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CHOOSING BY ADVANTAGES FOR BETTER DECISION QUALITY IN CONSTRUCTION PROCUREMENT: A CASE STUDY

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ABSTRACT

Decision-making in construction procurement is characterized by high complexity, multiple stakeholders, and competing technical, economic, and organizational objectives. Conventional evaluation methods, such as weighting rating calculating (WRC), are widely used in practice but often lack transparency and provide limited support for systematic reasoning and collaborative learning. This study investigates the impact of Choosing by Advantages (CBA) on decision quality in a real-world procurement context. Using a quasi-experimental field case study design, two participant groups evaluated an interior fit-out package and a technical building equipment (TBE) package using both WRC and CBA. Data were collected through post-intervention and follow-up surveys that combined quantitative ratings with structured qualitative justifications and were analyzed using repeated-measures comparisons and qualitative content analysis. The results show that CBA improves perceived transparency, traceability, and fairness of decisions while reducing frustration. Participants reported more focused discussions, stronger shared understanding, and greater acceptance of outcomes. Learning effects were observed over successive applications, suggesting increasing familiarity and confidence in using the method. Although CBA requires initial training and facilitation, most participants expressed a strong intention to apply the method in future projects. The study provides field-based empirical evidence that CBA enhances the quality and defensibility of procurement decisions under real project conditions.

KEYWORDS

Choosing by Advantages, decision quality, procurement, group decision-making, case study.

INTRODUCTION

Decision-making in construction projects is characterized by high complexity, multiple stakeholders, and competing technical, economic, and organizational objectives. Procurement decisions, in particular, require a systematic evaluation of alternatives based on heterogeneous criteria, while remaining transparent, justifiable, and acceptable to diverse stakeholders. Despite their strategic importance, bid evaluation processes in practice are often constrained by time pressure, information asymmetries, and organizational routines, which may limit analytical rigor and collaborative learning (Arroyo et al., 2025; Schöttle, 2022).

Conventional evaluation approaches, such as weighted rating calculating (WRC) and point-based scoring systems, are widely used in tendering procedures. These methods appear simple and comparable; however, previous research has highlighted their susceptibility to subjective weighting, compensatory distortions, and limited transparency of underlying trade-offs. As a result, formally structured procedures may conceal intuitive judgments rather than support

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systematic reasoning (Schöttle & Behme; 2024). In response to these limitations, Choosing by Advantages (CBA) has gained increasing attention in both research and practice. CBA is a multi-criteria decision-making system that emphasizes the systematic evaluation of differences among alternatives (Suhr, 1999). By focusing on the importance of advantages rather than aggregated scores, CBA aims to enhance transparency, foster shared understanding, and improve the defensibility of collective decisions (Arroyo et al., 2025).

Experimental evidence supporting these assumptions was provided by Arroyo et al. (2016), who compared CBA and WRC in a controlled laboratory setting for sustainable building design decisions. Their study demonstrated that CBA led to higher levels of collaboration, more consistent reasoning, and greater decision transparency than WRC. While these findings provide strong internal validity, the authors emphasized the need for further research in real project environments to examine how CBA performs under practical constraints. Despite the growing interest in CBA, to the author's knowledge, no empirical studies have examined its application in field-based construction procurement contexts comparing WRC and CBA. The present study addresses this gap by conducting a quasi-experimental field comparison of CBA and WRC in construction procurement. Building on the experimental work of Arroyo et al. (2016), the study adopts a quasi-experimental field case study design to compare CBA and WRC across two procurement packages and two participant groups. The findings demonstrate that CBA significantly improves perceived transparency and reduces frustration in comparison to WRC, thereby enhancing the quality of decision-making in construction procurement.

This paper is structured as follows. First, relevant literature on conventional scoring methods and CBA in procurement contexts is reviewed. Next, the research design, data collection, and analytical approach are presented. The empirical findings are then reported and discussed, followed by concluding remarks.

