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Selection of Contractors for Middle-Sized Projects in Turkey

Ayşegül YILMAZ[1], Sema ERGÖNÜL[2♠],

[1]*MSB İnşaat Emlak ve NATO Güvenlik Yatırımları Daire Başkanlığ, Bakanlıklar-Cankaya/Ankara*[1]

[2]*Mimar Sinan Fine Arts University, Faculty of Architecture, 34427 Fındıklı, Istanbul*[2]

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ABSTRACT

In the last decade, there has been a trend rising towards the improvement of the methods for effective contractor evaluation. Governments may have been utilizing these kind of studies during legislation and legal regulations on procurement. To achieve the best value for money, the tender evaluation should consider not only price competitiveness, but also compliance with users' requirements, reliability of performance, capabilities and experience, qualitative superiority, and whole-life costs. Turkish public authorities arise the need for proper contractor selection approach including factors other than price. A contractor selection model is structured to cover non-price attributes together with the bid price. The concern of the model is the public authorities, who want and need to consider the factors other than price during contractor evaluation process of middle-size and semi-complex projects. The model is tested by a hypothetical scenario which evaluates four contractor candidates. The results show that the model provides a guide for the public client to reward experienced, capable and qualified candidate contractors, and to eliminate incompetent, inexperienced, or underfinanced contractors for the success and quality of works.

Key words: *Procurement, Public Sector, Clients, Contractor Evaluation, Contractor Selection*

1. INTRODUCTION

The concept of project success does not have a common and certain definition because of varying perceptions of different parties including the client, the architect, the contractor, various surveyors and engineers in construction sector. Each project participant will have his or her own opinion of success and the definition of success changes from project to project. Traditionally, a project is considered successful if the building is delivered at the right time (schedule), price (budget), and quality. Construction contractor selection is very important task as the contractor plays a vital role for the progress and sucsess of the project. In every country, public procurement environment has different characteristics in respect to dissimilarities in political, social and economical features. Evaluating contractors and selecting the best bidder requires a sophisticated knowledge and experience to ensure that the selected contractor is capable of executing the project according to the owner's requirements.

Owners in various sectors have different procedures for evaluating construction bids. The private sector clients mostly develop their own procedures and have unrestrictive system for bid evaluation. The method implemented in the public sector is that of awarding the contract to "the lowest bidder", because clients are publicly responsible and must demonstrate that the best value for their money has been obtained [1, 2, 3, 4]. However, the selection of the lowest bidder is one of the major reasons for project delivery problems as contractors, when faced with a shortage of work, desperately quoted a low bid price simply to, remain in business with the expectation to be offset through claims [5].

Turkish Public Procurement Law (PPL), which is revised in 2003 provides a public procurement system with more transparent regulations, no arbitrary and unequal treatment of public client to candidate contractors, elimination of discriminatory and unwelcome procurement practices, and development of effective competition. Based upon all these attributes, PPL 4734 [6] constrains public clients to contract with the lowest bidder, excepting some cases like invalidity of documents

Corresponding author, e-mail: ergonul@msgsu.edu.tr

of the lowest bidder. Bid evaluation based on the lowest bid price without contractor qualification may be suitable in simple and small-scale public projects. But, it may result in a failure for middle-size and semi-complex projects. As far as non-price criteria are concerned, there are no clear regulations, standard forms and instructions for contractor evaluation method in PPL 4734 [6]. Therefore, public authorities do not prefer to use non-price attributes for fear of impropriety, and damaging transparency and competition during the evaluation process of contractor's tenders. Currently, public clients in Turkey need some kind of qualification criteria together with bid price during bid evaluation and contractor selection process for the success of their projects.

This study aims to present a contractor selection model which is practicable for public authorities who are willing to take into account the factors other than price, to be able to select the best bidder. Middle-size and semi-complex public projects are the primary concern of this study. The model is hypothetically tested by a scenario evaluating four candidate contractors.

