Research on the Application of Bidding and Evaluation Methods in Construction Engineering

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Abstract: This article researches the application of methods in the bidding and evaluation of construction engineering projects. It discusses four application approaches: quantitative scoring by weight in the comprehensive evaluation method, screening via the reviewed lowest bid price method, defining the quotation range using the reasonable low price method, and commercial bid ranking under a technically qualified system. It analyzes the operational processes and applicable scenarios of each method. Furthermore, it explores three optimization strategies: refining evaluation indicators to reduce subjective bias, dynamically adjusting weights to suit project needs, and introducing big data to assist review decisions, proposing targeted implementation paths. The aim is to demonstrate that by scientifically selecting evaluation methods combined with optimization strategies, the problems of traditional methods being disconnected from project requirements, insufficient review fairness, and low efficiency can be solved, achieving the effects of improving evaluation accuracy, ensuring review fairness, and increasing bidding efficiency, thereby providing practical reference for the standardized conduct of bidding and evaluation work in construction engineering.

1. Introduction

Bidding and evaluation in construction engineering are key links for controlling project quality and selecting high-quality contractors, directly affecting the subsequent construction effectiveness of the project. Currently, within the industry, some projects suffer from a "one-size-fits-all" approach in selecting evaluation methods. Technically complex projects still use cost-focused methods like the lowest bid price method, leading to the selection of contractors with insufficient technical capability. Simultaneously, traditional evaluation relies on manual judgment, which is prone to significant subjective bias, and the review process lacks support from efficient tools, easily resulting in low efficiency and incomplete record-keeping. In-depth research on the application methods and optimization strategies for construction engineering bidding and evaluation, teasing out the applicable conditions and operational key points of each method, and exploring paths to improve evaluation quality are of great significance for standardizing the bidding process, preventing bidding risks, and ensuring project construction quality.

2 Application Methods of Bidding and Evaluation in Construction Engineering

2.1 Quantitative Scoring by Weight in the Comprehensive Evaluation Method

Conduct weight setting: During the tender document preparation stage, determine the weight ratio between the technical bid and the commercial bid based on the project type and core requirements. For technically complex projects, set the technical bid weight at 60% and the commercial bid at 40%; for conventional projects, set the technical bid weight at 40% and the commercial bid at 60%. Weights must be clearly announced in the tender documents to avoid disputes caused by later adjustments. Perform indicator refinement: Break down the technical bid into four first-level indicators: construction plan, quality control, safety assurance, and resource

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allocation. Each indicator is further subdivided into quantifiable sub-items. For example, "Construction Plan" is refined into "Reasonableness of Schedule (max 20 points, deduct 5 points for key node deviations exceeding 3 days)" and "Advanced Nature of Technical Process (max 15 points, add 3 points for each use of new industry technology)". The commercial bid is broken down into three first-level indicators: quotation deviation, commitment to construction period, and payment terms. "Quotation Deviation" sets a scoring rule such as "deduct 2 points for 1% deviation from the benchmark price, higher score for smaller deviation". All sub-items must have clear score ranges and deduction criteria to avoid subjective discretion by evaluators. Carry out itemized evaluation: Evaluators are grouped to independently review technical and commercial bids. During technical bid review, check the responsiveness of the bid documents against the refined indicators one by one. For "Quality Control", check whether a special testing plan is provided; no plan means no score for this item. During commercial bid review, calculate the deviation of each bidder's quote from the benchmark price and automatically convert it into a score according to the rules. During the review process, evaluation record forms must be filled out, stating reasons for deductions. Conduct total score calculation: The system aggregates the itemized scores (technical and commercial) from each evaluator, removes the highest and lowest scores, takes the average, and then calculates the total score based on the preset weights (Total Score = Average Technical Score × Weight + Average Commercial Score × Weight). Rank the bidders from high to low based on the total score to determine the top 3 winning candidates. Simultaneously, generate an evaluation report detailing the score breakdown and ranking basis for each bidder.

