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Development and Evaluation of A Hybrid AHP–TOPSIS Framework for Contractor Selection in Mining Infrastructure Projects

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Abstract

Contractor selection in mining infrastructure projects requires balancing technical competence, safety, financial capacity, and commercial competitiveness. Conventional qualification screening followed by commercial evaluation may overlook differences in contractor capabilities. This study aimed to develop and evaluate a hybrid Analytic Hierarchy Process–Technique for Order Preference by Similarity to Ideal Solution (AHP–TOPSIS) framework for infrastructure contractor selection at PT XYZ, an Indonesian coal mining company. A mixed-methods approach combined a literature review, semi-structured interviews, expert questionnaires, and tender documentation. Eleven experts and stakeholders participated in the criteria assessment and validation. AHP was used to determine evaluation weights, while TOPSIS was used to rank contractors across three infrastructure projects. Comparative analysis and strategic stakeholder validation were conducted to assess organizational applicability. Technical Capability received the highest weight (25.1%), followed by Health, Safety, Environment, and Security (24.9%), Commercial Competitiveness (18.4%), Financial Capability (15.4%), Performance History (9.4%), and Local Capability and Participation (6.8%). The overall consistency ratio was 0.5%. Contractors SXX, DXX, and MXX ranked first in their respective projects, with preference values of 0.759, 0.718, and 0.685, respectively. These results highlight project-specific suitability and capability considerations beyond price alone. Stakeholder validation supported the framework's applicability while emphasizing the importance of managerial discretion, collaboration, and reliable data. The framework provides structured decision support for mining procurement; however, its broader generalizability and effects on project performance require further evaluation.

INTRODUCTION

Contractors play a critical role in the successful delivery of infrastructure projects within the mining industry (Batdelger et al., 2018; Hickson & Owen, 2022; McCosker, 2002; Moyo, 2025). In large-scale mining operations, infrastructure development activities such as building construction, facility rehabilitation, utility installation, and supporting operational infrastructure are frequently executed by external contractors (Steenkamp & Van der Lingen, 2014). Consequently, contractor performance directly influences project quality, schedule performance, safety performance, operational

continuity, and overall project success. Selecting an appropriate contractor is therefore a strategic decision that affects both project outcomes and organizational performance.

Despite its importance, contractor selection remains a complex decision-making process. Traditional contractor evaluation practices often rely on qualification screening followed by commercial assessment, whereby contractors that meet minimum technical and safety requirements are subsequently evaluated based on bid competitiveness (Olaniran, 2015; Plebankiewicz, 2012). Although such approaches provide a practical procurement mechanism, they may not adequately capture the multidimensional capabilities required for successful project execution. Technical expertise, safety performance, financial capability, historical performance, local participation, and commercial competitiveness may all influence project outcomes, yet these factors are frequently assessed separately or assigned different levels of importance during decision-making.

The complexity of contractor selection has encouraged the application of multicriteria decision-making (MCDM) methods to support more systematic and transparent evaluations (Jato-Espino et al., 2014). MCDM approaches enable decision-makers to evaluate alternatives based on multiple criteria simultaneously while reducing excessive dependence on subjective judgment (Cinelli et al., 2014; Ishizaka & Nemery, 2013). Among the various MCDM methods, the integration of the Analytic Hierarchy Process (AHP) and the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) has been widely adopted because of its ability to combine criteria weighting and alternative ranking within a structured decision framework (Daulay & Dinariyana, 2023; Syafrianita et al., 2023).

Previous studies have demonstrated the usefulness of AHP–TOPSIS in supplier selection, contractor evaluation, project prioritization, and procurement decision-making (Issa et al., 2022; Putri & Nusraningrum, 2022). However, limited research has examined the application of hybrid AHP–TOPSIS models within mining infrastructure projects, where contractor selection decisions involve unique operational, safety, and stakeholder considerations. Furthermore, existing studies generally focus on developing ranking models and identifying preferred alternatives, while relatively limited attention has been given to evaluating the practical applicability of proposed frameworks within organizational settings.

This study addresses these gaps by developing and evaluating a hybrid AHP–TOPSIS framework for infrastructure contractor selection at PT XYZ, one of Indonesia's largest coal mining operations. The proposed framework integrates Technical Capability; Health, Safety, Environment, and Security (HSES); Financial Capability; Performance History; Local Capability and Participation; and Commercial Competitiveness into a structured decision-making model. The framework is applied to three infrastructure project case studies and subsequently evaluated through comparative analysis and strategic expert validation.

