

CONSTRUCTION PROCUREMENT IN THE AREA OF ELECTRONIC REVERSE AUCTIONS

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Abstract

The aim of this paper is to explore how tenders for public works contracts differ from other public tenders in the area of Czech electronic reverse auctions. Data on real electronic reverse auctions were analysed in order to examine selected basic auction inputs and outputs (number of bidders, amount of realized relative savings, and method of evaluation used). Histogram and chi-square test of independence were used in order to evaluate the dataset. The findings show that the level of competition and amount of realized relative savings in ERA among construction tenders and other tenders are similar, while the chi-square test of independence revealed an association between the type of the tender and the evaluation method used in auction. Possible future research directions are outlined at the end of the paper.

Key words

electronic reverse auction; construction; procurement; public tenders

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1 INTRODUCTION

This paper examines the area of electronic reverse auctions (ERA). ERA have become a popular tool to select suppliers and award contracts. ERA are associated with various benefits such as financial savings [1], time savings [2], enhanced transparency [3] (especially in public procurement) and they provide a clear and disciplined purchasing process [4]. However, the adoption and application of ERA is also related to various barriers. For example, ERA can harm the buyer-supplier relationships [5], they can suffer from an unwillingness of suppliers to participate [3], and ERA are also criticized for a possible decrease in the quality of the delivered product as a result [6].

As the construction sector is a specific one, some authors have already investigated the application of ERA in construction tenders. Apart from the above-mentioned study of Tassabehji et al. [6], more recent studies have been published, especially by Wamurizi [7], Ozorhon, Arditi [8], and Ballesteros-Pérez et al., e.g. [9], [10], and [11].

The aim of this paper is to evaluate selected ERA parameters and compare them among construction tenders and other types of tenders. More specifically, the research investigated whether there were differences in construction public procurement in 1) the level of competition measured in terms of the number of bidders participating in the auction, 2) the evaluation method used in the auction and 3) the amount of realized relative savings achieved in the auction. In particular, the research hypothesis examines the relation between the evaluation method used in auctions and the type of the tender. The null hypothesis assumes that the categorical variables “type of tender” and “evaluation method of tender” are independent.

Such a comparison should provide an additional perspective on the problem that ERA has a bad reputation for use in construction tenders. Previous studies [12] conducted among Czech construction companies on the supplier side have revealed that 80% of them prefer the traditional way of making tenders. They concluded that construction companies in the position of the supplier perceive the reverse auctions rather negatively even if they bring a more lucid tender process and greater transparency.

2 METHODOLOGY

In order to achieve the research goal, quantitative data on real electronic reverse auctions were collected and processed. The data set was acquired from one of leading providers of ERA systems in the Czech Republic. All data records of completed ERA derive from Czech public procurement. It was required that the ERA data include the name of the tender, number of bidders, value of the best bid price before ERA, value of winning bid price after ERA, and method of tender evaluation.

According to the name of the tender, individual ERA records were categorised as Construction Tender or Other Tender. The number of bidders was analysed, as this shows the level of competition in the ERA. Furthermore, data on the value of the best bid price before ERA (BPB) and the value of winning bid price after ERA (BPA) were used to calculate the relative amount of savings (RAS) achieved in ERA. More specifically, the following equation was applied:

$$RAS = 1 - (1/BPB * BPA) \quad (1)$$

Finally, the information about the method of tender evaluation has a two-category dimension, as all tenders were classified as evaluated by the lowest bid price criterion or by a multicriteria evaluation. Unfortunately, the data set does not contain detailed information on particular criteria within the multicriteria evaluation, and consequently the evaluation made in this paper is limited to only the lowest bid price criterion vs. multicriteria evaluation.

All ERA records that were missing one or more parameters were removed from the sample. In the next step, boxplot analysis was applied in order to remove all outliers.

Data were processed in Minitab statistical software by using a histogram (evaluation of competition level and amount of RAS) and chi-square test of independence (evaluation methods used in ERA).

