



ANALYSIS OF CRITERIA FOR CONTRACTORS' QUALIFICATION EVALUATION

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Abstract. Selecting a construction contractor is a major decision which may influence the progress and success of any construction project. The paper analyses criteria used to evaluate qualification of contractors in Lithuania and abroad. Both in Lithuania and abroad, the bid price of construction works is the main criterion for evaluation of contractors. The lowest price often cannot guarantee commitments on quality and duration of a construction project. Therefore, when selecting a contractor, a client must not only compare bid prices but also set other criteria for evaluation of qualification and determine their weight. A contractor must be selected according to both quantitative and qualitative criteria, and bids should be compared. Only on the basis of quantitative and qualitative evaluation criteria and by comparing bids of contractors it is possible to select a qualified, competent and reliable contractor, to evaluate its qualification, economic and financial condition and technical capability and skills and to achieve relevant results in a construction project. The paper provides an investigation of Lithuanian companies, which analyses issues related to evaluation of contractors' qualification. The paper is completed with a discussion of the investigation results and delivery of proposals based on expert estimations of the weight of criteria for evaluation of contractors.

Keywords: contractors' qualification, evaluation criteria, criteria weight, survey.

1. Introduction

Various stakeholders (clients, contractors, technical supervisors of construction, etc) are involved in the construction process. A construction project is developed considering the goals and requirements of a client and the potential of a contractor and suppliers. In a construction project, the selection of an appropriate contractor is the most critical for project success. Quite often construction projects behind schedule, price changes and inappropriate quality are a direct outcome of the selection of an inadequate contractor.

In Lithuania selection of a qualified contractor is clearly regulated only in the public sector. Construction tenders are regulated only when works are performed under public procurement or construction projects are funded by international programmes (e.g. PHARE, ISPA, SAPARD, etc). However, these laws are only guidelines for the private sector and a client may devise his own evaluation criteria and form his own bid priority list when selecting a contractor. When selecting a contractor, a client evaluates its qualification (checks whether it meets specified legal, fi-

nancial, economic and technical requirements) and compares qualification of different contractors.

There are three prime causes of inadequate contractor selection. Firstly, inappropriate criteria are selected when evaluating qualification of a contractor. Secondly, inappropriate significance is attributed to the criteria (e.g. to bid price). Thirdly, inappropriate methodology is applied for the contractor evaluation and selection task. This paper is focused on the contractor evaluation/selection criteria. It describes an investigation of Lithuanian construction companies on the criteria for evaluation of contractors' qualification and the importance of criteria weight.

The paper is organized as follows: Section 2 provides a review of some relevant literature on contractor selection. This literature is utilized to review contractor evaluation methodology and criteria, contractor selection models, and to identify appropriate investigation issues. Section 3 introduces a qualitative study that was conducted to address the research issues. Section 3 is composed of the investigation objectives and tasks, and the questionnaire survey data analysis. Furthermore, the results of the conducted survey

and summary discussions are presented in Section 4. Section 5 provides conclusions and recommendations.

2. Review of literature

Selecting a construction contractor is one of major decisions which may influence the progress and success of any construction project. Contractor prequalification is a commonly used process for identifying a qualified, sound and reliable construction contractor. A general prequalification exercise is performed to identify an appropriate i.e. the best, contractor from the applicants and to evaluate and score them according to their economic and technical aspects, quality standards, past performance and other characteristics.

Various procedures, such as open tendering, restricted tendering or negotiation, are practised for contractor selection. A contractor is selected either from all the bidders or the contractor selection process can be divided into two phases: prequalification and final selection. Contractor prequalification involves a screening procedure based on a set of criteria set forth by each individual owner [1]. As pointed out by Palaneeaswaran [2] contractor prequalification is generally preferred by clients to minimize risks and failures and to enhance the performance levels of selected contractors by means of established minimal capacities below which contractors will not be considered.

F. Ling [3] examined bidding practices in Australia, Canada, Saudi Arabia, Singapore, the UK and the USA. In the case of a governmental project, contractor selection by means of a bidding mechanism is required by law. However, G. Ang et al [4] state that traditional forms of procurement and tendering, supported by prescriptive, solution-based specifications, and the lowest price only, are suitable for routine projects but will hamper innovation in other types of projects. Selection of the lowest bidding contractor is one of the major causes of the poor performance of a construction project.