The study contributes to the contractor selection and project management literature by extending the application of hybrid AHP–TOPSIS to mining infrastructure projects

and incorporating framework evaluation and strategic stakeholder validation to assess its practical applicability within an organizational context. Therefore, this study aims to develop and evaluate a hybrid AHP–TOPSIS framework for contractor selection in mining infrastructure projects and to assess its practical applicability within an organizational context.

Within the Indonesian organizational context examined in this study, these broader concerns are reflected in infrastructure procurement at PT XYZ, an anonymized large coal mining company. The company's existing contractor selection process combines technical and Health, Safety, Environment, and Security (HSES) qualification assessments with subsequent commercial evaluation. Although this sequence provides an established procurement mechanism, it does not represent every contractor capability as an explicit, consistently weighted assessment dimension. Financial capability, performance history, and local capability and participation may receive consideration depending on tender requirements and available information. The specific research problem is therefore how to integrate these dimensions with technical capability, HSES, and commercial competitiveness while maintaining compatibility with the company's procurement governance and the requirements of individual infrastructure projects.

Multicriteria decision-making (MCDM) provides a methodological basis for addressing this problem by organizing competing evaluation dimensions within an explicit decision structure. Contractor selection research has examined this approach for more than a decade, including San Cristóbal's (2012) application of MCDM methods to contractor selection. A hybrid framework combining the Analytic Hierarchy Process (AHP) and the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) separates two related tasks: determining the relative importance of criteria and ranking contractor alternatives according to those priorities (Hwang & Yoon, 1981; Saaty, 1987). This separation is useful when expert judgments inform organizational preferences while tender records provide evidence regarding individual contractors. However, the resulting rankings remain dependent on the selected criteria, assigned weights, and quality of the underlying assessment data.

Previous research provides substantive support for integrating contractor capabilities and procurement risks within formal evaluation models. Cheaitou et al. (2019) developed a tender evaluation and contractor selection framework for public organizations that explicitly incorporated risk considerations. More recently, Almohassen et al. (2023) developed a contractor prequalification model for the Saudi Arabian construction industry. Their study began with 39 criteria identified from earlier research, used judgments from nine experts to identify 10 important criteria through AHP, and involved 21 specialized managers in subsequent weighting using Multi-Attribute Utility Theory. These studies demonstrate that contractor evaluation can extend beyond commercial comparison and systematically incorporate expert knowledge (Alkaabi & Mahjoob, 2023; Marović et al., 2021). They also show that evaluation criteria and decision structures are shaped by the institutional and industry settings in which procurement occurs.

Related studies further demonstrate the breadth of MCDM applications while clarifying the need for context-specific evaluation. Issa et al. (2022) applied a hybrid AHP–fuzzy TOPSIS approach to selecting deep excavation support systems, illustrating the use of integrated weighting and ranking for a specialized construction decision. Štilić et al. (2023) examined MCDM in public procurement through an empirical study concerning contractor selection for landslide rehabilitation. These applications concern different alternatives, project characteristics, and procurement environments. Their relevance to mining infrastructure lies in the structured treatment of competing criteria rather than in the direct transfer of their evaluation models. Consequently, an organizational application in mining requires criteria that reflect its specific technical demands, HSES considerations, contractor information, and stakeholder priorities.

Taken together, the reviewed studies establish a methodological foundation but leave a contextual question regarding the suitability of an integrated evaluation framework for infrastructure procurement within an operating Indonesian coal mine. The research gap addressed here is not the absence of contractor selection models or the development of AHP–TOPSIS itself. Instead, it concerns how six contractor capability dimensions can be operationalized together and evaluated against existing procurement practices within the setting of PT XYZ. A further question concerns organizational applicability: quantitative rankings alone do not explain whether stakeholders consider a framework feasible, whether the necessary information is available, or how its outputs interact with managerial discretion. Addressing these questions requires examination of both analytical outputs and the organizational conditions surrounding their use.

The urgency of this research arises from the varied requirements of the infrastructure projects included in the study. The three cases comprise roof replacement at an ammonium nitrate storage facility, modification of shipping containers into operational facilities and a first-aid post, and rehabilitation of an operational telecommunications tower. Their approximate contract values are IDR 1.1 billion, IDR 900 million, and IDR 725 million, respectively, with four, seven, and three contractor alternatives. These differences create distinct evaluation demands involving specialized procedures, coordination within active operational areas, and work-at-height competency. An explicit framework can help decision-makers examine how contractor capabilities align with these requirements and document the rationale underlying their preferences. Its practical value therefore warrants assessment across several project contexts rather than through a single illustrative ranking.