2.CONSTRUCTION CONTRACTOR SELECTION

Contractor selection aims to minimize the possibility of contractor default and the time involved in bidding by restricting the number of eligible contractors involved. It is one of the most challenging tasks performed by an owner or contract administrator, due to the complexity involved in this process [7]. Construction clients are becoming more aware of the fact that the selection of a contractor based on bid price alone is quite risky and may lead to the failure of the project in terms of time delay and poor quality standards [8-10]. In order to evaluate the overall efficiency of a project it is necessary to identify selection attributes, to assess information relating to these attributes, and to develop methods for evaluating the attributes to meet the participant's needs [11].

In practice, contractors' suitability to participate in a project bid is usually assessed by the project owners according to their previous experience, judgement and a set of criteria which might vary between projects and clients. The multi-criteria evaluation model is broadly used by researchers as a means of alternative selection [12-15] addresses 25 attributes for contractor selection while Alsugair [1] proposes a framework of 36 evaluating factors grouped into nine classes. However, literature review shows that the most acceptable contractor's pre-qualification criteria are financial stability, management and technical ability, contractor's experience, contractor's performance, resources, quality management, plant and human resources, health and safety and environmental concerns [5, 16-18].

Numerous researchers [19-21] emphasizing the importance of contractor selection, suggest methods/models for the evaluation of candidate contractors. Some of the models deal with quantitative data while others are able to treat the quantitative as well as qualitative data.

Hatush and Skitmore [9] proposes a contractor selection and bid evaluation based on utility theory which permits different types of contractor capabilities to be evaluated. Multi-criteria utility theory provides one such approach and is especially useful as it allows the treatment of both quantitative and qualitative criteria and in situations where there are several stake-holders. Turskis [22] proposes a multi-attribute model as a feasible tool to aid in decision-making for contractor pre-qualification. The model may reduce the risk involved in the selection of a contractor and can lead to the elimination of unqualified contractors during the bidding process.

Hatush and Skitmore [23] use the PERT approach to develop a linear model for the assessment of contractor data. The model incorporates a multiple ratings permitting the uncertainty in contractor data to be evaluated. Sonmez et al [24] explores the Evidential Reasoning approach as a means of solving the contractor selection problem. The process of building a multiple criteria decision model of a hierarchical structure represents both quantitative and qualitative information in a unified manner. Lam et al. [7] discuss that non-linearity, uncertainty and subjectivity are the three predominant characteristics of contractors prequalification which lead to the process being more of an art than a scientific evaluation They explore the practicality and effectiveness of the fuzzy neural network (FNN) model for contractor prequalification and selection. It is possible for the FNN to identify the fuzzy rules used by the prequalifiers and tune the membership functions by utilizing neural networks' learning capability. The FNN model applying to the case study of contractor selection in Hong Kong has produced encouraging results.

A fuzzy decision framework developed by Singh and Tiong [25] makes the contractor selection process more systematic and realistic as the use of fuzzy set theory allows the decision makers to express their assessment of contractors' performance on decision criteria in linguistic terms rather than as crisp values. Bendana et al [26] also presents a fuzzy-logic-based system for selecting contractors. This system is created for the private sector client in traditional design–bid–build projects with one-step selection processes, but its philosophy can also serve other types of clients, industries, contracts, and selection processes. The system develops an assessment of different qualitative and quantitative issues that influence a contractor's suitability for constructing a specific design in a specific environment (client's needs and objectives, objectives prioritization, site conditions, etc.), taking into account the risk of not achieving the client's objectives. Zavadskas et al [11] demonstrate the concept of general contractor choice on the basis of multiple attributes of efficiency with fuzzy inputs applying COPRAS-G method. The method can be applied to the solution of wide range discrete multi-attribute assessment problems in construction.

An alternative contractor selection model called the analytical hierarchy process (AHP) is suggested by Mahdi et al [27] and Topcu [18]. The AHP model is used to help construction clients to identify contractors with the best potential to deliver satisfactory outcomes in a

final contractor selection process which is not based simply on the lowest bid. The model gives clients the flexibility to add or reduce the elements of a problem hierarchy regarding an individual project [28]. Cheng and Li [29] demonstrate the analytic network process (ANP) for contractor selection. ANP extends the function of AHP and is a method for multi-criteria decision problems that involve interdependent relationships. Sawalhi et al [30] suggests a state-of-the-art model by using a hybrid model, combining the merits of Analytical Hirarchy Process (AHP), Neural Network (NN) and Genetic Algorithm (GA) in one consolidated model called Genetic-Neural Network (GNN). The model gives a chance to improve the client expectation for project success through selecting contractors that are able to meet their objectives.