2.2 Screening via the Reviewed Lowest Bid Price Method

Conduct substantive review: Evaluators check bidder qualifications, technical documents, and commercial commitments against the tender document requirements. Bid documents with substantive deviations are directly rejected, and only compliant bidders proceed to the next stage. Review results must be recorded in writing and signed by the evaluators for confirmation [1]. Perform price correction: Correct arithmetic errors in the quotes of compliant bidders. When the unit price and total price disagree, adjust the total price based on the unit price. When the product of quantity and unit price is incorrect, recalculate using the correct quantity. The corrected price must be notified to the bidder in writing for confirmation. If the bidder raises no objection, the review proceeds with the corrected price; if there is an objection and no agreement can be reached, the bid is deemed invalid. Implement deduction of non-competitive costs: Deduct items such as provisional sums, dayworks, and provisional estimates for specialist works from the corrected quotation—parts not independently quoted by the bidder—retaining only competitive costs like measured work items and preliminaries. This ensures the reviewed price reflects the bidder's actual competitive price. The deduction process must strictly follow the cost composition agreed in the tender documents to avoid omissions or errors [2]. Conduct price ranking: Rank the reviewed prices (after deducting non-competitive costs) from low to high. Select the bidder with the lowest reviewed price as the first winning candidate. If two or more bidders have the same lowest price, compare the completeness of their technical documents, ranking the one with better technology higher. Finally, form the ranking result and explain the cost deduction details and ranking reasons in the evaluation report.

2.3 Defining Quotation Range Using the Reasonable Low Price Method

Calculate the benchmark price: From all valid bid prices (excluding those below cost price or above the maximum limit price), calculate the benchmark price using methods like "arithmetic average after removing the highest and lowest bid" or "weighted average". The calculation process

must be supervised jointly by evaluators and the tendering authority's representative, simultaneously entered into the review system to generate a calculation log, ensuring the benchmark price is traceable [3]. Next, set the reasonable quotation range: Based on the benchmark price, set the range according to the project type: ±5% of the benchmark price for residential projects, ±6% for municipal projects. The range must be agreed upon in advance in the tender documents to avoid adjustments during review. Bid prices outside this range are directly categorized as "unreasonable quotes" and do not participate in further evaluation. Conduct two-stage evaluation: First, perform technical bid compliance review for bidders within the range, checking whether the construction plan meets basic project technical requirements and whether safety measures are adequate. Bidders with technically disqualified bids are eliminated even if their price is within the range. Then, conduct price evaluation for technically qualified bidders, calculating the deviation of their quote from the benchmark price—the smaller the deviation, the higher the priority. Simultaneously, check if the price composition is reasonable to avoid malicious competition below cost price [4]. Select the best winning candidate: Rank based on the principle of "technically qualified and price closest to the benchmark price". If two bidders have the same deviation value, compare their performance bond amounts or enterprise credit ratings. Finally, determine the top 3 winning candidates and detail the benchmark price calculation process, range setting basis, and elimination reasons in the evaluation report.

2.4 Commercial Bid Ranking Under a Technically Qualified System

Conduct technical bid evaluation: Evaluators, following the principle of "compliance review", check the bid documents one by one against the technical threshold requirements in the tender documents, such as construction qualification grade, allocation of special operation personnel, and completeness of special construction plans. Bid documents that do not meet qualification requirements, fail to provide special plans for hazardous works, or lack safety assurance measures are directly judged as technically disqualified. During review, the responsiveness to each technical requirement must be recorded with checkmarks, and reasons for disqualification must be specified [5]. Qualified screening stage: Summarize the technical bid evaluation results, retaining only technically qualified bidders for the commercial bid evaluation stage. For technically disqualified bidders, list their names and reasons for disqualification separately in the evaluation report, and notify the bidders for signature confirmation. If bidders have objections, they can raise them on site; evaluators must review the objections and issue a review opinion. Conduct detailed commercial bid evaluation: For technically qualified bidders, evaluate from four dimensions: quotation, construction period, payment terms, and performance bond. Quotation review focuses on checking for arithmetic errors and responsiveness to provisional sum agreements; construction period review compares the bid committed period with the tender document requirement, with appropriate bonus points for earlier completion; payment term review prioritizes options favorable to the tendering authority; performance bond review checks the bond amount and issuing bank's qualifications. Set scoring standards for each dimension and calculate the commercial bid score according to the standards [6]. Determine commercial bid ranking: Rank bidders from high to low based on their commercial bid score. The bidder with the highest score is the first winning candidate. If scores are tied, compare the enterprises' performance in similar projects over the past 3 years. The ranking result must be detailed in the evaluation report, listing the commercial bid score breakdown and ranking basis for each bidder, ensuring the review process is transparent and verifiable.

