

PAPER

Integrating Affective Computing and MCDM in Mobile Interactive Systems for Construction Project Manager Selection

Nurul Hafizah Hazwani
Hashim, Mohd Nasrun
Mohd Nawati (✉), Mohd
Faizal Omar

Universiti Utara Malaysia,
Kedah, Malaysia

nasrun@uum.edu.my

ABSTRACT

Selecting an effective construction project manager is critical to project success, given the complex, high-risk, and people-intensive nature of construction environments. While existing selection frameworks emphasize technical expertise and managerial experience, behavioral and emotional factors that influence leadership and team performance are often assessed subjectively or overlooked. Moreover, conventional multi-criteria decision-making (MCDM) approaches remain largely static and are not designed to capture emotion-related dynamics during evaluation. To address these limitations, this study proposes an integrated framework that combines a mobile interactive system for affective computing with MCDM techniques for construction project manager selection. Facial expressions elicited during structured interview scenarios are analyzed using deep learning-based emotion recognition, incorporating both categorical emotions and pleasure–arousal–dominance (PAD)–based intensity measures to quantify emotional intelligence objectively. These affective indicators are then integrated with technical, managerial, and communication criteria within an MCDM framework to generate systematic and transparent candidate rankings. The proposed approach advances existing selection methods by operationalizing emotional intelligence as a measurable decision attribute and embedding it within a structured decision-support system. By enabling the joint evaluation of cognitive and affective competencies through a platform-independent framework, this study offers a more holistic, consistent, and context-aware basis for construction project manager selection, with practical implications for improving managerial effectiveness and project outcomes.

KEYWORDS

affective computing, multi-criteria decision-making (MCDM), emotional intelligence (EI), convolutional neural network (CNN), construction project manager selection

Hashim, N. H. H., Nawati, M. N. M., Omar, M. F. (2026). Integrating Affective Computing and MCDM in Mobile Interactive Systems for Construction Project Manager Selection. *International Journal of Interactive Mobile Technologies (iJIM)*, 20(9), pp. 69–79. <https://doi.org/10.3991/ijim.v20i09.61575>

Article submitted 2026-01-16. Revision uploaded 2026-03-19. Final acceptance 2026-03-20.

© 2026 by the authors of this article. Published under CC-BY.

1 INTRODUCTION

The rapid growth of construction projects has intensified the need for competent project managers, making their selection a critical challenge in construction project management. Project managers are responsible for ensuring that projects are delivered on time, within budget, and to the required quality standards, while coordinating diverse teams with varying objectives and priorities. Their leadership, decision-making, and self-awareness directly influence project outcomes, highlighting the importance of assessing both technical and interpersonal competencies.

Construction projects are inherently complex and subject to uncertainty, with risks arising from internal and external factors. Ineffective management of these risks can result in project delays, cost overruns, and reduced operational viability [1]. Consequently, systematic risk management is essential, yet many construction firms, particularly in developing countries, struggle to implement it due to limited tools and processes for informed decision-making. Frameworks that integrate structured risk management while accounting for real-world constraints are therefore urgently needed.

Selecting an appropriate project manager is one of the most critical decisions for construction companies [2]. Given the multidimensional nature of the selection problem, multi-criteria decision-making (MCDM) techniques are particularly suitable. These approaches allow decision-makers to evaluate candidates across multiple technical, managerial, and interpersonal criteria, assigning utility scores for each criterion [3]. MCDM encompasses two main paradigms: multi-objective decision making (MODM), which optimizes solutions in well-structured, clearly bounded problems, and multi-attribute decision making (MADM), which addresses complex, poorly structured problems characterized by uncertainty and evolving objectives. Both paradigms provide a rigorous basis for systematic project manager evaluation.