Current literature highlights the need for a multi-criteria approach to select the right contractor. Existing models can significantly improve the contractor selection process. However, they are mostly very complex and difficult to apply in practice. As Turskis [22] points out, the construction industry needs simple but effective methods in contractor selection process due to limited time intervals of the biding periods. It is also important that the model should allow the stakeholders to modify the attributes depending on the demand of each project. In general, present models are more significant for academic usage than for practice.

3. CURRENT PRACTICE IN TURKEY

In contractor selection, the current practice in Turkey can be regarded as "the lowest bidder among prequalified contractors is the winner" approach. At the first stage, prequalification criteria are used for evaluation and some contractors prequalify to bid for the tender. At the second stage, prequalified contractor having the highest discount rate with respect to cost estimate is awarded the contract. The winner may have a relatively low prequalification score but this low score has no effect on the second stage. The only decision criterion for selection is the bid price [18].

Article 40 of Turkish Public Procurement Law 4734 states that "in cases where it is not possible to determine the economically most advantageous tender on the basis of the lowest price only, the economically most advantageous tender shall be determined by taking into account the factors other than price such as operation and maintenance costs, cost-effectiveness, productivity, quality and technical merit". However, there is no any regulations, standard forms and instructions described for any contractor selection method detailing non-price attributes. Therefore public authorities do not prefer to use non-price attributes for fear of impropriety, and damaging transparency and competition during the evaluation process of contractor's tenders.

In the scope of EC-Directives, a study report by Turkish Public Procurement Authority [31] discusses "factors other than price" for construction works. The report emphasizes that quality, assessment cost, environmental concerns as "factors other than price" become increasingly strong. All these factors should be defined clearly in tender documents. In the study report, the total weighting of "price" and "factors other than price" are equal to 100 percent. The subject and scope of the project determines the weighting score of each. In the study report of Public Procurement Authority [31], this weighting is generalized according to project type as follows:

- between 20/80 and 40/60 in innovative projects,
- between 15/85 and 35/65 in complex projects,
- between 10/90 and 25/75 in simple projects,
- between 5/95 and 10/90 in repetitive projects.

In the evaluation of "factors other than price", one method is comparison of tenders and the other is separate evaluation of each tender as to criteria defined in tender documents. In current practice, most of Turkish public clients avoid forming non-price criteria for bid evaluation procedure in spite of the authorization given them in Article 40. The reason for avoidance is the probability of subjective evaluation of contractors and bids as to non-price criteria that may not be translated into numerical impact data. Subjective and arbitrary treatments of public clients may harm public benefits. Waara and Bröchner [32] indicate that Public sector owners should be aware of how the transparency and complexity of their system of price and non-price criteria affect the incentive power.

'The lowest tender' is insufficient for success of projects in long term. Instead, objective evaluation methods in addition to price should be improved and presented in PPL 4734 for determination of the economically most advantageous tender. The demand for factors other than 'lowest price' for contractor selection has been expressed by almost all Turkish public authorities. Hence, there is a need in Turkish conctruction sector for a simple and comprehensible model covering qualitative and quantitative measures, to guide public clients to select the right contractor for their project instead of developing models which are not practical in use.

4. CONCEPTUNAL MODEL FOR CONTRACTOR SELECTION

A conceptual model has been structured for contractor selection including bid price and non-price criteria in relation to Article 40 of PPL 4734 and also taking into account the needs of public clients. In structuring the model, most of non-price evaluation criteria that may not be translated into numerical impact data are eliminated in order to avoid the subjective evaluation of contractors and others are grouped according to similarities and relations between them. In the model non-price criteria are grouped at 9 main headings as *Contractor's Organization, Past Performance, Past Experience, Plant and Equipment, Personnel, Project Management, Quality Management, Health and Safety Management, Environmental Management.* Each main criteria has its own sub-criteria as shown in Table 1. Price criteria refers to the lowest cost in evaluation process. The model enables the user to designate the weighting of non-price and price criteria depending on the needs and wants of the clients and/or projects.

