

# MULTICRITERIA APPROACH TO PUBLIC PROCUREMENT FOR TECHNICAL SECTOR IN SERBIAN PUBLIC COMPANIES

Milutin ŽIVKOVIĆ<sup>1</sup>, Milutin M. MILOSAVLJEVIĆ<sup>2</sup>, Mališa ŽIŽOVIĆ<sup>3</sup>

<sup>1</sup>High Technical Mechanical School Trstenik, Serbia, milutinživkovics@gmail.com

<sup>2</sup>University of Priština, Kosovska Mitrovica, Serbia

<sup>3</sup>University Singidunum, Belgrade, Faculty of business, Valjevo, Serbia

*Summary:* The paper presents a brief analysis of the Law on public procurement and its application in the technical sector in Serbian public companies. A practical example has been used to show that the selection of offers through the criterion of the minimal price, which is usually applied, is not always the optimal one. The multicriteria analysis and making decisions based on it are provided in the paper as an alternative to the above mentioned way of selection.

**Keywords:** public procurement, contracting authority, criteria, multi-criteria optimization, best offer, bidder

## 1. Introduction

Not so long ago in the time of socialism in Republic of Serbia, as in all other socialistic economies, there wasn't a problem of public procurements because that area was in the jurisdiction and control of the political group. By changing the ownership structure most of companies have a need to choose the supplier and contractor for various procurements. This is especially important in cases where the contracting authority are mostly public companies. In order to regulate this area and to prevent easily possible abuse in Serbia, as well as in many former socialist countries Act was adopted on Public Procurement. An attempt to regulate this area at transparent manner taking into account all stakeholders in the process. The paper will list its basic characteristics as the basic principles and all phases of the selection [1, 2]. Numerous examples and experiences of recipients and suppliers of services/goods show that the best tender and is not always the most appropriate solution. In fact, almost always for the grantor requires the procurement of goods/services often and collect money. As a good example may be the tender for the maintenance of the US Embassy in Belgrade. In fact, they selected the lowest bid at the current PPL but it turned out that the various annexes of the contract, these costs were twice as high, which is publicly confirmed by US Ambassador Kirby. In the case of Parking service Belgrade (tender for repairs and maintenance services for certain parts of the vehicle "spiders") will show how to define the conditions and what is the way of selection of the best bidder.

## 2. Law of public procurement

Law of public procurement from 2008 defines the conditions, procedure and manner of what is the contracting authority, subject of procurement (goods or service), the basic principles of public procurement (economy and efficiency, competitiveness and transparency, equality and protection of data) as well as the necessary documentation and registration of the protocol, the language in public procurement procedures. Also, it specifies the conditions and

manner of conducting public procurement procedure, with the definition of mandatory requirements for participation, proving the fulfillment of conditions for participation. Also on defined criteria (type of criteria) for the best deals. The same is defined way of submitting a bid, the method of advertising, opening bids and the manner of submitting the report on the public procurement. Also are binding the reports on the selection of the best offer, expert evaluation of tenders, public procurement contract the selected bidders, [1-3].

It is interesting that this law, at least in Serbia, suffered a significant number of amendments showing that for him, the businessmen, existed and still there is great interest. The legislator intended to make regulations by the contracting authority (services, equipment, ...) will be able to transparently publish a competition, complete the contest and choose the best deal. The legislator has set up also a very difficult task that this must be "easily explained even for those who are not familiar with the problems of the tender procurement, [2,3]. For example, in Section 4.3. Law on Public Procurement (last version that after the changes come into force on 01.01.2016.) In the implementation part of the eliminatory bid contains, among other things, to quote part of Article 4.3. Of Law, [2].

Call for submission of tenders comprises:

1. Information on the nature of the use of information system of the contracting authority;
2. The date and time of the auction,
3. The result of the previous technical evaluation of bids;
4. Mathematical formula that will be applied in the electronic auction, which allows to automatically identify changes in the ranking of the bids on the basis of the offered new price, or other elements of the contract award criteria.

Mathematical formula must contain the weights of all the elements of criteria that the contracting authority specified in the invitation for submission of bids in the tender documentation adapted to the changed evaluation of parts supply. Also interesting are the members 44,45 and 46 of this Law, [2].

Article 44.

If you are in the process of public procurement bids submitted in electronic form, electronic contracting authority may bid to implement without special invitation of bidders immediately after the opening of bids and its automatic ranking, provided that each of the bidders to provide access to data on the current rankings and on offered values of other offerings bids.

Article 45.

