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APPLYING CHOOSING BY ADVANTAGES IN THE PUBLIC TENDERING PROCEDURE

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Abstract: Schöttle and Arroyo (2017) and demonstrate that the implementation of choosing by advantages (CBA) in the tendering procedure is beneficial for i) achieving transparency; ii) clarifying what an owner truly values in a project, and iii) assessing value, prior to requesting proposals and receiving responses. Furthermore, CBA allows decision-makers to separate the value of the technical proposal versus the cost of the proposal; thus, a bad technical proposal cannot be compensated by a low bid. This paper explains how CBA can be applied in the tendering procedure and also how to adjust the CBA tabular method for public procurement. The authors explain the process steps of the method and outline what the owner needs to define before requesting and evaluating proposals. Finally, based on the constructed case of Schöttle et al. (2015) the procedure is analyzed and discussed.

Keywords: Choosing by advantages, project team, selection, tendering procedure.

1 INTRODUCTION

CBA is a multiple-criteria decision-making process developed by Suhr (1999), which is neither well-understood nor widely used in the AEC industry. Most research studies focus on the implementation of CBA in the design process (e.g., Grant and Jones 2008; Parrish and Tommelein 2009; Arroyo, et al. 2014a; Arroyo, et al. 2014b; Kpamma et al. 2015; Arroyo et al. 2016). Schöttle and Arroyo (2016) and Schöttle et al. (2015) did preliminary research for applying CBA in the tendering procedure. In their study, they compared CBA with weighting-rating-calculating (WRC) and best value selection (BVS) using sensitivity analysis. Their results demonstrate the benefits of applying CBA, such as avoiding the problem of combining value with cost. Furthermore, using a decision method, such as weighted average or cost per value, can result in speculative bidder behavior because it allows the potential of compensating a bad technical proposal that includes a favorably low price (Schöttle and Arroyo 2017).

This paper focuses on implementing CBA in the tendering procedure to select a project team, in consideration of the fact that most public owners are required to publish the factors under consideration, their weight and the scoring system to be used, before receiving proposals. Suhr (1999) describes the prior anchoring method for regulated systems, but didn't integrate it in the CBA tabular method. This paper fills that gap, and, additionally, adjusts the CBA tabular method with the prior anchoring process for application in the public tendering procedure. Further, based on the constructed case of

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Schöttle et al. (2015) this paper illustrates and analyzes the prior anchoring CBA tabular method.

2 Research Method

Based on the constructed case of Schöttle et al. (2015), this paper develops a further case to show how the CBA tabular method needs to be adjusted to provide for proper application in the public tendering procedure. In addition, a protocol for the procedure was developed. This paper focuses on answering the following research questions.

- Is the CBA method applicable in the tendering procedure?
- Does CBA require modification?
- How to apply CBA in the tendering procedure for public owners?
- What does the public owner need to take into account in order to successfully implement CBA?

To answer the research questions the researchers developed a concept that was shown and discussed it in a focus group (Gray 2009). The focus group consisted of two researchers and two individuals working for a public organization.

First, this paper explains the theory of the CBA tabular method and the theory of the prior anchoring process. The prior anchoring process is then integrated in the CBA tabular method, and therefor, the method was adjusted. Every process step for the implementation in the tendering procedure is described and its application exemplified. Finally, the paper discusses the implementation.

3 CBA Background

3.1 Motivation for applying CBA

The authors see two major issues that easily occur while using the current methods WRC and BVS. (1) The combination of a technical proposal with the price proposal and vice versa. Because both methods mix value with cost, the bidders could, potentially, "game" the system. CBA does not mix cost and value, thus the bidder cannot speculate in this respect. (2) Members of the focus group observed the problem of unclear differentiation among the proposals during the evaluation process. Often, the group had problems in expressing the differentiating factors in the score, which, in the end resulted in less difference among the proposals. In case of the tendering of an office building at UCSF in 2012, the owner adopted a ranked scoring system so that the proposers could only achieve 3/3, 2/3, or 1/3 of each of the maximum achievable scores, to get a clear judgment and a clear bidder delineation of ranking (see Schöttle et al 2015). When CBA is in place, this would not be necessary because, if a proposal does not have an advantage, then it does not get any score (Schöttle and Arroyo 2017), so the spread of the scores occur naturally (see Arroyo et al. 2014b, Schöttle and Arroyo 2017).