Table 1 Non-price evaluation criteria for contractor selection

Evaluation Criteria	Subcriteria	Explanation
Contractor's Organization	Age	Minimum period of trading under same company name (attained stability, reliability and accrued experience)
	Permenant Place of Business	Location of main office and proximity of contractor's home office to project site (accrued experience man-power accommodation, company's 'mobility' potential)
	Quality Control Certification	Availability of ISO 9000 certification (or equivalent) or intention to register
Past Performance	Past Quality Grade	By notices about past clients' levels of satisfaction with the quality of previous works by the contractor (Architectural-aesthetics-structural aspects; electrical-mechanical systems; geotechnical and foundation aspects; maintenance, reparation and technical assistance etc) in the past 5 years
	Maintenance Services During defects liability period	By notices about past clients' levels of satisfaction with the contractor's maintenance services during defects liability period in the past 5 years.
Past Experience	Experience in local area	Availability of previous constructed projects in the same region of the contractor (knowledge of the contractor about the region of the project geographically; and local governmental bodies (provincial, municipial, local, public institutions, universities, etc.) from local experiences in the area)
	Experience with construction of hospitals	Experience with construction of projects on hospital buildings
Plant and Equipment	Ownership of plant and equipment	The ratio of owned major plant and equipment to the whole of plant and equipment resources; Availability of owned major plants and equipments for construction
	Testing equipment	The testing equipment as quality assurance
Personnel	Qualifications of key personnel	Degree of education, experiences, capabilities and competencies, skills including professional and technical expertise, and special qualifications of key construction personnel
	Years of key personnel with the company	Years with company of contractor's key personnel
Project Management	Site supervision / management	Availability of written site work policy and rules, site organization and supervision charts
	Market information system	Availability of the system dealing with market information
Quality Management	QA/QC programs	Availability of an outline of quality assurance / quality control (QA/QC) programs
	Qualifications of QA/QC personnel	Evaluation of resumes and CVs of QA/QC personnel
Health and Safety Management	Safety measures on site	Availability of safety measures on site, health and safety information chart for employees
	Safety records	Availability of accident book and safety and health record, compilation of accident records by foremen and superintendents, records of safety performance/ accident rate in the past 3 years
Environmental Management	Environmental control policy	Availability of environmental policy, management system, environmental protection plan effectiveness of flora and fauna protection

The proposed model works at three steps: the first step lets the evaluation of contractors in accordance with factors other than price; the second is the evaluation of selected bid of contractors; and the third step points out the overall winner [33]. The model enables public clients to have unrestricted authority to select non-price evaluation criteria and the weighting of non-price and price criteria. Since the concern of this study is middle-sized and semi-complex projects, accepting the weighting of price criteria as 70 percent and non-price-criteria as 30 percent will be significant to evaluate the contractor. Once the weighting scores are determined, then the next will be the determination of the maximum score of each non-price evaluation criteria and sub-criteria. Maximum scores are assigned by public clients considering the importance of each main criteria. Then a score is assigned to each sub-criteria, knowing that the maximum score of its main criteria will not be exceeded.

In assessing the characteristics of each candidate contractor, client's point definition and their impact coefficient becomes important. As shown in Table 2, client's point definition refers to the current position of each candidate contractor regarding each criteria. Impact coefficient defines the grade of each client's point definition like '0'(unsatisfactory or very bad), '0.25'(poor or bad), '0.50'(satisfactory or average), '0.75'(good), and '1'(outstanding or very good). Impacts like availability of some criteria have been scored as '0'(none or unavailable) and '1'(available). Quality score of each candidate contractor is reached by multiplying the maximum score with the impact coefficient of client's point definition.