During the implementation of the electronic auction in one or more of the following ways:

- 1) determine the exact date and time of termination of the electronic auction;
- 2) termination of the receipt of the new price or the elements of criteria, which meet the requirements concerning minimum differences. The time is allowed to elapse after receiving the last bid changes, but before the end of the auction stated in the invitation to tender;
- 3) completion of the number of phases of electronic auction specified in invitation to bid.

After completion of the electronic auction contracting authority shall take a decision on allocation of contracts on the basis of the results of the automatic ranking of bids.

So here we have multi-criteria analysis that is multi-criteria optimization (MCA) where will, therefore, the contracting authority have automatic ranking list after each new bidding. But in this case, almost all methods (MCA) have the ability to introduce new alternatives to change the order of other alternatives. Obviously, if the three bidders act synchronized it may be favoring for one of them: Two give bids which has the third rejected in the first place, [2,3]. There are methods in which this is not possible, but they are generally not in use (the same as comparative and, for practical application, is very simple) [5,6].

### 2.1. What is done in practice?

If we aim at making the best tender for the purchase of an asset, that is goods or services, a number of criteria, can be universal, ie. applicable in all procurements. However, although universal, these criteria in a variety of procurement often have different importance, that is significance which varies depending on the type of procurement. Also, to determine the significance (importance) criteria very important question of the nature or the character of the customer. As an example, we can take two purchases in a single service companies, procurement of special vehicles and the purchase of paper for administrative tasks. Quality criteria, in the case of procurement of vehicles will certainly be dominant in relation to the purchase of paper, where it is expected its greatest relative weight of such criteria prices.

Recourse is usually a simple multi-criteria methods always give a "good" order and that does not change the order of the alternatives but in fact do not solve the problem in the right way. Relatively easy it could be demonstrated that the essential meaning that the contracting authority did not choose the optimal variant. But in order to avoid complex litigations (required by law in the event of non-compliance with company procedures) contracting authorities apply these methods.

**Table 1.**

	C <sub>1</sub>	C <sub>2</sub>	. . .	C <sub>n</sub>
A <sub>1</sub>	a <sub>11</sub>	a <sub>12</sub>	. . .	a <sub>1n</sub>
A <sub>2</sub>	a <sub>21</sub>	a <sub>22</sub>	. . .	a <sub>2n</sub>
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
A <sub>m</sub>	a <sub>m1</sub>	a <sub>m2</sub>		a <sub>mn</sub>

In practice most commonly is applied lexicography method which in essence gives "good result". In short, this method is simple so we will describe it (we have multi-criteria problem given in table matrices) Table T-1[5-7]: Where : C<sub>1</sub>, C<sub>2</sub>, . . . , C<sub>n</sub> criteria (sorted by importance), A<sub>1</sub>, A<sub>2</sub>, . . . , A<sub>m</sub> alternative for choice a<sub>ij</sub> values for alternative A<sub>i</sub> by criteria C<sub>j</sub>. Some criteria are of maximizing character (chosen as best – maximum value) and some are of minimizing character (chosen as best – maximum value).

## 2.2. Choice procedure:

- Chosen as best option, best offer by criteria  $C_1$ . If it is unique, it is the optimal solution.
- If there are more options which have same and best value by criteria  $C_1$ , among them is chosen the closest value by criteria  $C_2$ . If it is unique then this option is proclaimed to be the best.
- If there are multiple options which have same best option by  $C_2$  then we go to choice by criteria  $C_3$  and the same all until the end.

If at the end we have more of them with the same results then take the offer that has arrived first. This previously implemented methodologies most commonly occurs in cases where we do not have electronic auction but a regular system of tenders and the opening of envelopes (usually public) and their ranking.

## 3. Examples from practice

As an example from practice we can give a public procurement (of small value) No. - 20-U-60/15 for services of repair and manufacturing of parts for hydraulic instalations on vehicles (50116000) – services of repair and maintenance for certain parts of vehicles „tow trucks“ from 15.12.2015. [4].

Requirements specification of procurement (of that quantity - number of pieces) [4]:

- overhaul of hydraulic cylinders sorted by diameter and stroke (the length of the piston rod)
- overhaul of gear pumps are classified according to the working pressure and the working volume,
- overhaul of axial and radial piston pumps are classified according to the working pressure and the working volume,
- overhaul of distribution valve (according to the number of distribution elements - clips)
- Overhaul of electromagnetic valve,
- remint hydraulic coupling,
- mechanical works (repair of leaks and diagnose faults).

Basic criteria for choice is the *criteria of lowest price*, [4]. In particular, it was emphasized that if two or more bidders have the same lowest price offered, will be selected as the best offer that bidders who offered the shortest term. In the event offered the same due date, will be selected as the best offer that bidders who offered a longer validity period, [4].