3.2 Theory of the CBA Tabular Method

The CBA tabular method was developed by Suhr (1999). Therefore, the following section is based on Suhr (1999). CBA is a system designed to make sound decisions. Before the method is explained, the related glossary of terms must be understood. Table 1 presents the definitions of the key terms, factors, attributes, advantages, and criteria.

According to Suhr (1999), the method is based on four principles: (1) pivotal cornerstone principle; (2) fundamental rule of sound decision-making; (3) principle of anchoring, and (4) methods principle. The first principle stands for the learning process and the use of sound decision-making methods to make sound decisions. The second principle states that "decisions must be based on the importance of advantage" and not on factor weight (Suhr 1999). Moreover, Suhr (1999) specifies weighting of advantages and disadvantages, of pros and cons, of factors, goals, roles, categories, criteria, objectives, attributes, characteristics, or consequences as unsound decision making. The difference between advantages and disadvantages is simply the perspective. The third and primary principle of the method is anchored judgment, which allows making both reproducible and transparent decisions. The last principle emphasizes the fact that different decision types call for different sound methods (Suhr 1999).

Table 1: Definition of CBA key terms (based on Suhr 1999).

Term	Explanation
Factor	Element or component of a decision, a container for criteria, attributes, etc.
Criterion	Decision rule or guideline.
Attribute	A quality, characteristic, or consequence of one alternative, a distinctive feature is neither a pro nor a con.
Advantage	Difference between attributes of two alternatives in quality or quantity.

The CBA tabular method can be summarized by the following eight steps (Suhr 1999): (1) Identify alternatives; (2) define factors; (3) define must/want have criteria for each factor; (4) summarize the attributes of each alternative; (5) decide the advantage of each alternative by underlining the least-preferred attribute in each factor and summarizing the difference, which will be the advantages; (6) deciding the importance of each advantage based on the selected paramount advantage (PA) and the established scale of importance; (7) calculating the total importance of advantages of each alternative, and (8) evaluating cost data. The PA is necessary to weight every alternative on the same scale of importance. The decision of importance itself is based on four major considerations: (1) the identified purpose, not on finding a solution for a problem; (2) the preference; (3) the magnitude of the advantages, and (4) their attributes (Suhr 1999). If the owner has problems in choosing the PA, a defender-challenger process can be used to select the PA. The advantages are weighted by comparing the difference of the attributes in each factor.

3.3 The Prior Anchoring Process

The public tendering procedure is usually restricted by regulations with the purpose of installing a fair and objective competition, thus, the CBA tabular method needs to be adjusted to fulfill the corresponding constraints. Suhr (1999, pp. 221-226) describes the prior anchoring process, the prior weighting of advantages, for decisions in a regulated system with four steps. (1) The expected range of attributes has to be estimated for each factor. (2) Determine the expected range of advantages by identifying the worst acceptable (WA) attribute, the worst expected (WE) attribute, and the best expected (BE) attribute in each factor; select the least-preferred attribute as anchor to identify advantages, and

describe the advantages between the least-preferred and BE attribute which indeed is the most important advantages, also named anchor-statement advantage. (3) Then, the importance of the expected advantages needs to be determined. Therefore, the PA, most important anchor-statement advantage, must be selected and the scale of importance established to weight the importance of each anchor-statement advantage based on the PA. (4) Choose the preferred alternative based on cost and total importance.