Table 2 Non-price criteria with maximum scores, point definitions and impact coefficients

Evaluation Criteria / *Subcriteria*	Maximum Score (a)	Client's Point Definition	Impact Coefficient (b)	Quality Score (axb)
Contractor's Organization	**6**			
Age	2	-0–2 years old -3–5 years old -6-8 years old -9-11 years old -> 12 years	0 0.25 0.50 0.75 1.00	-(2x0) -(2x0.25) -(2x0.50) -(2x0.75) -(2x1.00)
Permenant Place of Business	2	-> 200 kms -100-200 kms -50-100 kms -0-50 kms	0.25 0.50 0.75 1.00	-(2x0.25) -(2x0.50) -(2x0.75) -(2x1.00)
Quality Control Certification	2	-Unavailable -Available	0 1	-(2x0) -(2x1)
Past Performance	**4**			
Past Quality Grade	2	-<60 pts=unsatisfatory -61-70 pts=Poor -71-80 pts=Average -81-90 pts=Good -91-100 pts=Outstanding	0 0.25 0.50 0.75 1.00	-(2x0) -(2x0.25) -(2x0.50) -(2x0.75) -(2x1.00)
Maintenance Services During defects liability period	2	-<60 pts=unsatisfatory -61-70 pts=Poor -71-80 pts=Average -81-90 pts=Good -91-100 pts=Outstanding	0 0.25 0.50 0.75 1.00	-(2x0) -(2x0.25) -(2x0.50) -(2x0.75) -(2x1.00)
Past Experience	**4**			
Experience in local area	2	None Available	0 1	(2x0) (2x1.00)
Experience with construction of hospitals	2	None Available	0 1	(2x0) (2x1.00)
Plant and Equipment	**2**			
Ownership of plant and equipment	1	-<40%=very poor -41-60%=Poor -61-80%=Average -81-100%=Good -100%=Very good	0 0.25 0.50 0.75 1.00	-(2x0) -(2x0.25) -(2x0.50) -(2x0.75) -(2x1.00)
Testing equipment	1	None Available	0 1	(2x0) (2x1.00)
Personel	**3**			
Qualifications of key personnel	2	-<60 pts=unsatisfatory -61-70 pts=Poor -71-80 pts=Average -81-90 pts=Good -91-100 pts=Outstanding	0 0.25 0.50 0.75 1.00	-(2x0) -(2x0.25) -(2x0.50) -(2x0.75) -(2x1.00)
Years of key personnel with the company	1	-< 1 year=Very short -1-2 years=Short -3-4 years=satisfactory -5-6 years=Good -> 6 years=Outstanding	0 0.25 0.50 0.75 1.00	-(2x0) -(2x0.25) -(2x0.50) -(2x0.75) -(2x1.00)
Project Management	**2**			
Site supervision / management	1	-Unavailable -Available	0 1	-(2x0) -(2x1.00)
Market information system	1	-Unavailable -Available	0 1	-(2x0) -(2x1.00)
Quality Management	**4**			
QA/QC programs	2	-Unavailable -Available	0 1	-(2x0) -(2x1.00)

Qualifications of QA/QC personel	2	-<60 pts=unsatisfatory -61-70 pts=Poor -71-80 pts=Average -81-90 pts=Good -91-100 pts=Outstanding	0 0.25 0.50 0.75 1.00	-(2x0) -(2x0.25) -(2x0.50) -(2x0.75) -(2x1.00)
Health and Safety Management	**3**			
Safety measures on site	2	-Unavailable -Available	0 1	-(2x0) -(2x1.00)
Safety records	1	-Unavailable -Available	0 1	-(2x0) -(2x1.00)
Environmental Management	**2**			
Environmental control policy	2	-Unavailable -Available	0 1	-(2x0) -(2x1.00)

4.1 Application Of The Model To A Hospital Project

The contractor evaluation model can be of assistant throughout the contract awarding process to select the contractor. In order to show how public clients get benefits from the model a military hospital project with a construction work of a 100-bed is chosen because its size and characteristics are quite appropriate example of middle-size and semi-complex public projects. The client of the project is Ministry of National Defense, the total construction area is 9.254 square meters and total estimated construction cost is about 6.125.500 USD.