Suppose that the warranty service intervention excluded and if there is a need for such costs borne by the bids. Of course, this brings negative points with the subsequent reporting on a tender can happen if it becomes a rule that the same break. As for the coverage to serve the required bank guarantee for the success of the execution of services whose value depends on the planned annual repair costs. Multi-criteria analysis will be taken only labor costs (service costs) because it is assumed that the parts that need to be replaced, all bidders must be purchased at an average price. After the takeover devices for correcting the record says the failures (as the basis for invoicing) detailing separating material and service costs. Therefore, the tender offer is required to define the following three criteria, [4]:

- Price of services (din/h) and material costs,
- Payment deadline 45 days,
- Warranty period (not less than 6 months). In the event that the bidder determine with precision the guarantee period the offer will be deemed inadmissible.

Deadline corrections is defined by the requirements of the tender: no more than five (5) days of receipt of the request bidders. If the same cannot be repaired within the specified time due to the impossibility of providing spare parts or the technological process, define a new delivery date to which the contracting authority agrees.

Table 2.

Bidder	Price per hour [din/h]	Payment deadline (days)	Warranty (months)
<b>A</b>	180	30	6
<b>B</b>	168	10	9
<b>C</b>	144	15	6
<b>D</b>	168	60	9

Choice of best offer and choice of bidder we will show on supposed offers (A; B; C and D), which are given in table T-2, [4-7]. Weighting coefficients is defined the character of all three of these criteria and on the basis that the (MCA) reach the winning bidder, indicating T - 3, [4-7].

Table 3.

CRITERIA			
Bid	C <sub>1</sub>	C <sub>1</sub>	C <sub>3</sub>
	min	min	max
<b>A</b>	180	30	6
<b>B</b>	168	10	9
<b>C</b>	144	15	6
<b>D</b>	168	60	9

If according to the lexicographical method conduct analysis then obviously the order:

**C → B → A → D**

However, if it is applied for solving this kind of problems, some of other multi-criteria methods (PROMETHEE, VIKTOR, ...), where for example weight coefficients:  $\rho_1 = 0,7, \rho_2 = 0,15, \rho_3 = 0,15$  receives the order, [5], **B → C → D → A**.

### 3.1. What are the characteristics?

In criteria C<sub>3</sub>, in bid C we have a small warranty deadline (minimal according to contest). It is most often the consequence of cheaper spare parts supposed for instalment (which are usually of poorer quality). According to these assumptions it is easily noticeable that if we chose bid C there is a need for shorter time interval of repair (for two years there will be three repairs). In case of choosing bid B need for repair would be after 12 months (same as third by value given as reserve) where in two years we would have total two repairs. It is obvious that bid B, from above stated, is of better quality.

#### **4. Observations of anomalies**

The implementation of the Law on Public Procurement, and because of many obvious examples of bad choices appeared the next article (Article 92) of the "unusually low price". We quote this entire article because there can already see what can be the reason of low prices (which is by lexical method first criterion):

##### **Quoting of Article 92.**

The purchaser may reject a bid due to the unusually low prices. Abnormally low price in terms of this Act has offered a price that was significantly different compared to the comparable market price and raises doubts as to the possibility of execution of public procurement in accordance with the terms offered. If the client determines that it contains any unusually low price, it shall require from bidders detailed explanation of all its integral parts it considers relevant, in particular those concerning the economy of the construction method, production or selected technical solutions and exceptionally favorable terms the bidder has to available for performance of the contract or in the terms of originality of products, services or works which bidders offers. Contracting authority is obligated to determine a suitable deadline in case of paragraph 3 of this Article. Contracting authority is obligated that after receiving the explanation check suitable comprising elements from paragraph 3 of this Article. Purchaser particular verifies fulfillment of the obligations arising from applicable regulations on occupational safety, employment and working conditions, environmental protection and protection of intellectual property rights by the bidder or candidate and can request bidders from submitting appropriate evidence.

#### **5. CONCLUSION**

Bearing in mind that public procurement is an important and significant segment of many systems in each country and in the Republic of Serbia, both from the standpoint of the performance of these systems (as a buyer) and from the point of bidders (the company that this procurement copies), the aim is to the multi-criteria optimization method is better and more effectively implemented. All for reasons that the contract be the highest quality in all relevant criteria (price, dates of service / purchase, dates of payment and as the length of the warranty period). The conducted analysis shows that only the criterion of the lowest price is not, often times, the optimal solution but must be mathematical methods i.e. methods (MCA) analysis of alternative solutions reach by winning the customer.

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