The proposed novelty lies in combining a mining-specific evaluation structure with comparative assessment and strategic stakeholder validation. The framework integrates Technical Capability; HSES; Financial Capability; Performance History; Local Capability and Participation; and Commercial Competitiveness within a single AHP–TOPSIS model. It is applied to three completed infrastructure tender cases and compared with the company's existing selection approach. Strategic validation then examines its perceived applicability and implementation requirements within the organization. This combination enables the research to connect criterion weighting and contractor ranking

with questions of procurement practices, data availability, and stakeholder coordination. The intended contribution is therefore an empirically grounded organizational application of established methods, with particular attention to how decision-support outputs can inform procurement judgments.

Accordingly, this study aims to develop and evaluate a hybrid AHP–TOPSIS framework for contractor selection in mining infrastructure projects at PT XYZ. Its specific objectives are to identify and validate relevant criteria and subcriteria, determine their relative weights through expert judgment, rank contractor alternatives across three project cases, compare the proposed framework with existing selection practices, and assess its practical applicability through strategic stakeholder validation. Academically, the study contributes evidence regarding the use of integrated MCDM within a specific mining procurement setting. Practically, it provides a basis for more explicit capability comparisons, traceable evaluation decisions, and improved organization of contractor information. These benefits are assessed in terms of the framework's decision-support potential within the studied company, while its broader applicability and effects on subsequent project performance require further investigation.

METHOD

This study employed a mixed-methods approach to develop and evaluate a hybrid AHP–TOPSIS framework for infrastructure contractor selection in the mining industry. The research combined a literature review, semi-structured interviews, expert judgment, and multicriteria decision-making (MCDM) analysis. Contractor selection criteria and subcriteria were identified and validated, after which their weights were determined and contractor alternatives were ranked using the proposed framework. The framework was subsequently evaluated through comparative decision analysis and strategic expert validation.

Sampling and Research Context

The study was conducted within PT XYZ, a large coal mining company in Indonesia. The unit of analysis consisted of infrastructure contractor selection decisions associated with infrastructure projects executed within the company. Purposive sampling was applied to select respondents possessing relevant knowledge and experience in contractor evaluation, procurement, project execution, and contractor management.

The study involved two groups of participants. The first group consisted of subject matter experts who participated in the criteria validation process and pairwise comparison assessment for AHP weighting. The second group consisted of project stakeholders involved in contractor evaluation activities, including project management, procurement, HSES, and infrastructure personnel. In total, eleven experts and stakeholders participated in the AHP pairwise comparison assessment and validation process.

Three completed infrastructure tender projects were selected as case studies to evaluate the applicability of the proposed Hybrid AHP–TOPSIS framework under different project conditions. The selected projects represent diverse infrastructure scopes,

technical requirements, and contractor participation levels commonly encountered within PT XYZ. A summary of the selected projects is presented in Table 1

Table 1. Selected Infrastructure Project Case Studies

Project	Infrastructure Scope	Contract Value	Contractor Alternatives
Project A	Replacement of an ammonium nitrate magazine roof system within an explosive material storage facility	± IDR 1.1 billion	4
Project B	Modification of shipping containers into operational facilities and first aid post infrastructure	± IDR 900 million	7
Project C	Rehabilitation and structural strengthening of an operational telecommunication tower	± IDR 725 million	3

Project A involved roof replacement works within an explosive material storage facility, requiring strict HSES compliance and specialized work procedures. Project B consisted of facility modification works across multiple operational areas within an active mining environment, requiring significant coordination and mobilization efforts. Project C involved structural rehabilitation of an operational telecommunication tower, requiring specialized work-at-height competency and structural execution capability.

The variation in project characteristics, contract values, operational risks, and contractor participation levels provided an appropriate basis for assessing the applicability of the proposed framework across different infrastructure project contexts.

Data Collection

Data were collected from both primary and secondary sources. Primary data were obtained through semi-structured interviews and expert judgment questionnaires. Semi-structured interviews were conducted to identify relevant contractor selection criteria, validate the proposed evaluation framework, and assess its practical applicability within the organizational context. Expert judgment questionnaires were used to perform pairwise comparisons required for the AHP analysis.

Secondary data were obtained from tender evaluation documents, contractor assessment records, procurement documentation, and project-related information associated with the selected infrastructure projects. To maintain confidentiality, contractor identities and certain commercial information were anonymized throughout the study.

