.
- Financial and credit criterion is in the second rank.
- Experience, managerial power and specialized employees rank third and fourth with a small difference.

- Good records, equipment power and procurement of product and services rank fifth to seventh.

The results of this research regarding identified criteria differ from the results of studies conducted by Heidari (2011) and Wat et al(2010) because the results of wat et al show that previous performance of contractors, executive background and similarity of records, technical expertise and control have the greatest levels of importance and experience and good records have the least importance.

Analysis of the results on the third question of the research

A comparison of the results obtained in a particular tender and use of AHP technique in similar conditions for ranking in a tender considering the 6 main criteria and 24 sub-criteria in this study and compatibility of these results in determination of the best and lowest rank with the real ranging results of tender verify the results of this study and indicates the effectiveness of AHP technique for ranking of contractors especially in selection of the best and worst ranks.

Recommendations

-considering the commonality of important and effective criteria in many sectors of different projects, it is recommended that in other sections of tender holding some committees be formed in order to identify factors affecting performance of contractors in order to create comprehensive information banks of contractors and update it periodically such that it is possible for experts to rapidly access to contractors' documents.

- it seems that experts of employers tend to select contractors with high levels of credit and financial powers because of budget restrictions within the recent years and a high share of financial index weight. In this regard, it is recommended that some contracts should be used in a way that the contractor(s) take on responsibility for financing all or a large part of the project and reach its benefits by project future income.

-in order to help managers and experts, it is recommended that some training courses be held on the way of identification and evaluation of qualitative and quantitative criteria in evaluation of contractors and use of auxiliary software and methods in solving multivariate decision-making problems.

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