THEORETICAL BACKGROUND

CONVENTIONAL SCORING-BASED METHODS IN TENDERING

Decision-making in construction procurement requires the systematic evaluation of bidders based on technical, organizational, and economic criteria. WRC and scoring-based methods remain the dominant approaches in many tendering procedures (Schöttle, 2022; Schöttle, et al., 2015). These methods involve assigning weights to predefined factors and aggregating numerical scores to determine weighted rankings. Comparative studies indicate that WRC-based approaches are relatively easy to implement and efficient in routine applications but often lack methodological transparency and robustness (Arroyo et al., 2025; Schöttle & Arroyo, 2017; Arroyo et al., 2016). In practice, weighting and scoring procedures are frequently influenced by subjective judgments and informal negotiation processes, which may undermine their intended objectivity (Arroyo et al., 2025; Schöttle et al. 2017). In regulated procurement environments, these limitations are particularly problematic, as decisions must be justified to stakeholders and comply with legal requirements. Schöttle & Behme (2024) show that conventional scoring models often struggle to meet documentation and traceability requirements, which easily results in questionable decision outcomes. Overall, existing research suggests that while WRC-based approaches offer administrative simplicity, they frequently compromise transparency and argumentative rigor.

CHOOSING BY ADVANTAGES IN TENDERING

CBA is a multi-criteria decision-making system that focuses on comparing the advantages of alternatives (Suhr, 1999). Rather than aggregating weighted scores, CBA requires decision-makers to document relevant attributes, identify advantages, and assess the importance of the advantages.

Empirical studies in tendering contexts suggest that CBA supports clearer argumentation, stronger justification, and improved traceability compared to conventional scoring methods (Schöttle & Arroyo, 2017; Arroyo & Haas Georgiev, 2017). Comparative investigations further indicate that CBA reduces compensatory distortions and makes value judgments more explicit (Schöttle & Arroyo, P, 2017). However, research on collaborative project delivery in the public sector shows that the successful adoption of structured decision-making approaches such as CBA depends on organizational context, including the autonomy, competence, and relatedness of project teams (Schöttle, 2022). Arroyo et al. (2016) provided experimental evidence that CBA enhances collaboration, consistency of reasoning, and transparency compared to WRC. Subsequent field-based studies confirm these effects in real procurement settings, particularly regarding perceived fairness and stakeholder acceptance (Schöttle & Behme, 2024; Schöttle & Arroyo, 2017; Schöttle et al., 2017; Schöttle et al., 2015). Despite these positive findings, most existing studies are based on experiments, regulatory analyses, or single-case applications. Systematic field-based comparisons under real project constraints remain scarce.

RESEARCH DESIGN AND METHODOLOGY

STUDY DESIGN AND PROCEDURE

This research applies a quasi-experimental field case study design to examine the effects of CBA on decision-making in construction procurement. The study combines quantitative ratings with structured qualitative justifications to capture measurable outcomes and participants' experiences. It was conducted within a large construction project of Siemens Real Estate located on the campus of the Technical University of Munich (TUM) in Munich, Germany. The project represents the second construction phase of a research facility and comprises approximately 11,000 m² gross floor area for around 600 employees. The five-story building includes flexible office, workspace, meeting spaces, coworking zones, research facilities, and a staff restaurant. The study was conducted during the procurement phase for two major packages: an interior fit-out package and a technical building equipment (TBE) package. Two participant groups took part in the study: an experimental group (project team members; group size varied due to scheduling constraints; see Table 1, participants A, B, C, D, E, and I) and a control group (non-project participants; n = 3 throughout; see Table 1, participants F, G, and H). None of the participants had prior experience with CBA. The control group did not function as a strict experimental control, but as an independent comparison group. While the experimental group was directly involved in the project, the control group evaluated the same alternatives using the same information, without project involvement, to reduce project-specific bias. In particular, this excluded process-related biases arising from interactions with bidders (e.g., procurement interviews). Table 1 provides an overview of the study timeline and participant involvement.

The study was conducted between February and November 2025 and included training sessions, workshops, and evaluation with both participant groups. All participants attended a one-day training on CBA. In the preparatory phase, the experimental group defined and weighted evaluation criteria to structure tender documents and bidder interviews. After bid submission, both groups evaluated the same alternatives using WRC and CBA. For the control group, the facilitator compiled the required information based on the experimental group's WRC evaluation. CBA assessments were conducted in facilitated workshops using the same information basis for both methods to ensure methodological comparability.