3.Optimization Strategies for the Application of Bidding and Evaluation Methods in Construction Engineering

3.1 Refining Evaluation Indicators to Reduce Subjective Bias

Categorize and sort out core indicators according to the evaluation method. For different methods like the comprehensive evaluation method and reasonable low price method, extract the core review dimensions for technical and commercial bids respectively. This includes focusing on dimensions like construction plan and quality control for technical bids in the comprehensive evaluation method, and concentrating on dimensions like quotation and construction period for commercial bids, ensuring indicators cover key review aspects. Quantitatively decompose each dimension, transforming abstract indicators into measurable sub-items. For example, decompose "Construction Plan" into "Reasonableness of Schedule" and "Adequacy of Resource Allocation". Further define "Reasonableness of Schedule" as "Full marks for key node deviation ≤3 days, deduct 2 points for each additional day". Set the standard for "Adequacy of Resource Allocation" as "Full marks for mechanical equipment quantity compliance rate≥90%", avoiding vague descriptions [7]. Clarify scoring rules and basis, annotating the scoring basis and deduction gradient for each sub-item to form a visual scoring table. On this basis, dynamically calibrate indicators: collect review feedback quarterly, adjust quantification standards for disputed indicators, ensuring they comply with industry norms and accurately reflect bidder strength, thereby reducing differences in evaluators' subjective discretion.

3.2 Dynamically Adjusting Weights to Suit Project Needs

Establish a project classification system: Categorize projects into different types based on technical complexity (e.g., conventional residential, super high-rise, special engineering), investment scale (≤100 million CNY, 100-500 million CNY, >500 million CNY), and quality requirements (ordinary standard, high-quality engineering, Luban Prize target), forming a classification list [8]. Set initial weights by category: Initially set technical bid weight at 60% and commercial bid at 40% for technically complex projects, emphasizing technical capability; initially set technical bid weight at 40% and commercial bid at 60% for conventional residential projects, emphasizing cost control; for large-scale investment projects, appropriately increase the weight of "Payment Terms" in the commercial bid to reduce risk. Organize expert demonstration: Invite industry experts to review the initial weights, proposing adjustment suggestions based on actual project needs. For special engineering projects, the weight of the "Safety Assurance" sub-item might need increasing from 10% to 15%. The demonstration results form written opinions for archiving. Implementation: Incorporate the demonstrated weights into the tender documents, clearly stating the basis for weight adjustment. During evaluation, strictly calculate scores according to the established weights, avoiding ad-hoc adjustments, ensuring weights highly align with project needs.

3.3 Introducing Big Data to Assist Review Decisions

Build an industry database: Collect data from the past 3 years on average quotes for similar projects of different types, enterprise performance scores, and material price fluctuation trends. Store data categorized by project type and region. Simultaneously, connect to government credit platforms to import data on enterprise qualifications and discredit records, ensuring authoritative data sources and comprehensive coverage. Build a big data evaluation system: The system must possess functions for data comparison, risk warning, and automatic scoring, while supporting data visualization to assist evaluators in quick judgment. Subsequently, apply data in evaluation: During bid evaluation, the system automatically retrieves database data, compares bidder quotes with industry benchmark prices, and generates a "Quotation Reasonableness Analysis Report". Combined with historical enterprise performance scores, it labels "high-risk bidders", providing reference for evaluator decisions. Meanwhile, the system automatically calculates scores, reducing

manual calculation errors [9]. Retain review traces: The system records every operation, data source, and warning message, forming a complete review log. After the review, it automatically generates an evaluation report with electronic signatures. Logs and reports are archived simultaneously and can be retrieved for verification at any time.

4. Conclusion

The above analysis shows that the effective application of bidding and evaluation methods in construction engineering requires consideration of both "method suitability" and "process optimization". Different evaluation methods have clear applicable scenarios and operational logic: The comprehensive evaluation method, through weight-based quantitative scoring, is suitable for technically complex projects with high-quality requirements, enabling a comprehensive assessment of the bidder's technical and commercial capabilities. The reviewed lowest bid price method focuses on compliant low prices, suitable for conventional projects with unified technical standards, strengthening cost control. The reasonable low price method, by defining a quotation range, balances cost and technical reliability, avoiding malicious low-price competition. Commercial bid ranking under a technically qualified system first screens technical thresholds and then compares commercial strength, suitable for projects emphasizing performance capability. Refining evaluation indicators can reduce the space for subjective discretion, dynamically adjusting weights can achieve precise matching between methods and project needs, and introducing big data can improve review efficiency and transparency.

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