Beyond technical skills, emotional intelligence (EI) and affective responses significantly influence performance in high-stress construction environments [4]. Recognizing this, the proposed framework integrates emotion-aware indicators, derived from facial and speech analysis using affective computing techniques, into the MCDM process. By combining pleasure–arousal–dominance (PAD)-based emotional intensity measures with traditional selection criteria, the framework enables a holistic, quantitative, and objective assessment of candidates. Furthermore, the pipeline is platform-independent, supporting deployment on both desktop and mobile devices, which facilitates real-time or asynchronous evaluations in diverse organizational contexts.

This approach provides construction managers with a robust toolset for incorporating both technical competencies and soft skills into hiring decisions, ultimately enhancing project performance and managerial effectiveness.

The paper is organized as follows: Section 2 reviews relevant literature; Section 3 details the proposed methodology, including each stage of the affective computing and MCDM components; Section 4 presents a practical application of the framework in a construction company; and Section 5 concludes with managerial insights and implications.

2 RELATED WORKS

Studies in [5] determine and rank the particular abilities that a project manager needs to have in order to guarantee the success of a construction project.

After a thorough theoretical analysis, 10 technical and 22 soft skills were shown to be crucial for project managers to guarantee the success of building projects. To assess the relative significance and connections between the indicated talents, a preliminary questionnaire was employed. The expert questionnaire that followed was evaluated using two analytical techniques: the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) for skills based on the success factors and the Stepwise Weight Assessment Ratio Analysis (SWARA) for skills and the primary success factors of the construction project. All project manager abilities were considered to be of significant importance, according to the preliminary questionnaire, with percentages ranging from 0.7 to 0.818. Furthermore, there was a medium association (0.707) for technical skills and a moderate to weak correlation (ranging from 0.005 to 0.686) for soft skills. Coordination, general project management knowledge, communication, interpersonal relationships, and organization were shown to be the top five skills. The preference order of soft skills, as determined by the TOPSIS technique, was coordination skill (0.98), supervision (0.552), and general project management knowledge (0.473). Legal expertise (0.672), oral skills and listening (0.369), and planning, strategic planning, and goal setting (0.359) were shown to be the most preferred technical capabilities. The results of this study offer a framework for choosing a project manager based on these capabilities and help those in charge of making judgments regarding the most crucial abilities needed for a project manager.

To further enhance the decision-making process, [6] uses a combination of deep learning and MCDM techniques to solve the managers' selection issue. As a result, several methods will be examined and contrasted, including convolutional neural networks and other algorithmic modifications. As part of the input, the emotion in our face's emotion recognition intensity value will be sent to MCDM, which will ultimately produce an impartial and high-quality decision. By including EI in the decision-making process, it is expected that this study will help companies find the ideal candidate for construction project managers and streamline and implement an efficient hiring process. As a result, this study is in line with the national construction agenda under the Construction 4.0 Strategic Plan (2021–2025), which calls for adjustments to be made in the construction sector in line with the quick advancement of technology and more intelligent systems. It places a strong emphasis on improving skills and knowledge in addition to using digital technology.

Another approach in similar studies is presented in [7], which chose a project manager based on soft talents using fuzzy logic. A focus group interview was used in the first step to determine the weights based on the chosen list of soft talents. The fuzzy TOPSIS logic was used in the second stage. A closeness coefficient is established to ascertain the ranking order of all options in accordance with the fuzzy TOPSIS idea. The outcomes made it possible to create the framework known as "fuzzy TOPSIS-ranked multi-criteria" for choosing the best applicant based on the chosen profile and criteria. This study's contribution is to enable the assignment of values to soft talents, which are essentially subjective. This framework is user-friendly, requires little investment, and can be modified for many situations.

3 METHODOLOGY

This study proposes a structured methodological framework that integrates affective computing with MCDM to support construction project manager selection. The framework is designed to promote systematic evaluation, objectivity, and reproducibility, while extending conventional selection practices by

incorporating emotion-aware indicators. Figure 1 provides the working design of the proposed model.