The contractor's qualification (i.e. financial strength, past experience, business plan, work capacity, quality and experience of the technical personnel, etc), and project characteristics (i.e. work schedule, type, value, duration, complexity, location of a project, contract type and variation between the contractor's bid price and the next lowest bidder's price etc) are the fundamental factors that affect contractor default [5]. Time-delays and cost-increases of construction projects are closely related to specifications on the qualifications of contractors (financial, technical, experience, etc) [6]. In construction projects, quality performance of constructors is considered as vital for client satisfaction [7]. The selection of a construction contractor is a decision characterized by multiple objectives [8]. Selection of the most suitable procurement route and tendering requires a broad analysis of the project characteristics

and specific requirements of the client, i.e. his/her ambitions and risks. Clients' goals and objectives are concerned with the aforementioned project aspects (i.e. cost, time and quality). Based on these main aspects, a list of criteria can be generated. Numerous researchers, such as J. Russell et al [1], S. Ng and R. Skitmore [9], C. Wong et al [10, 11], K. Molenaar and D. Johnson [12], Y. Topcu [13], and E. Zavadskas et al [14] have identified common criteria for prequalification and bid evaluation. G. Holt and D. Edwards [15] provide qualitative analysis that identifies criteria to be considered when evaluating and selecting a domestic builder.

Contractor multi-criteria evaluation has received a sufficient attention of research professionals. Y. Topcu [13], K. Al-Harbi [16], P. Fong et al [17] solve the problem of prequalification and final contractor selection by applying the analytical hierarchy process (AHP) that allows the consideration of multiple criteria. As pointed out by K. Al-Harbi [16] AHP allows group decision-making where group members can use their experience, values and knowledge to break down the contractor prequalification problem into a hierarchy and solve it by the AHP steps. The contractor selection model introduced P. Fong et al [17] helps 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. A. Andruškevičius [18] used the method of multi-criteria complex proportional assessment (COPRAS) for contractor evaluation. N. Kvederytė et al [19] study contractor selection as a constituent of a building life cycle. Z. Hatush and M. Skitmore [8] proposed a multi-criteria decision analysis technique for contractor selection and bid evaluation based on the utility theory. J. Minchin et al [20] proposed an innovative model, called the Quality-Based Performance Rating (QBPR) system, for contractor selection. K. Lam et al [21] proposed a fuzzy neural network (FNN) model, based on the fuzzy set and neural network theories, for contractor prequalification and selection.

A. Paul and G. Gutierrez [22] studied project contracting from the perspective of bidding price. They used a stochastic model to compare the expected price fetched by some commonly used contract forms. R. Kandanala et al [23] proposed a conceptual model of automation of pre-bidding process in order to increase bid-process efficiency and to minimize possible human errors and the risks associated with this process. L. Shen et al [24] developed a computer-aided decision support system for assessing a contractor's competitiveness. Measures of competitiveness are employed to describe a contractor's strengths and weaknesses, thus assisting clients in identifying proper contractors at the pre-qualification stage. H. Tserng and P. Lin [25] prescribe an accelerated subcontracting and procuring model for construction projects. The proposed model uses IT to

speed up the construction project subcontracting process, helps to improve the obvious limitations of traditional processes of selecting subcontractors, including the overly limited time for selection, high levels of uncertainty, and difficulties in judging quality.

The review of literature revealed the existence of various criteria, methods and IT use for contractor prequalification and bid evaluation.

3. Survey of opinion

3.1. Investigation objectives

The investigation had two main objectives:

1. to investigate the contractor selection/evaluation criteria;
2. to evaluate the importance of these evaluation criteria.

The defined objectives were achieved through the accomplishment of the following tasks:

- a thorough review of literature about the key issues involving contractor selection;
- collection of data using a structured questionnaire in conducting the survey;
- analysis of questionnaires for examining the findings;
- generation of conclusions and recommendations for contractor evaluation methodology and criteria.