DATA COLLECTION AND ANALYSIS

Data were collected through an immediate post-intervention survey and a three-week follow-up survey in a two-wave repeated-measures design. This approach enables the assessment of short-term intervention effects and their persistence over time (Singer & Willett, 2003; Menard,

2002). Participants rated perceived frustration and transparency on a 0–10 scale and provided written justifications in a survey. The experimental group completed the post-intervention survey only for the second package, whereas the control group completed it for both packages. The follow-up survey included closed- and open-ended questions. The quantitative data were analyzed based on qualitative content analysis (Mayring, 2010). Repeated-measures comparisons were used to examine changes between the WRC and CBA phases. Integrating numerical ratings with structured reasoning strengthened internal validity (Yin, 2018).

Several limitations should be noted. Sequential application of WRC and CBA may have introduced learning effects, and varying group sizes may have influenced interaction dynamics. The researcher's dual role as both facilitator and researcher, and the single-project context, further limit generalizability. These factors were considered in interpreting the findings.

Table 1: Timeline and participation (x = experimental group; X = control group)

			Participants								
Date	**Workshop**	**Format**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
2025-02-27	Definition of factors and criteria for bid evaluation	on site	x	x	x	x	x				
2025-03-11	Finalization of factors and criteria for bid evaluation	online	x	x	x	x	x				
2025-03-21	Factor weighting for bid evaluation	online	x	x							
2025-10-06	Pre-filling of the WRC evaluation matrix for fit-out	online	x	x							
2025-10-09	CBA training	on site	x	x	x	x		X	X	X	
2025-10-10	CBA evaluation of fit-out	online	x	x	x	x					
2025-10-14	Control group: evaluation of fit-out package with WRC and CBA	on site						X	X	X	
2025-10-14	Pre-filling of the TBE evaluation matrix for fit-out	online	x	x							
2025-10-16	Control group: evaluation of fit-out package finalizes CBA	online						X	X	X	
2025-10-24	CBA evaluation TBE package	online	x	x	x	x					x
2025-10-28	Control group: evaluation of TBE package with WRC and CBA	online						X	X	X	

EMPIRICAL FINDINGS ON CBA AND WRC

POST-INTERVENTION SURVEY

Perceived Frustration

For the experimental group, frustration ratings were consistently lower for CBA than for WRC (see Figure 1). Individual CBA scores ranged from 0 to 3.5, resulting in a mean value of 1.75, whereas WRC scores ranged from 6.5 to 7, with a mean of 6.75. This indicates a markedly lower level of perceived frustration when using CBA. A similar pattern was observed in the control group. CBA-related frustration scores ranged from 3 to 4.5, yielding a mean of 3.83, while WRC scores ranged from 4 to 7.5, with a mean of 6.00. Although frustration levels were

slightly higher in the control group than in the experimental group, CBA was still associated with substantially lower frustration than WRC. Across both groups, mean frustration scores for CBA were between 2 and 4 points lower than those for WRC, indicating a consistent reduction in perceived frustration when applying CBA.

Perceived Transparency and Traceability

Participants also reported higher levels of transparency and traceability for CBA than for WRC (see Figure 2). In the experimental group, CBA scores ranged from 3 to 9 with a mean of 7.00, whereas WRC scores ranged from 3 to 5 with a mean of 4.00. The control group showed a comparable pattern. CBA-related transparency scores ranged from 5.5 to 8, yielding a mean of 7.17, while WRC scores ranged from 4.5 to 6, with a mean of 5.00. In both groups, CBA was associated with higher perceived transparency and traceability than WRC. The difference was particularly pronounced in the experimental group, where the mean CBA score exceeded the WRC score by three points.

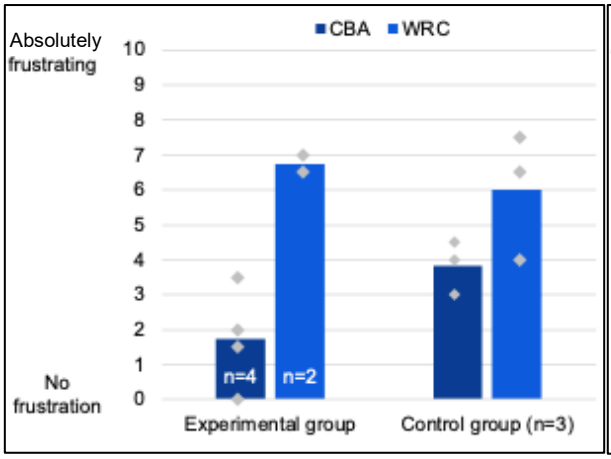

Figure 1: How frustrating was the decision-making in TBE?