It is assumed that there are four candidate contractors, named as Contractor A, B, C, and D, offering tender for the Construction Work of Kocaeli 100-Bed Military Hospital Project. Moreover, it is supposed that candidate contractors submitted company quality information required by the client in the public notice in addition to their bids on price. Table 3 shows the company qualities of each candidate, in relation with the client's point definitions in Table 2. The quality score of candidate contractors is determined by multipliying maximum score with impact coefficient of the client's point definition. Summation of all quality scores will provide the total quality score for each candidate. Since the total maximum quality score is 30 over 100, the quality score percentage (c) of each contractor is obtained by [(a/b)*100)] as shown in Table 4.

Table 3 Company qualities of candidate contractors

Evaluation Criteria / *Subcriteria*	Maximum Score	A	B	C	D
Contractor's Organization	**6**				
Age	2	7 years old	4 years old	10 years old	13 years old
Permenant Place of Business	2	30 km.s	70 km.s	120 km.s	260 km.s
Quality Control Certification	2	Unavailable	Unavailable	Available	Available
Past Performance	**4**				
Past Quality Grade	2	Good	Good	Good	Average
Maintenance Services During defects liability period	2	Good	Outstanding	Outstanding	Good
Past Experience	**4**				
Experience in local area	2	Available	Available	Available	None
Experience with construction of hospitals	2	None	None	Available	Available
Plant and Equipment	**2**				
Ownership of plant and equipment	1	Good	Poor	Poor	Average
Testing equipment	1	Unavailable	Available	Available	Available
Personnel	**3**				
Qualifications of key personnel	2	Good	Average	Outstanding	Outstanding
Years of key personnel with the company	1	Good	Satisfactory	Satisfactory	Good
Project Management	**2**				
Site supervision/management	1	Available	Available	Available	Available
Market information system	1	Unavailable	Available	Available	Available
Quality Management	**4**				
QA/QC programs	2	Available	Available	Available	Available
Qualifications of QA/QC personnel	2	Average	Outstanding	Outstanding	Good
Health and Safety Management	**3**				
Safety measures on site	2	Average	Good	Outstanding	Good
Safety records	1	Available	Available	Available	Available
Environmental Management	**2**				
Environmental control policy	2	Unavailable	Available	Available	Available

Table 4 Quality score of candidate contractors

Evaluation Criteria / *Subcriteria*	**A**	**B**	**C**	**D**
Contractor's Organization				
Age	1.0	0.5	1.5	2.0
Permenant Place of Business	2.0	1.5	1.0	0.5
Quality Control Certification	-	-	2.0	2.0
Past Performance				
Past Quality Grade	1.5	1.5	1.5	1.0
Maintenance Services During defects liability period	1.5	2.0	2.0	1.5
Past Experience				
Experience in local area	2.0	2.0	2.0	-
Experience with construction of hospitals	2.0	-	2.0	2.0
Plant and Equipment				
Ownership of plant and equipment	0.75	0.25	0.25	0.5
Testing equipment	-	1.0	1.0	1.0
Personnel				
Qualifications of key personnel	1.5	1.0	2.0	2.0
Years of key personnel with the company	0.75	0.5	0.5	0.75
Project Management				
Site supervision/management	1.0	1.0	1.0	1.0
Market information system	-	1.0	1.0	1.0
Quality Management				
QA/QC programs	2.0	2.0	2.0	2.0
Qualifications of QA/QC personnel	1.0	2.0	2.0	1.5
Health and Safety Management				
Safety measures on site	1.0	1.5	2.0	1.5
Safety records	1.0	1.0	1.0	1.0
Environmental Management				
Environmental control policy	-	2.0	2.0	2.0
TOTAL SCORE (a)	**19.00**	**20.75**	**26.75**	**23.25**
TOTAL MAXIMUM SCORE (b)	**30**	**30**	**30**	**30**
QUALITY SCORE PERCENTAGE, % (c)	**63.33**	**69.17**	**89.17**	**77.50**