Measures and Data Analysis

The proposed contractor selection framework consisted of six main criteria: Technical Capability, HSES, Financial Capability, Performance History, Local Capability-Participation, and Commercial Competitiveness. These criteria were further decomposed into measurable sub-criteria based on literature findings and expert validation.

The Analytic Hierarchy Process (AHP) was applied to determine the relative importance of the evaluation criteria through pairwise comparison analysis (Saaty, 1987).

The AHP calculations were performed using the AHP Online System (AHP-OS), a web-based decision-support tool developed by Goepel (2018). The tool was used to calculate criteria weights, aggregate expert judgments, and assess the Consistency Ratio (CR) of pairwise comparison matrices. Consistency Ratio values below the recommended threshold of 0.10 were considered acceptable, indicating a satisfactory level of judgment consistency.

Subsequently, the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) was used to rank contractor alternatives based on their weighted performance scores (Hwang & Yoon, 1981). The resulting contractor rankings were compared with existing contractor selection outcomes to evaluate the effectiveness of the proposed framework. Finally, strategic expert validation was conducted to assess implementation feasibility and practical applicability within the organizational environment.

RESULTS AND DISCUSSION

Criteria Weighting Results

The AHP analysis was conducted to determine the relative importance of the contractor selection criteria and sub-criteria. The consolidated results are presented in Table 2. The overall Consistency Ratio (CR) of 0.5% indicates an acceptable level of consistency in expert judgments and confirms the reliability of the weighting process.

Table 2. Criteria and Sub-Criteria Weights

Main Criteria	Weight	Rank	Sub-Criteria	Local Weight
Technical	25.1%	1	Technical Expertise	32.7%
			Qualified Personnel	30.9%
			PM Capability	22.2%
			Equipment Availability	14.2%
HSES	24.9%	2	HSES Management System	33.6%
			Safety Performance Record	27.6%
			Workforce Safety Competency	25.6%
			Risk Management Capability	13.2%
Financial	15.4%	4	Liquidity & Cash Flow	47.7%
			Financial Stability	28.2%
			Access to Financial Resources	24.1%
Performance History	9.4%	5	Project Delivery	39.6%
			Experience in Similar Project	38.7%
			Contractor Performance Evaluation	21.7%
Local Capability-Participation	6.8%	6	Workforce Utilization	50.0%
			Local Development	30.0%
			Supplier Involvement	20.0%
Commercial	18.4%	3	Bid Price Competitiveness	54.8%
			Cost Realism	45.2%

The results indicate that Technical Capability (25.1%) and HSES (24.9%) were identified as the two most important criteria, jointly accounting for approximately half of the total decision weight. Commercial Competitiveness ranked third with a weight of 18.4%, followed by Financial Capability (15.4%), Performance History (9.4%), and

Local Capability-Participation (6.8%). These findings suggest that contractor capability and operational risk considerations were prioritized over purely commercial factors in the contractor selection process.

At the sub-criteria level, Technical Expertise, HSES Management System, Liquidity and Cash Flow, Project Delivery, Workforce Utilization, and Bid Price Competitiveness received the highest local priorities within their respective criteria groups. The results demonstrate that experts considered technical competence, safety management, financial sustainability, delivery performance, local workforce involvement, and commercial competitiveness as critical factors influencing contractor selection decisions.

Contractor Ranking Results

The weighted criteria obtained from the AHP analysis were subsequently incorporated into the TOPSIS model to evaluate and rank contractor alternatives across three infrastructure project case studies. The final contractor ranking results are presented in Table 3.

Table 3. Final Contractor Ranking Results

Project	Contractor	Preference Value	Rank
Project A - P8 Ammonium Nitrate Magazine Roof Replacement	SXX	0.759	1
	KXV	0.561	2
	KKX	0.474	3
	HXX	0.330	4
Project B - ADT Workshop & Inul Lignite First Aid Post Container Modification	DXX	0.718	1
	KMX	0.689	2
	SKX	0.521	3
	KXV	0.473	4
	KKX	0.463	5
	HXX	0.387	6
	MMX	0.301	7
Project C - Service of Rehabilitation Far North Tower	MXX	0.685	1
	SXX	0.558	2
	OXX	0.354	3

For Project A, contractor SXX achieved the highest preference value (0.759), indicating the strongest overall performance among the evaluated alternatives. For Project B, contractor DXX obtained the highest preference value (0.718), followed closely by KMX (0.689). In Project C, contractor MXX achieved the highest preference value (0.685), while OXX received the lowest ranking among the evaluated alternatives.