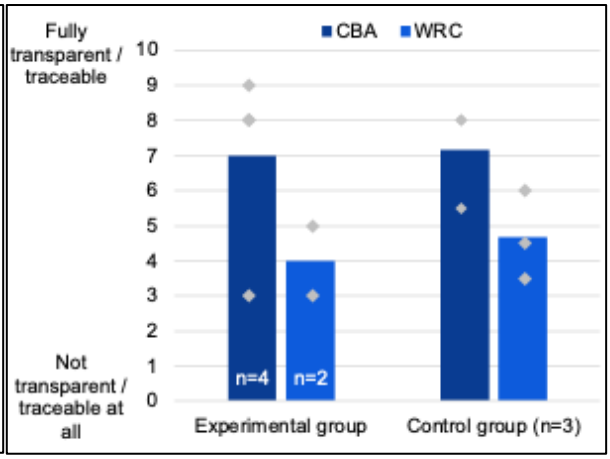

Figure 2: How transparent and traceable was the decision-making in TBE?

Development from Fit-out (D1) to TBE Package (D2)

A comparison of post-intervention ratings for the Fit-out and TBE packages indicates a clear development in participants' perceptions over time (see Figure 3).

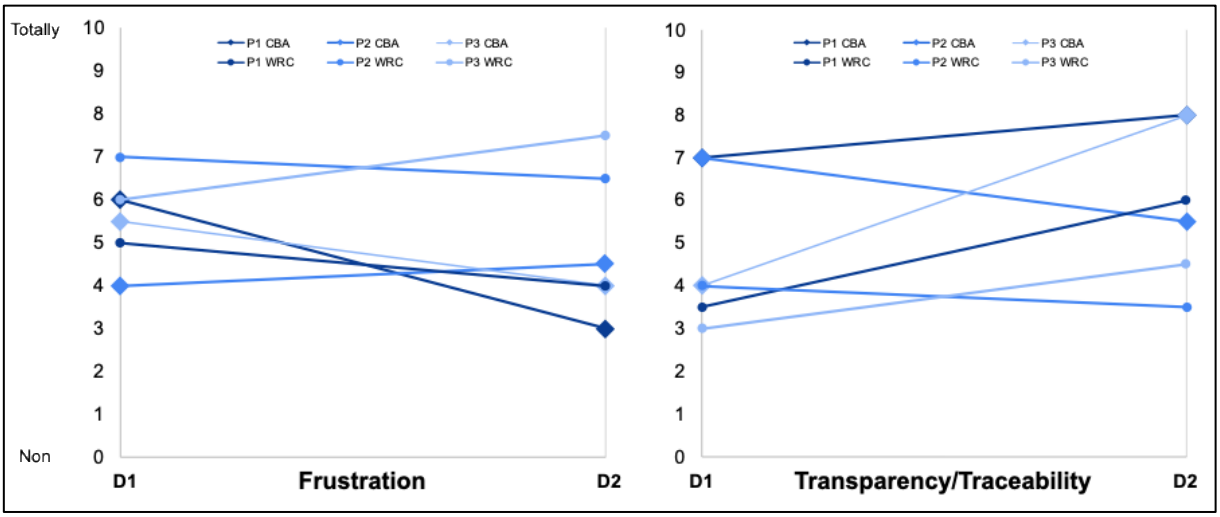

Figure 3: Immediate post-process survey - Comparison within the control group

Under CBA, mean frustration decreased from 5.17 to 3.83, while perceived transparency increased from 6.00 to 7.17. This suggests that growing familiarity with the method supported a more efficient and comprehensible decision-making process. Under WRC, frustration remained constant at 6.00, and transparency increased only slightly from 3.50 to 4.67, indicating a weaker learning effect. Overall, these results indicate a learning and adaptation effect, particularly for CBA, highlighting the importance of repeated application and practice to realize its full benefits in procurement decisions.