3.2. Data analysis

The data used for analysis of contractor evaluation criteria were obtained from the questionnaire survey. Three main categories of questions were included in the questionnaire: (1) about a company – its activity, size (number of employees) and quantity of contracts; (2) current contractor/subcontractor selection practices – contractor selection procedure, attitude towards evaluation, and evaluation criteria; (3) attitude towards the weight of contractor evaluation criteria. The criteria listed in the third section were

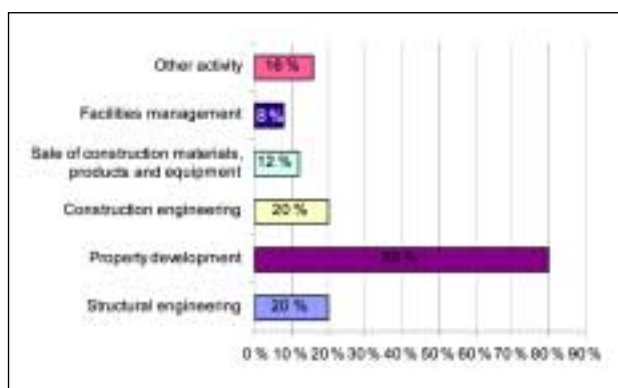


Fig 1. Activity of sampled enterprises

identified after a comprehensive literature review, and law requirements and real tender material analysis. Likert scaling was used for ranking questions. The respondents were asked to check a number on five-point scale (1 – the least important to 5 – the most important), which reflects their assessment regarding the evaluation criteria to be important for contractor qualifying. Data from the questionnaires were extracted to derive the weight of the criteria included.

A list of all the organizations within the construction sector was obtained from the relevant directory, i.e. the Lithuanian architecture and building directory (www.eniro.lt). The choice of a sample was made on the basis of representativeness. The study sample was drawn from property development and construction companies that have to qualify a contractor/subcontractor for construction works. The list consisted of 55 organizations. During the survey all the organizations were contacted, and 10 of them dropped out. Companies' personnel related to organization of tenders or selection of a contractor were asked to fill a questionnaire. Initially an attempt was made to contact an executive of a company (managers of various levels and technical personnel) and to recommend someone who has relevant knowledge and experience to answer the questionnaire. Only then the person was provided with the questionnaire directly or via e-mail.

45 questionnaires were distributed, and 25 (55.6 %) completed questionnaires were received. About 60 % of questionnaires were electronically delivered to the respondents by e-mail, and 40 % – directly to the respondents. Of the total number of respondents, 23 (92 %) were private contractor organizations, and 2 (8 %) of them were public companies. The surveyed data were analysed and results compared. A detailed discussion of these findings is presented below.

4. Results and discussion

The survey respondents were classified into micro, small, medium-sized and large organizations. In 25 organizations, 4 % employed fewer than 10 employees, 20 % employed fewer than 50 employees and 60 % employed fewer than 250 employees, and their annual turnover did not exceed 50 million EURO. Thus, most of the sample was comprised of large and medium-sized organizations. As shown in Fig 1, most of the respondents (80 %) develop property and follow structural engineering and construction engineering (accordingly, 20 % and 20 %).

The results displayed in Fig 2 indicate that 80 % of the responding companies construct single family houses, multiple housing units and other residential buildings, 72 % of the respondents construct public buildings (commercial, educational, health, etc), and 64 % construct industrial buildings.

After describing the size and activity of a company, respondents were asked what tendering procedure they used for contractor selection. Regarding the procedure, 72 % of the respondents have survey of prices, 56 % of the respondents carry out the negotiations, and 40 % of the respondents use restricted tendering. However, only 16 % of the respondents use two-stage selection, i.e. prequalification and final selection. There was a clear preference for using a survey of prices against a common one-stage or two-stage tendering procedure, which in turn is reflected in a large number of private contractor organizations (92 %) what does not need to meet the law requirements. The results are displayed in Fig 3.

Fig 4 illustrates the bidding goals of the responding companies. 72 % of the respondents reported that they use bidding to assure selection of an appropriate contractor. 32 % of the respondents reported using a ‘standard procedure’. This option was chosen by large contractor organizations, and their number could be explained by the number of companies certified according to ISO 9001 standard. Interestingly, private contractors discount the public opinion, and, consequently, they did not choose ‘social responsibilities’ option.

After analyzing the bidding goals, the respondents were asked how they determined selection criteria. Attitude towards contractors’ selection criteria is presented in Fig 5. There was a clear preference to determination of selection criteria depending on the project size, type and complexity, i.e. 70 % of the respondents determine selection criteria depending on the fact that only 8 % follow the regulation of department, and 12 % consider the client’s requirements. It follows that the contractors have a wider knowledge and experience for subcontractor selection than clients, and they do not make demands on related activity.