After the submission, the proposals are evaluated by scoring their advantages. In the event that proposal exceeds the BE attribute, the corresponding advantage would achieve an importance score greater than the importance of the anchor-statement advantage. This applies also to the PA. In case that an attribute does not exceed the least-preferred attribute but achieves the (WA) attribute, the scale can be extended to assign negative importance scores (Suhr 1999).

4 ADJUSTED CBA TABULAR METHOD FOR IMPLEMENTATION

4.1 Adjustment based on Legislation

The tendering procedure must be based on the legislation applicable to the particular public entity. Now, two options exist to implement CBA in the selection process based on the existing regulations. First option would be to state in the request for proposal (RFP) that CBA will be used to evaluate the proposals, and then simply evaluate the proposals using CBA. For example, this will be the case of University of California, as the California Public Contract Code (PCC), that gives instructions for the owner about how to proceed in public procurement, states that for best value selection procedure, owners needs to describe the criteria, the methodology and rating or weighting system, and the relative importance or weight assigned to the criteria on which the proposals will be evaluated in the RFP (see Cal. Pub. Contract Code section 10506.6, subd. (2)).

The second option is to integrate a prior anchoring process (Suhr 1999). The first option is easier, because the classic CBA tabular can be applied and no further effort is necessary. In relation to the first option, Suhr (1999) states that an objective judgment requires the non-identification of the contractor with their proposals. This is a conflict and needs to be considered because as soon as a pre-qualification and interview process is used to select the bidders for the competition phase; the owner knows who is going to bid. The second option is to integrate a prior anchoring process (Suhr 1999) as will be shown in the following two sections.

4.2 The prior anchoring CBA Tabular Method

Public owners who need to publish weights in the RFP, can use the CBA tabular method with the prior anchoring method. Because the authors questions the advantage and do not see the necessity of having a WA and WE attribute, the authors will implement the minimum requirement (MR) attribute. The MR attribute represents the attribute that needs to be fulfilled by the bidder. If a proposer does not meet the MR attribute, the bid must be rejected. This rule protects bidders against the speculative behavior of a competitor. For example, a bidder could speculate to not achieve the minimum requirement LPS as it does not provide a high score. A proposal, which exceeds the maximum value, may not be valuable for the owner. For example, one bidder proposes a building with an interior program space of 280,000 GSF. This exceeds the maximum value by 5.66%. This might be, but doesn't have to be, a positive option for the owner as maybe higher life-cycle-cost surfaces. Nevertheless, the proposal that doesn't provide an advantage in the factor will

still be scored zero. In case that none of the components of the proposal fulfills all minimum requirements, the process should be stopped and a root-cause analysis should be done to answer the question why no part of the proposal fulfills the minimum requisites. Table 2 provides an overview of the CBA process steps, including a modified prior anchor method.

Table 2: Process steps of the prior anchoring CBA tabular method.

Process step	Explanation
Define factors	All factors on which the proposals will be evaluated need to be documented.
Define MR and BE attribute	MR and BE attribute represents two possible alternatives and are needed to determine the expected range of attributes for each factor.
Describe anchor-statement advantage	This is the difference between the MR and the BE attribute.
Select the PA	Search for the most important anchor-statement advantage.
Develop the scale of importance	Choose a scale, such as 0-100, 0-10, or 0-1.
Weight the importance of each anchor-statement advantage	Weight the importance based on the PA.
Choose the preferred alternative	This is the anchor for the final decision.
Identify alternatives	Based on pre-qualification and interviews.
Request for proposals	Publish the factors, the scale of importance, the anchor-statement advantage, and the weight of the anchor-statement advantage in the RFP.
Open the technical proposal	-
Summarize the attributes of each alternative	Document the attribute of each alternative for every factor in the CBA table.
Decide the advantages of each proposal	Evaluate the technical proposals based on anchored judgment.
Decide the total importance of each proposal	Calculate the total of advantages for each bidder.
Open the price proposal	-
Evaluate the proposals based on the diagram	Insert every alternative into the diagram and analyze which proposal provides the preferred alternative for the owner.