3 RESULTS AND DISCUSSION

3.1 Basic statistics of the research sample

In total, 781 records were collected for the purpose of this research. After the elimination of incomplete ERA records and outliers, a final data set of 474 records was processed and analysed. In terms of the ERA subject type, 256 belonged to construction tenders and 218 to other tenders covering all other types of tenders which were not of a construction nature. Basic information on the research sample is given in Table 1. A sufficiently uniform distribution of tenders among categories creates suitable conditions for the evaluation of relevant data.

Table 1: Basic information on the research sample

	Construction tenders	Other tenders	Total
Number	256	218	474
Frequency	54.0%	46.0%	100%

3.2 Evaluation of competition level

The comparison of the competition level between construction (BIDS CA) and other tenders (BIDS OA) was processed by using a histogram (Figure 1) and is based on the number of submitted bids in individual tenders.

The histogram shows that the distribution of the data is similar, but for a smaller number of bids (1 and 2) it can be observed that the proportion is slightly higher among “other tenders”. It can therefore be argued that construction tenders have better prerequisites for ensuring a basic level of competition in ERA. The academic literature recommends the participation of at least 4 bidders in an ERA [13]; from this perspective both construction and other tenders can be evaluated as almost equal.

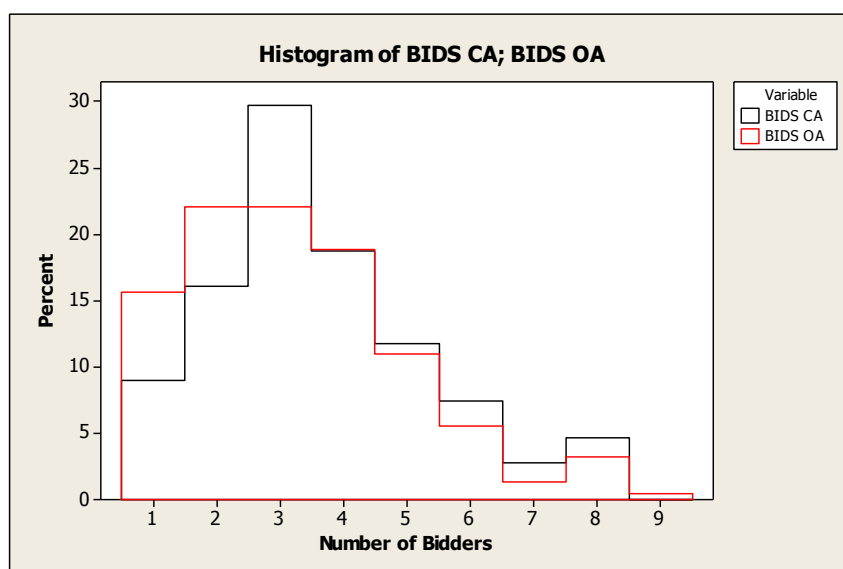


Figure 1: Histogram of number of bidders according to the subject type of ERA

3.3 Evaluation method used in ERA

The data on the preferred method of bid evaluation are displayed in Table 2.

Table 2: Evaluation method used in ERA

Evaluation method	Construction tenders	Other tenders	Total
Lowest bid price	243	182	425
Multicriteria	13	36	49

An analysis was carried out to determine if the relationship between the two categorical variables is statistically significant. This analysis was done through a chi-square test of independence. In this relation, the null hypothesis assumes that the categorical variables “type of tender” and “evaluation method of tender” are independent.

Pearson Chi-Square value of 16.612 with DF (Degree Of Freedom) equals 1 and the p-value is 0.000. Given that the acquired p-value of 0.000 is less than the alpha of 0.05 (level of importance), the null hypothesis that the type of the tender and the evaluation method of the tender are independent is rejected. It is therefore concluded that there is an association between the two variables examined. Contrary to other tenders, construction tenders are more often evaluated on the basis of the lowest bid price criterion. It can be stated that in public construction procurement, multicriteria evaluation is rarely used. This finding is consistent with the results presented in [14]. This result can be attributed to the fact that use of multicriteria evaluation is more risky in terms of ensuring transparency of the tender (appropriate selection of criteria weights and how they are chosen requires proper justification), and as a result public authorities prefer an easier way (single criterion evaluation in terms of the lowest bid price).