The results indicate that contractor rankings varied across projects depending on the combination of technical capability, HSES, financial capability, performance history, local capability-participation, and commercial competitiveness. The findings demonstrate the ability of the proposed framework to differentiate contractor performance across different project contexts and contractor profiles.

Framework Evaluation Results

To assess the effectiveness of the proposed framework, the contractor evaluation approach currently practiced within PT XYZ was compared with the proposed Hybrid AHP–TOPSIS framework. The comparison is presented in Table 4.

Table 4. Comparison Between Existing Contractor Selection Practice and Proposed Hybrid AHP–TOPSIS Framework

Evaluation Aspect	Existing Contractor Selection Practice	Proposed Hybrid AHP-TOPSIS Framework
Technical Capability	Assessed as a minimum qualification requirement during technical evaluation	Assessed as a weighted evaluation criterion within the decision framework
HSES	Assessed as a minimum qualification requirement during HSES evaluation	Assessed as a weighted evaluation criterion within the decision framework
Financial Capability	Considered during tender evaluation when relevant information is available	Assessed as an explicit weighted evaluation criterion
Performance History	Considered based on previous project experience and available performance records	Assessed as a structured weighted evaluation criterion
Local Capability-Participation	Considered as part of tender requirements when applicable	Assessed as a structured weighted evaluation criterion
Commercial Competitiveness	Evaluated after qualification assessment and commonly used as a primary selection factor	Integrated with other evaluation criteria within a multi-criteria decision-making process
Evaluation Output	Qualification results and commercial comparison among eligible contractors	Preference values and contractor ranking results
Decision Process	Sequential evaluation process consisting of qualification assessment followed by commercial evaluation	Integrated evaluation process combining all criteria within a single decision framework

The comparison shows that the existing contractor selection process primarily relies on qualification-based technical and HSES assessments followed by commercial evaluation. In contrast, the proposed framework incorporates multiple contractor capability dimensions within a structured multi-criteria decision-making process. Financial Capability, Performance History, and Local Capability-Participation are explicitly evaluated as weighted criteria rather than being considered informally or only when required.

Furthermore, the proposed framework generates quantitative preference values and contractor rankings that provide additional decision-support information beyond conventional qualification and commercial assessment approaches. These findings indicate that the framework offers a more comprehensive mechanism for evaluating contractor performance while maintaining compatibility with the existing tender governance structure.

Strategic Validation Results

To complement the analytical evaluation, a strategic validation interview was conducted with a senior project stakeholder possessing extensive experience in mining infrastructure project execution and contractor management. The validation results are summarized in Table 5.

Table 5. Strategic Validation Summary

Validation Theme	Strategic Feedback
Applicability	Framework is applicable within PT XYZ and can support contractor selection decisions.
Management Intervention	Final decisions may still be influenced by management discretion despite analytical results.
Cross-Functional Implementation	Successful implementation requires collaboration between project, procurement, and management stakeholders.
Financial Assessment	Financial data can be maintained through historical contractor records and periodic verification.
Contractor Library Concept	Establishing a centralized contractor database would improve evaluation efficiency and consistency.
Payment Commitment	Timely owner payments can reduce contractor cash-flow risks and improve financial performance.
Transparency	The proposed framework is more robust because it evaluates a broader set of contractor capability dimensions.

The interview results indicate that the proposed Hybrid AHP–TOPSIS framework is considered applicable within PT XYZ and capable of supporting contractor selection decision-making. The stakeholder acknowledged that the framework provides a more robust evaluation structure by integrating multiple contractor capability dimensions into a single decision-making process. However, the interview also highlighted that final contractor selection decisions may still be influenced by managerial discretion and organizational considerations that extend beyond quantitative evaluation results.

The validation further emphasized the importance of cross-functional collaboration among project, procurement, and management stakeholders during implementation. The stakeholder also supported the development of a centralized contractor information library containing historical contractor performance records, financial information, tender submissions, and project experience data to improve future evaluation efficiency and consistency. Overall, the strategic validation results support the practical applicability of the proposed framework while identifying several organizational considerations that should be addressed during implementation.

This study aimed to develop and evaluate a Hybrid AHP–TOPSIS framework to support infrastructure contractor selection within the mining industry. The results demonstrate that the proposed framework provides a structured approach for integrating multiple contractor evaluation dimensions into a single decision-making process. By combining AHP-based weighting with TOPSIS-based ranking, the framework enables contractor selection decisions to consider technical, safety, financial, performance, local participation, and commercial factors simultaneously.