The methods contains three anchors: (1) anchor between MR and BE attribute; (2) anchor between weight of the anchor-statement advantage and PA, and (3) anchor between the importance weight of the anchor-statement advantage and the advantages of the new alternatives, which automatically result in an anchor between the advantages of the alternatives in each factor. Anchors (1) and (2) are established before the request for proposal is issued. Anchor (3) is used to evaluate the proposals.

4.3 Example for the prior anchoring CBA Tabular Method

Based on the constructed case of Schöttle et al. (2015), Table 3 exemplifies the integration of the prior anchoring process in the CBA tabular as described in section 4.2. To simplify the example, the number of factors was reduced to five from 18 in the constructed case. The bid prices in the proposals were also adopted from the constructed case. Hence, Bidder 1 submits a price proposal of USD 93.8M, Bidder 2 submits USD 92.5M, and Bidder 3 submits USD 93.7M (Schöttle et al. 2015). The descriptions of the attributes were taken from the real tendering. A 0 - 100 scale of importance is used to weight the anchor-statement advantage and evaluate the proposals. The factor 'Building interior program spaces' is identified as the PA, because it contains the highest anchor-statement advantage weight with 100. Then, in the RFP, the first part of the table can be published. After proposals submission, the evaluation commences. Because the anchor-statement advantage is defined, the proposals are easier to evaluate. Thus, the advantages of the attributes must be described based on the criterion; and the importance of every advantage must be scored based on the defined scale of importance and in relation to, the prior defined MR and BE attributes. The alternative that does not provide any advantage in a factor must be scored zero.

Table 3: Example of the prior anchoring CBA tabular method.

Defined before request for proposals				Evaluation of proposals					
Factor / (Criterion)	MR attribute	BE attribute / ASA description	Weight of ASA	Alternative 1: Bidder 1		Alternative 2: Bidder 2		Alternative 3: Bidder 3	
Building interior program spaces	255,000 GSF	265,000 GSF	100	Att.: 261,283 GSF.		Att.: 264,197 GSF, but missing some classrooms.		Att.: 258,178 GSF.	
(The more fit between program space and designated gross area, the better.)		10,000 GSF		Adv.: Significantly Better fit between program spaces and gross area.	Imp.: 95	Adv.: Slightly better fit between program spaces and gross area.	Imp.: 50	Adv.:	Imp.:
Building interior	Little interactive	Very interactive	60	Att.: Typical floor plans have one major point of intersection for groups to collide and interact. Ground floor is separated into disparate zones without much required interaction.		Att.: Communal space and ground floor are very strong from a collaborative /interactive perspective.		Att.: Interactive. Atrium centralized with circulation and interactive spaces. Limited prefunction space.	
(The more interactive, the better.)		Significantly more interaction		Adv.:	Imp.:	Adv.: Significantly more interactive concept.	Imp.: 60	Adv.: More interactive concept.	Imp.: 40
Vegetated Roof	80 sf	160 sf	40	Att.: 130 sf		Att.: 150 sf		Att.: 80 sf	
(The more sf, the better.)		80 sf		Adv.: 50 sf more.	Imp.: 25	Adv.: 70 sf more.	Imp.: 35	Adv.:	Imp.:
Materials	Slightly recyclable	Totally recyclable	50	Att.: Partially addressed.		Att.: Choose not to pursue.		Att.: Partially addressed.	
(The more recyclable, the better.)		Much more recycable		Adv.: Slightly more recyclable.	Imp.: 20	Adv.:	Imp.:	Adv.: Slightly more recyclable.	Imp.: 20
Last Planner® System	PPC metrics	Demonstrate full understanding.	20	Att.: Demonstrate full understanding.		Att.: PPC during construction only.		Att.: Proposal shows thorough understanding. Response is general and does not show how this will be applied.	
(The greater the understanding, the better.)		Full understanding of the concept.		Adv.: Considerably more.	Imp.: 20	Adv.:	Imp.:	Adv.: Slightly more understanding	Imp.: 5
Total of As			**250**		**160**		**145**		**65**