Qualitative Content Analysis

The qualitative responses reveal three central themes: learning effort, perceived structure, and transparency of reasoning. Regarding frustration, participants associated CBA with higher initial effort, particularly due to time requirements and limited experience. Several respondents emphasized that insufficient training and incomplete information increased cognitive demands. However, good preparation and facilitation were perceived as mitigating these challenges. In contrast, WRC-related frustration was primarily linked to unclear criteria, missing information, and subjective interpretations. Participants noted that scoring tables created an impression of structure while masking intuitive judgments. With respect to transparency, CBA was consistently associated with clearer argumentation, detailed analysis, and better comparability of alternatives. Respondents emphasized the articulation of advantages and improved traceability for third parties. Conversely, WRC was frequently described as inconsistent, subjective, and difficult to reconstruct, limiting perceived transparency of decision outcomes.

FOLLOW-UP SURVEY RESULTS

Overall Impression and Global Preference

The follow-up survey results indicate a clear preference for CBA (see Figure 4). All six respondents indicated that CBA had left a stronger positive impression than WRC when asked which method they evaluated more favorably overall. No participant selected WRC or expressed uncertainty, indicating unanimous support for CBA in terms of overall perception.

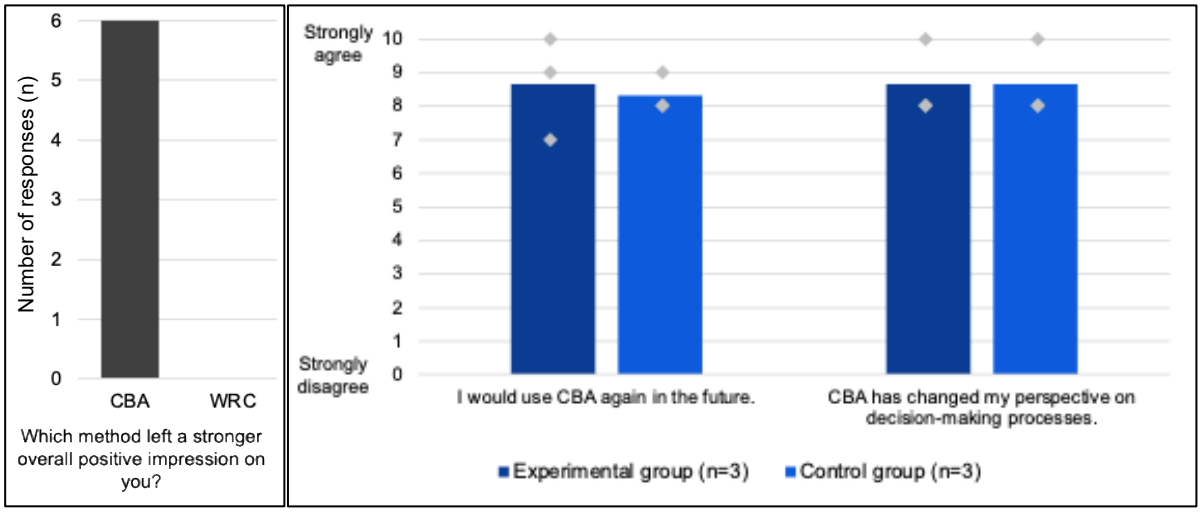

Figure 4: Overall impression and global preference

This general preference is reflected in the individual response data for the two global preference indicators. For the item "I would use CBA again in the future," mean values were 8.67 in the experimental group and 8.33 in the control group. Similarly, both groups reported identical mean values of 8.67 for the item "CBA has changed my perspective on decision-making processes," indicating a strong and consistent perceived impact of CBA on participants' understanding of decision-making. The distribution of individual scores further indicates low

variability and consistently positive evaluations across both groups. No respondent rated either item below 7, suggesting a uniformly favorable perception of CBA's applicability and conceptual influence. Taken together, these results demonstrate a high level of acceptance of CBA across participant groups and confirm that the method was perceived as both practically relevant and conceptually influential. The convergence of unanimous overall preference and high rating scores suggests that CBA generated a stable and broadly shared positive evaluation among participants.