3.4 Amount of Realized Savings in ERA

Finally, it was analysed whether the amount or relative savings (RAS) achieved through ERA differs among construction and other tenders. The results are shown in Figure 2.

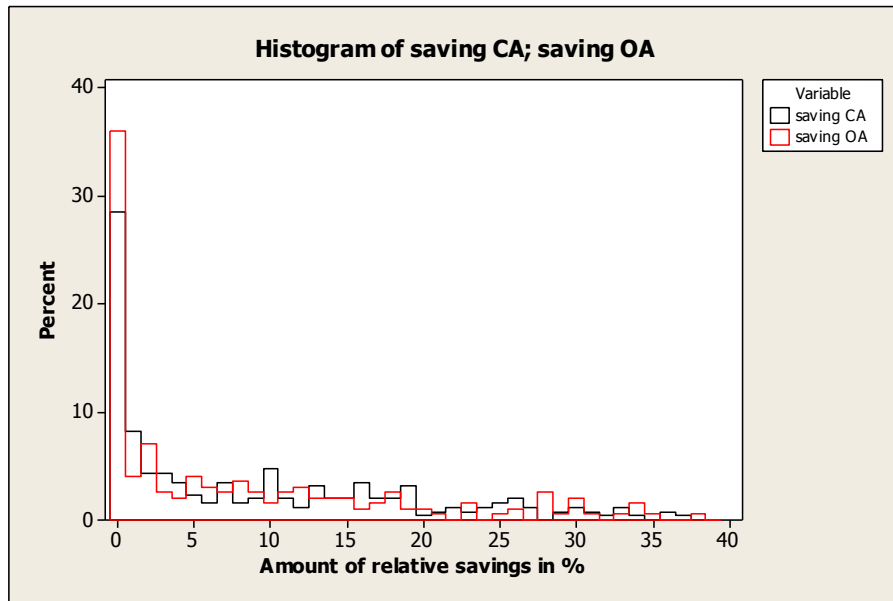


Figure 2: Histogram of RAS according to the subject type of ERA

From the figure, it can clearly be seen that a large number of ERA result in a very low RAS value (close to 0%). More specifically, this applies to 28.5% of construction tenders (saving CA) and 36.0% of other tenders (saving OA). A more detailed analysis shows that many tenders with a RAS close to 0% were realized with just 1 or 2 participating bidders, indicating that in these particular ERAs there was not sufficient competition, as the value of the best bid price before ERA and the value of the winning bid price after ERA are the same or almost equal. It was therefore revealed that insufficient competition in ERA reduces the ERA effect in terms of the financial savings achieved.

Generally, there is not a large difference in the distribution of RAS among construction and other tenders. However, as the value of construction tenders is usually higher than that of other products/services purchased, it could be postulated that construction tenders have a higher effect in terms of absolute financial savings, contrary to other tenders. However, this issue deserves further, more detailed analysis.

4 CONCLUSION

In this paper, it was revealed that the level of competition and amount or realized relative savings in ERA among construction tenders and other tenders are similar. However, in the case of an insufficient number of bidders (1 to 2) in ERA, other tenders suffer more from low competition than construction tenders. This issue should be investigated in more detail, and it is therefore one of possible future research directions in the area of ERA.

It has also been observed that there is a difference between construction and other tenders in terms of the valuation methods used. Construction tenders are more often evaluated purely on the basis of the lowest bid price criterion. However, even for other tenders, the proportion of multicriteria application in ERA is low. In light of this, it may prove interesting to identify the set of particular criteria used. Unfortunately, data about the individual criteria were missing from the dataset.

This research is not without limitations. It must be noted that the “other tenders” category is very comprehensive, as it covers vastly different types of purchases (e.g. materials, machines, vehicles, or services) in many areas (medicine, administration, etc.). If future research distinguishes more categories, the results obtained should provide a more detailed view on this topic.

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