An official contractor evaluation methodology [26] is based on the bid utility and the lowest bid. However, the current practice of contractor qualification evaluation in Lithuania can be regarded as the lowest bid approach. Therefore, the respondents were asked to evaluate how important the bid price and other three types of contractor evaluation criteria, i.e. ‘legal requirements’, ‘financial criteria’ and ‘technical and management criteria’, were for them. The respondents assigned 4.93 points to ‘bid price’, 3.60 points – to ‘legal requirements’, 3.60 points – to ‘financial criteria’ and 4.63 points – to ‘technical and management criteria’.

The respondents were asked to evaluate how important for them separate contractor selection criteria were. Fig 6 shows rating of importance of the legal requirements of construction contractors. The respondents considered ‘claims and contractual dispute’ (4.66), ‘legal activity’ (4.53), and ‘failed contracts’ (4.47) as important criteria. Fig 7 shows rating of importance of the financial criteria of

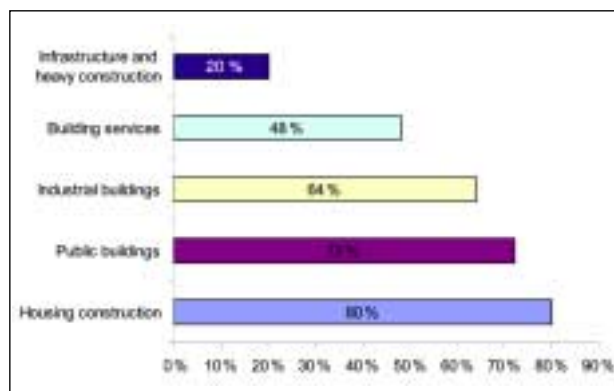


Fig 2. Construction category of sampled enterprises

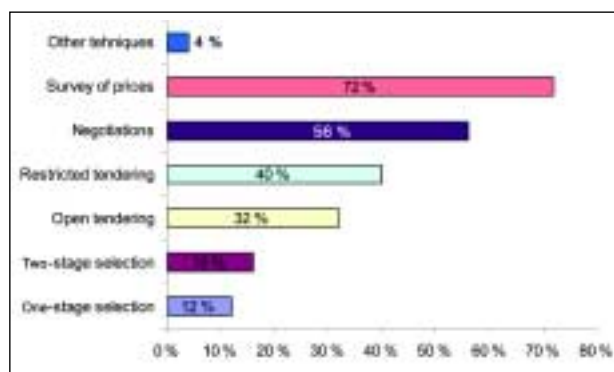


Fig 3. Procedure for contractor selection used by sampled enterprises

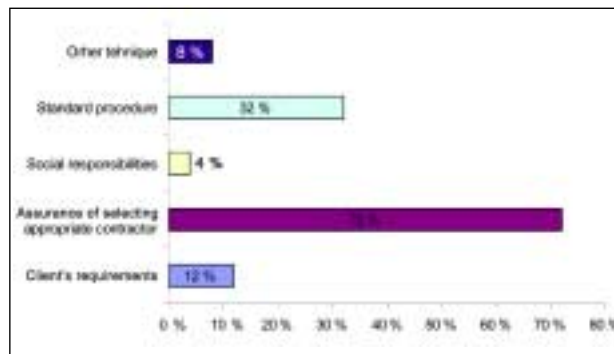


Fig 4. Bidding goals of sampled enterprises

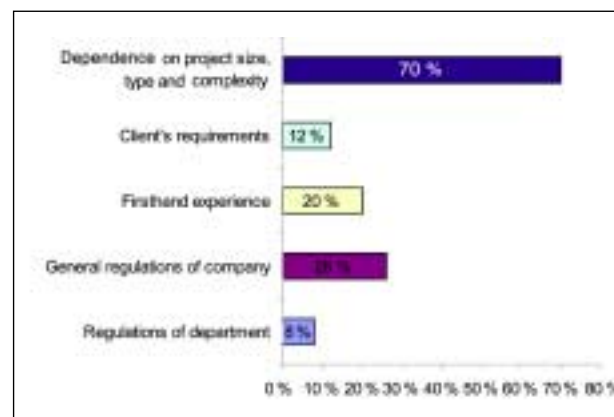


Fig 5. Attitude towards selection criteria of sampled enterprises

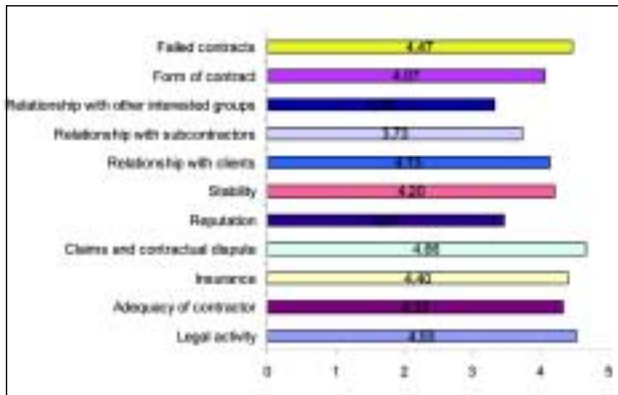


Fig 6. Ranking of legal requirements