The overall scores of candidate contractors are shown in Table 5. In order to find the Adjusted Quality Score (QSa), the contractor with the highest quality score is accepted to have an adjusted quality score of 100 percent and other contractors' scores are adjusted comparatively. In this case, the contractor C has an adjusted quality score of 100 percent and the adjusted quality score of each candidate is estimated as [(QSx100)/89.17]. Then, the adjusted quality score expressed as 100 percent is converted to 30 percent in order to achieve the weighted quality score (QSw) of each contractor. Therefore, The weighted quality score of the contractor C is 30 percent and the others are found as (QSax30/100).

Table 5. Quality and price scores of candidate contractors

	Contractor A	**Contractor B**	**Contractor C**	**Contractor D**
Quality Score (QS), %	63,33	69,17	89,17	77,50
Adjusted Quality Score (QSa), %	71,02	77,57	100	86,91
Weighted Quality Score(QSw) (Qsa x 0.30), %	**21,31**	**23,27**	**30**	**26,07**
Bid Price (BP), USD	5.386.500	5.850.880	5.791.200	6.005.210
Adjusted Price Score (Psa), %	100	91,38	92,49	88,51%
Weighted Price Score (PSw) (PSa x 0.70), %	**70.00**	**63,97**	**64,74**	**61,96**
Total Score (QSw + PSw), %	**91,31**	**87,24**	**94,74**	**88,03**
QUALITY RANKING	4	3	1	2
PRICE RANKING	1	3	2	4
TOTAL SCORE RANKING	**2**	**4**	**1**	**3**

Bid price offer of each candidate contractor is also presented in Table 5. Construction Estimated Cost for the Construction Work of Kocaeli 100-Bed Military Hospital Project is estimated as 6.125.500 USD and the offers are lower than this cost. Therefore, four bids are accepted as valid according to the principles of PPL 4734 on public benefit.

In order to estimate the Adjusted Price Score (Psa), the contractor with the lowest tender price is accepted to have the adjusted quality score of 100 percent and other contractors' scores are adjusted

comparatively. The contractor A has an adjusted quality score of 100 percent and the others are estimated as [100-(((BP$_A$-BP$_{B,C,D}$) x 100)/5.386.500)]. Adjusted price scores expressed as 100 percent are converted to 70 percent to determine the weighted price score (PSw) of each contractor. The weighted price score of contractor A is 70 percent and the others are found as (PSa x 70/100).

Total score of each candidate is found by summing the weighted quality score with weighted price score. In ranking of quality scores, the contractor having the highest QSw value is assigned to 1 and then others ranked comparatively. Similarly, the company offering the lowest price is assigned to 1 and others ranked comparatively. Total Score Ranking provides the winner by assigning number 1 to the highest total score. The result of the contractor evaluation process shows that 'Contractor C' is better than the others in the comparison of quality ranking while 'Contractor A' is the best one in the price ranking. However, considering both non-price and price criteria, 'Contractor C' is the winner although his bid price is not the lowest one.

5. CONCLUSIONS

Contractor selection in public sector, has been a much-debated issue over the past ten years. Today, public clients are most often constrained to select the lowest bidder by public procurement laws on the grounds of financial accountability and competitiveness. On the other hand, it is indisputable that reliance on bid prices alone as the discriminating factor between bidders alone is quite risky and short-sighted, and may lead to the failure of the project in terms of poor contractor performance and prolonged construction duration. Therefore, choosing a competent construction contractor is one of the most important tasks faced by a public client, that usually has a significant impact on the success of a project and the achievement of best value for money.

A model is introduced to guide public clients in selecting right contractor for their projects. The model presented in this study is a feasible tool to improve the selection process. The model suggests that the evaluation attributes are selected by taking into consideration the objectives and interests of the public clients. The model is tested hypothetically assuming that four candidate contractors offer tender for a military hospital project. The result shows that the model can lead to reward experienced, capable and qualified candidate contractors; and to eliminate incompetent, inexperienced, or underfinanced contractors during the bidding process.

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