In our example, Bidder 1 achieved the highest score, followed by Bidder 2 (see table 3). The differentiation of Bidders 1 and 2 to Bidder 3 is significant. The difference between Bidder 1 and 2 is small, but Bidder 2 does not fulfill the minimum requirement of the recyclable material factor (circled in Table 3) and, thus, its bid must be rejected. We are now positing the case that Bidder 2 fulfills the minimum requirement of the recyclable material factor. Bidder 2 would still get a zero score as the proposal doesn't provide an

advantage in this factor compared to the other two bidders, but is not rejected. Based on the case, Figure 1 represents the related cost versus value diagram. Viewing the cost versus value diagram, the owner can readily explain why a certain bidder is selected. Bidder 3 would not be an alternative, because the proposal contains significantly less value for almost the same price as the proposal of Bidder 1. Between Bidders 1 and 2, the owner now has to make its selection. The proposal of Bidder 1 achieved 15 scores more than the proposal of Bidder 2, but is also USD 1.3M higher in price. The USD 1.3M differential seems high, but in comparison to the overall price, it is 1.39%.

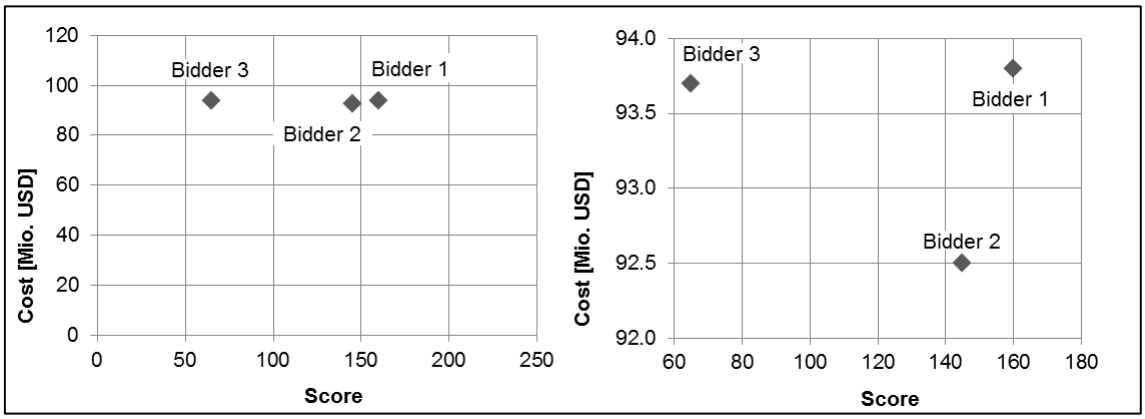

Figure 1: CBA cost vs. value diagram with full scoring and cost scale (left) and in detail (right)

5 Conclusions

This paper illustrates that the CBA method can be used for bidder selection in the public sector in accordance with applicable law. The authors present an example of pre-anchoring CBA in the case it is needed. The authors argue that a sound and fair method does not provide a basis for a claim against the CBA process when correctly applied. The method itself requires a facilitator to implement and training for the evaluation team. Usually, UCSF calculates one half of a day to evaluate the bids received and come to a conclusion. Also, the time to learn other methods is limited; therefore full implementation of CBA has barriers to overcome. However, we argue that the benefits of CBA implementation outweigh the time spent in training, in order to learn and implement a more transparent and collaborative decision-making method.

Future research is necessary to test the method in field and to develop optimal training for public owners. Furthermore, despite the import of life cycle to the owner, usually it is not a factor considered in the tendering procedure, and often it is contra affected by optimizing the bid price. Thus, life-cycle cost could be another area in the CBA diagram, so that the owner can study not only bid price versus value, but also bid price versus life-cycle cost and value versus life-cycle cost.

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