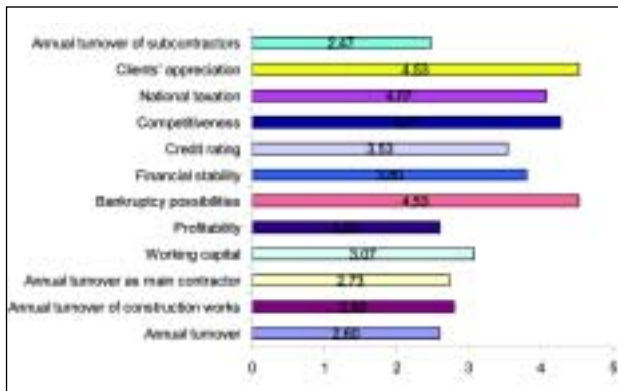


Fig 7. Ranking of financial criteria

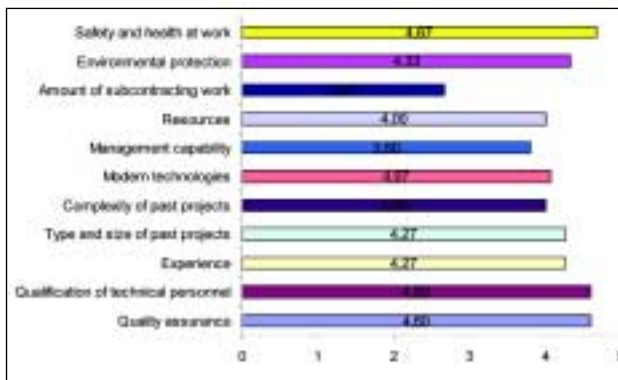


Fig 8. Ranking of technical and management criteria

Table 1. Weight of contractor evaluation criteria

Criteria	Weight
Bid price	0.073
Legal activity	0.067
Adequacy of contractor	0.064
Insurance	0.065
Claims and contractual dispute	0.069
Failed contracts	0.066
Bankruptcy possibilities	0.067
Competitiveness	0.063
Clients' appreciation	0.067
Quality assurance	0.068
Qualification of technical personnel	0.068
Experience	0.063
Type and size of past projects	0.063
Environmental protection	0.064
Safety and health at work	0.069

construction contractors. The respondents considered 'bankruptcy possibilities' (4.53), 'client's appreciation' (4.53), and 'competitiveness' (4.27) as important criteria. Fig 8 provides details about ranking of technical and management criteria. The respondents considered 'safety and health at work' (4.67), 'qualification of technical personnel' (4.60), and 'quality assurance' (4.60) as important criteria.

In order to calculate the relative weight of evaluation criteria, a list of criteria, which are the most important for respondents, was determined. Agreement of the respondents' opinion on these criteria was satisfactory (the concordance coefficient $w = 0.059$; the significance of concordance coefficient $\chi^2 = 23.2 > \chi^2_{t} = 21.1$ [27] ($p = 0.1$)). The results of determination of the weight of contractor evaluation criteria are shown in Table 1.