Participants' Perceived Understanding of Decision Rationales

Participants reported higher levels of understanding of the key insights underlying procurement decisions when using CBA than when using WRC (see Figure 5). In the experimental group, ratings for CBA were consistently high, with individual scores of 9, 10, and 9, resulting in a mean value of 9.33. In contrast, ratings for WRC ranged from 7 to 9, yielding a lower mean of 7.67. A similar pattern emerged in the control group. Participants reported CBA-related understanding scores of 9, 8, and 8, corresponding to a mean of 8.33. For WRC, individual scores were substantially lower at 7, 4, and 5, resulting in a mean of 5.33. Across both groups, perceived understanding was consistently higher for CBA than for WRC. The difference was particularly pronounced in the control group, where the mean score for CBA exceeded that of WRC. This suggests that CBA supported a clearer understanding of the determinants of decisions, even among participants who were not directly involved in the project.

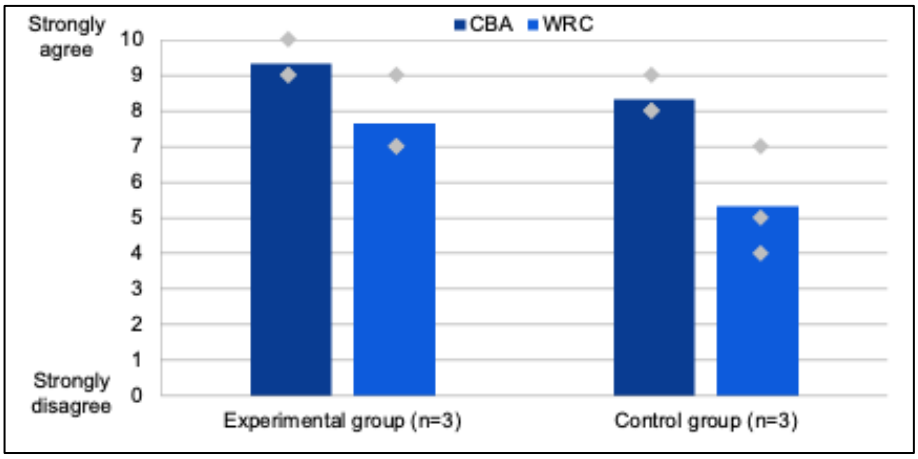

Figure 5: I understand the decisive aspects that led to the decision when using CBA/WRC.

The relatively low variability in CBA scores indicates a stable perception of transparency and traceability of decision rationales. In contrast, WRC scores exhibited greater variability, especially within the control group, suggesting less consistent understanding of how evaluation results were derived. Overall, the findings suggest that CBA was perceived as more effective than WRC in making the key drivers of procurement decisions understandable to participants, regardless of their level of project involvement.

Comparative Assessment of Perceived Process and Outcome Quality

Participants' responses show a strong and consistent preference for CBA across most evaluated quality dimensions (see Figure 6). For key aspects such as understanding of evaluation criteria, traceability of decisions, development of shared understanding, satisfaction with outcomes, and perceived fairness, the majority of respondents selected CBA as the superior method.

In particular, all six respondents associated CBA with higher perceived fairness and better development of a shared understanding. Similarly, five out of six participants indicated that CBA provided greater traceability of decisions and higher satisfaction with outcomes. A strong preference for CBA was also evident, as it improved understanding of evaluation criteria and

enhanced trust in the results. Process-related dimensions showed slightly more differentiated responses. For satisfaction with the process and the focus and objectivity of team discussions, most participants favored CBA, while a small number selected "no difference" or "I don't know." These responses suggest that participants were more consistent in their evaluation of outcomes than in their assessment of the evaluation process. Notably, no respondent indicated that WRC performed better than CBA on any of the assessed criteria. Neutral and uncertain responses were limited and occurred primarily regarding process satisfaction and discussion quality. This indicates that while CBA was broadly perceived as superior, some participants experienced challenges in evaluating process-related aspects.

Overall, the results demonstrate that CBA was consistently associated with higher transparency, stronger mutual understanding, greater acceptance of results, and improved perceived fairness. The convergence of positive assessments across both experimental and control groups suggests that these perceptions were largely independent of direct project involvement and reflect method-related effects rather than contextual bias.