The criteria weighting results indicate that Technical Capability and HSES were identified as the most influential factors in contractor selection. Together, these two criteria accounted for approximately half of the overall decision weight. This finding is consistent with the characteristics of mining infrastructure projects, where operational safety, regulatory compliance, and technical execution capability play critical roles in determining project success. The result also supports previous contractor selection studies that emphasize the importance of technical competence and risk management considerations beyond purely cost-based evaluation approaches (Almohassen et al., 2023; Araujo et al., 2015; San Cristóbal, 2012). A similar emphasis on quality, health and safety, and price has been reported in AHP–TOPSIS-based subcontractor selection for building construction projects (Putri & Nusraningrum, 2022).

The contractor ranking results further demonstrate the capability of the proposed framework to differentiate contractor performance across various project contexts. The framework generated different ranking outcomes for each case study project, indicating that contractor suitability depends on the interaction between project requirements and contractor capability profiles. These findings support the argument that contractor selection should be treated as a multi-criteria decision problem rather than relying primarily on qualification screening and bid price comparison. Similar conclusions have been reported in previous studies highlighting the advantages of multi-criteria decision-making methods for contractor evaluation and tender assessment (Cheaitou et al., 2019; Štilić et al., 2023). This finding confirms that contractor superiority is project-dependent rather than universal across all infrastructure projects.

An important contribution of this study lies in extending the discussion beyond contractor ranking outcomes. While many previous studies focus primarily on methodological development and alternative ranking, this study also evaluated the practical applicability of the proposed framework through comparative analysis and strategic stakeholder validation. The comparison with the existing contractor selection practice indicates that the framework provides a more comprehensive evaluation structure by explicitly incorporating Financial Capability, Performance History, and Local Capability-Participation alongside Technical Capability, HSES, and Commercial Competitiveness. Consequently, contractor evaluation is no longer limited to qualification assessment and commercial comparison but incorporates broader organizational and operational considerations.

The strategic validation results further support the practical relevance of the framework. The stakeholder interview confirmed that the framework is generally applicable within PT XYZ and aligns with existing contractor evaluation processes. However, the validation also highlighted several implementation considerations. First, final contractor selection decisions may still be influenced by managerial discretion and organizational priorities. Second, successful implementation requires collaboration among project, procurement, and management stakeholders. Third, the availability and consistency of contractor evaluation data remain important prerequisites for effective implementation. These findings reinforce the importance of considering organizational

context when introducing analytical decision-support tools. The validation results also suggest that analytical decision-support tools should be viewed as decision-enabling rather than decision-replacing mechanisms, as final contractor selection decisions may still involve managerial judgment and organizational considerations.

From a managerial perspective, the proposed framework offers several practical benefits for contractor selection within mining organizations. The framework provides a transparent mechanism for evaluating contractors across multiple dimensions while maintaining compatibility with existing procurement governance processes. In addition, the recommendation to establish a centralized contractor information library can support future evaluation activities by improving data availability, consistency, and traceability. Such an approach may contribute to more informed contractor selection decisions and facilitate organizational learning from previous tender outcomes. Several limitations associated with the research context, weighting process, and stakeholder representation are discussed in the following section.

CONCLUSION

This study developed and evaluated a hybrid AHP–TOPSIS framework for contractor selection in mining infrastructure projects. The results demonstrated that the proposed framework effectively integrated Technical Capability, Health, Safety, Environment, and Security (HSES), Financial Capability, Performance History, Local Capability and Participation, and Commercial Competitiveness into a structured decision-making process. The AHP analysis identified Technical Capability and HSES as the most influential criteria, while the TOPSIS analysis effectively differentiated contractor performance across three infrastructure project case studies.

The findings indicated that contractor selection decisions should not rely solely on qualification screening and commercial evaluation. By simultaneously incorporating multiple dimensions of contractor capability, the proposed framework provided a more comprehensive assessment of contractor suitability across different project contexts. Furthermore, the strategic validation results supported the practical applicability of the framework and highlighted its potential to improve decision-making consistency and transparency in mining infrastructure procurement processes.

This study contributed to the contractor selection and project management literature by demonstrating the application of an integrated multicriteria decision-making (MCDM) approach in the mining industry. Beyond methodological development, the study incorporated strategic stakeholder validation, providing insights into organizational factors that could influence the successful implementation of decision-support frameworks in practice. Consequently, the proposed framework provided a practical decision-support mechanism for enhancing transparency, consistency, and capability-based contractor selection in mining infrastructure projects.

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