5. Conclusions and recommendations

The aim of this paper is to review the criteria employed in selection of qualified contractors and evaluation of bids in Lithuania and abroad, to compare the criteria and to provide offers on how to improve the system of criteria for selection of a contractor, which would enable selection of a qualified construction contractor, to evaluate its suitability not only according to the bid price but also according to other quantitative and qualitative criteria.

The following are the conclusions and recommendations that were derived from combined results of literature, tender material and the survey:

- In order to achieve the aims of a construction project, qualified contractors must be selected for execution of construction works. Thus, their qualification must be evaluated by determining and defining appropriate evaluation criteria.
- Evaluation criteria for bids of contractors must be selected considering the size and complexity of a construction project.
- Multi-criteria evaluation methods may be used in evaluation of contractor bids, and the weight of criteria is determined considering the priorities of a client (the lowest price, the shortest implementation period, experience in similar projects, etc).
- Currently, bid price is the most important criterion in the selection of a contractor both in Lithuania and abroad. Although tender conditions list many other evaluation criteria, clients tend to select a contractor with the lowest bid price. Contractors should not be selected according to the lowest price, but it should be attributed to the highest weight.
- There should be two stages in the process of evaluation of contractors: (1) determination of qualification of contractors, i.e. whether a contractor meets minimum requirements of project implementation, and (2) evaluation of selected bids of contractors.

References

1. Russell, J. S.; Hancher, D. E.; Skibniewski, M. J. Contractor prequalification data for construction owners. *Construction Management & Economics*, Vol 10, Issue 2, 1992, p. 117–135.
2. Palaneeswaran, E.; Kumaraswamy, M. Recent advances and proposed improvements in contractor prequalification methodologies. *Building and Environment*, Vol 36, Issue 1, 2001, p. 73–87.
3. Ling, F. Y. Y. Global factors affecting margin-size of construction projects. *Journal of Construction Research*, Vol 6, No 1, 2005, p. 91–106.
4. Ang, G.; Groosman, M.; Scholten, N. P. M. Dutch performance-based approach to building regulations and public procurement. *Business Research & Information*, Vol 33, Issue 2, 2005, p. 107–119.
5. Al-Sobiei, O. S.; Arditi, D.; Polat, G. Predicting the risk of contractor default in Saudi Arabia utilizing artificial neural network (ANN) and genetic algorithm (GA) techniques. *Construction Management and Economics*, Vol 23, Issue 4, 2005, p. 423–430.
6. Koushki, P. A.; Al-Rashid, K.; Kartam, N. Delays and cost increases in the construction of private residential projects in Kuwait. *Construction Management and Economics*, Vol 23, Issue 3, 2005, p. 285–294.
7. Palaneeswaran, E.; Ng, T.; Kumaraswamy, M. Client satisfaction and quality management systems in contractor organizations. *Building and Environment*, Vol 41, Issue 11, 2006, p. 1557–1570.
8. Hatush, Z.; Skitmore, M. Contractor selection using multicriteria utility theory: An additive model. *Building and Environment*, Vol 33, Issues 2–3, 1998, p. 105–115.
9. Ng, S. T.; Skitmore, R. M. Client and consultant perspectives of prequalification criteria. *Building and Environment*, Vol 34, Issue 5, 1999, p. 607–621.
10. Wong, C. H.; Holt, G. D.; Harris, P. Multi-criteria selection or lowest price? Investigation of UK construction clients' tender evaluation preferences. *Engineering Construction & Architectural Management*, Vol 8, Issue 4, 2001, p. 257–271.
11. Wong, C. H.; Holt, G. D.; Cooper, P. A. Lowest price or value? Investigation of UK construction clients' tender selection process. *Construction Management & Economics*, Vol 18, Issue 7, 2000, p. 767–774.
12. Molenaar, K. R.; Johnson, D. E. Engineering the procurement phase to achieve the best value. *Leadership & Management in Engineering*, Vol 3, Issue 3, 2003, p. 137–141.
13. Topcu, Y. I. A decision model proposal for construction contractor selection in Turkey. *Building and Environment*, Vol 39, Issue 4, 2004, p. 469–481.
14. Zavadskas, E. K.; Kaklauskas, A.; Banaitiene, N. Multi-criteria analysis of a building life cycle. Vilnius: Technika, 2001. 380 p. (in Lithuanian).
15. Holt, G. D.; Edwards, D. J. Domestic builder selection in the UK housing repair and maintenance sector: a critique. *Journal of Construction Research*, Vol 6, No 1, 2005, p. 123–137.
16. Al-Harbi, K. M. A.-S. Application of the AHP in project management. *International Journal of Project Management*, Vol 19, Issue 1, 2001, p. 19–27.
17. Fong, P. S. W.; Choi, S. K.-Y. Final contractor selection using the analytical hierarchy process. *Construction Management & Economics*, Vol 18, Issue 5, 2000, p. 547–557.
18. Andruškevičius, A. Evaluation of contractors by using COPRAS – the multiple criteria method. *Technological and Economic Development of Economy*, Vol 11, No 3, 2005, p. 158–169 (in Lithuanian).
19. Kvederyte, N.; Zavadskas, E. K.; Kaklauskas, A. Multi-criteria analysis of a dwelling life cycle. *Statyba (Civil Engineering)*, Vol 6, No 3, 2000, p. 179–192 (in Lithuanian).
20. Minchin, Jr. R. E.; Smith, G. R. Quality-based contractor rating model for qualification and bidding purposes. *Journal of Management in Engineering*, Vol 21, Issue 1, 2005, p. 38–43.
21. Lam, K. C.; Hu, T.; Ng, S. T.; Skitmore, M.; Cheung, S. O. A fuzzy neural network approach for contractor prequalification. *Construction Management & Economics*, Vol 19, Issue 2, 2001, p. 175–188.
22. Paul, A.; Gutierrez, G. Simple probability models for project contracting. *European Journal of Operational Research*, Vol 165, Issue 2, 2005, p. 329–338.
23. Kandanala, R.; Al-Hussein, M.; Vanderstar, A. Automation of pre-bidding process for construction projects. *Cost Engineering*, Vol 47, Issue 6, 2005, p. 30–34.
24. Shen, L. Y.; Lu, W.; Shen, Q.; Li, H. A computer-aided decision support system for assessing a contractor's competitiveness. *Automation in Construction*, Vol 12, Issue 5, 2003, p. 577–587.
25. Tserng, H. P.; Lin, P. H. An accelerated subcontracting and procuring model for construction projects. *Automation in Construction*, Vol 11, Issue 1, 2002, p. 105–125.
26. Public Procurement Office under the Government of the Republic of Lithuania. <http://www.vpt.lt/>
27. Oakshott, L. Essential quantitative methods for business, management and finance. Macmillan Business, 1998.