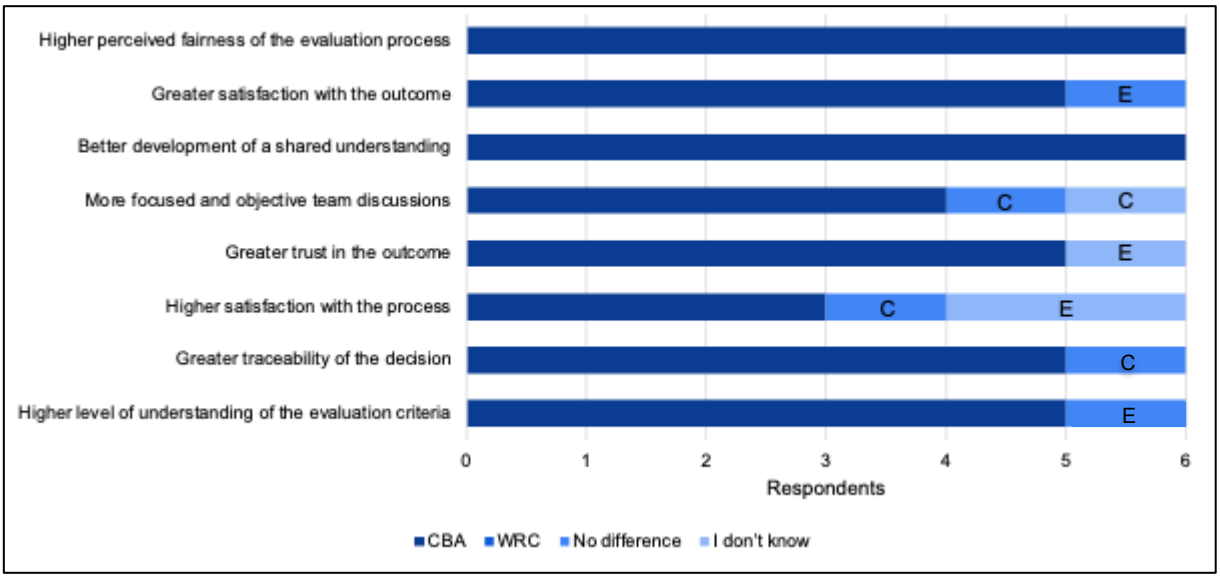

Figure 6: Comparative assessment

Qualitative Content Analysis

The qualitative content analysis examined participants' open-ended responses in the follow-up survey. An inductive coding process resulted in five thematic clusters, summarized in Table 2.

The first cluster, Transparency, Traceability, and Fairness, reflects participants' emphasis on clearer decision rationales, improved argumentation, and better justification of outcomes under CBA. Frequently mentioned codes include enhanced traceability and the decoupling of technical evaluation from price considerations. The second cluster, Quality of Discussions, captures improvements in team interactions. Respondents reported more in-depth and objective discussions, reduced reliance on intuitive judgments, and a stronger focus on advantages rather than numerical scores. The third cluster, Shared Understanding and Consensus, highlights stronger team consensus, higher acceptance of outcomes, and improved integration of diverse perspectives, indicating enhanced collective sense-making. The fourth cluster, Learning Effort and Cognitive Demands, addresses implementation challenges. Participants emphasized the need for training, facilitation, and methodological experience, particularly during early applications. The final cluster, Context Dependency and Limitations, reflects perceived boundaries of CBA applicability. Time pressure, small-scale decisions, and efficiency concerns were frequently mentioned.

In summary, the qualitative findings presented in Table 2 indicate that CBA was associated with higher transparency, improved discussion quality, and stronger shared understanding. At the same time, the results underline that these benefits depend on adequate training, facilitation, and contextual suitability.

Table 2: Thematic clusters derived from inductive coding of open-ended responses

Cluster	Assigned Questions	Codes	Frequency
Transparency, Traceability, and Fairness	Q6, Q7, Q15	Traceability of the decision	5
		Clear argumentation logic	4
		Fairer evaluation compared to WRC	3
		Decoupling of price and evaluation	3
Quality of Discussions	Q8	More in-depth discussions	4
		More objective argumentation	4
		Less reliance on intuition	3
		Focus on advantages rather than scores	3
Shared Understanding and Consensus	Q9, Q16	Greater team consensus	3
		Higher acceptance of the outcome	3
		Integration of diverse perspectives	3
		Shared understanding	2
Learning Effort and Cognitive Demands	Q10, Q12, Q16	Training and coaching requirements	5
		Methodological complexity	4
		Effort due to lack of experience	4
		Need for facilitation and expertise	3
Context Dependency and Limitations	Q13, Q16	Time-critical decisions better suited to WRC	4
		Small-scale decisions unsuitable	4
		Efficiency advantage of WRC	3

DISCUSSION

This study compared CBA and WRC in tendering. The findings provide converging quantitative and qualitative evidence that CBA enhances perceived decision quality, transparency, and acceptance across participants, consistent with prior comparative studies (e.g., Arroyo et al., 2016; Arroyo et al., 2014; Correa et al., 2017; Schöttle & Arroyo, 2017).