RANGOVŲ KVALIFIKACIJOS VERTINIMO KRITERIJŲ ANALIZĖ**N. Banaitienė, A. Banaitis****Santrauka**

Rangovo parinkimas yra labai svarbus veiksnys, turintis įtakos statybos projekto eigai ir sėkmei. Analizuojami Lietuvoje ir užsienio šalyse rangovų kvalifikacijai vertinti taikomi kriterijai. Ir Lietuvoje, ir užsienio šalyse svarbiausias rangovų atrankos kriterijus yra siūloma statybos darbų kaina. Dažnai mažiausia kaina neužtikrina išsipareigojimų dėl statybos projekto kokybės ir trukmės vykdymo. Todėl užsakovas, rinkdamasis rangovą, turi lyginti ne tik pasiūlymų kainas, bet nusistatyti ir įvertinti kitus kvalifikacijos vertinimo kriterijus, atsižvelgti į jų svarbą. Tik remiantis kiekybiniais ir kokybiniais vertinimo kriterijais ir lyginant rangovų pasiūlymus tarpusavyje, galima pasirinkti kvalifikuotą, kompetentingą ir patikimą rangovą, įvertinti jo ekonominę ir finansinę būklę, techninį pajėgumą ir gebėjimus, kvalifikaciją, pasiekti gerų statybos projekto rezultatų. Straipsnyje pateikiamas Lietuvos įmonių tyrimas, kuriame nagrinėjami rangovų kvalifikacijos vertinimo klausimai, pabaigoje aptariami tyrimo rezultatai bei, remiantis ekspertiniais vertinimais, pateikiami pasiūlymai dėl rangovų vertinimo kriterijų svarbos.

Reikšminiai žodžiai: rangovo kvalifikacija, vertinimo kriterijai, kriterijų svarba, tyrimas.

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