First, the survey results demonstrate a strong and stable preference for CBA. High ratings for future use and perceived changes in decision-making perspectives indicate that CBA was not only positively evaluated in the short term but also influenced participants' broader understanding of structured decision processes.

The low variability across both groups suggests that these perceptions were more closely associated with the decision-making methods used than with the specific project context. This

supports earlier experimental findings (Arroyo et al., 2016) and extends them to a field-based procurement setting. Second, participants consistently reported greater understanding of decision rationales when using CBA. Both the experimental and control groups showed substantially higher CBA scores than WRC scores, with particularly large differences among non-project participants. This confirms previous observations that CBA facilitates transparent reasoning and defensible decision justification (Arroyo et al., 2025; Schöttle & Behme, 2024). Third, the comparative assessment of process and outcome quality shows that CBA was perceived as superior across nearly all evaluated dimensions. While outcome-related aspects such as fairness, shared understanding, and acceptance received highly consistent evaluations, process-related dimensions showed slightly greater variability. Similar patterns have been reported in prior studies, indicating that initial learning effort and unfamiliarity influence participants' experiences during early applications (Arroyo et al., 2025; Arroyo et al., 2019). Fourth, post-intervention results indicate that CBA was associated with significantly lower frustration and higher transparency than WRC. These findings align with research showing that structured comparison of advantages reduces ambiguity in group decisions (Arroyo et al. 2025; Arroyo et al., 2016; Schöttle et al., 2019). The learning effects further support studies emphasizing the importance of repeated application and facilitation in developing methodological competence (Arroyo et al., 2019).

The qualitative analyses reinforce these quantitative results. Participants associated CBA with greater analytical rigor, improved collaboration, and reduced reliance on intuition. At the same time, learning requirements and contextual limitations were repeatedly emphasized, confirming that effective implementation depends on organizational readiness and training (Arroyo et al., 2025; Arroyo et al., 2019).

From a practical perspective, the study indicates that CBA is particularly suitable for complex, high-stakes procurement decisions where transparency and legitimacy are critical (Schöttle et al., 2022). Organizations seeking to adopt CBA should invest in capability development and structured facilitation during early applications. Over time, such investments are likely to be offset by improved decision quality and reduced process-related frustration.

Finally, the study contributes empirical field-based evidence to the growing literature on CBA in procurement contexts. By combining repeated measures with qualitative reasoning, this study demonstrates that CBA's advantages extend beyond controlled experiments and can be realized under real project conditions. Future research should examine larger samples, diverse project types, and long-term institutionalization effects.

CONCLUSION

This study provides initial evidence that applying CBA can enhance decision quality in complex construction procurement contexts. The findings suggest that CBA improves transparency, traceability, and decision justification, and may lead to outcomes perceived as fairer and more defensible by project participants. Furthermore, CBA appears to support more focused and objective discussions by shifting attention from intuitive judgments and arbitrary scoring toward the structured comparison of advantages. This promotes evidence-based reasoning, strengthens shared understanding, and facilitates the integration of diverse perspectives, ultimately increasing consensus and acceptance of outcomes. At the same time, the study highlights that CBA is methodologically demanding, particularly during initial applications. Participants emphasized that effective implementation requires training, coaching, and facilitation to reduce initial cognitive and time-related effort.

Several limitations should be acknowledged. The study was conducted within a single project and involved a small sample, limiting statistical generalizability. Learning and carry-over effects may have influenced participants' perceptions, and the researcher's dual role as facilitator and observer may have affected group dynamics. Overall, the findings indicate that

while CBA requires an initial investment in learning and facilitation, it offers substantial potential to enhance decision quality in construction procurement. Future research should examine larger samples, diverse project settings, and longitudinal applications to further assess the scalability and long-term integration of CBA in practice.

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