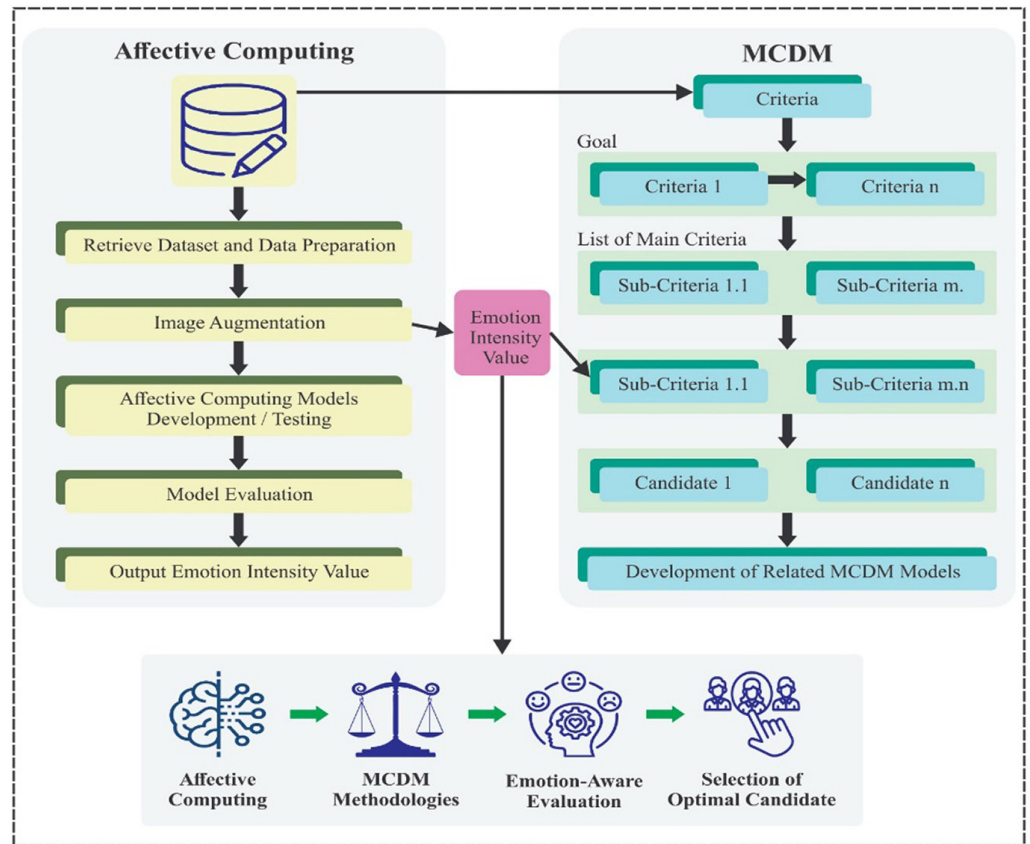


Fig. 1. Working design of the proposed model

3.1 Candidate selection and data collection

Within the proposed framework, a group of selected construction project manager candidates are to be evaluated through a structured selection process. Each candidate is expected to participate in a standardized interview session containing a problem-solving exercise designed to elicit both technical responses and emotional reactions. Multiple data sources were collected for each candidate, including professional background information, technical and managerial assessments, and affective data.

The decision criteria employed in this study are derived from the empirical findings of [8], [9], in which senior managers from eighteen major construction organizations were surveyed to identify factors used in construction project manager selection. The criteria summarized in Table 1 represent consolidated industry perspectives and form the baseline inputs to the proposed MCDM framework. This study extends the original criteria by operationalizing emotion-related factors through affective computing, enabling their inclusion as quantifiable decision attributes.

Professional and demographic attributes, such as age, educational background, total work experience, experience as a project manager, experience in similar projects, and project success rate, will be recorded [10]. Technical competency, leadership

ability, risk management capability, decision-making skill, and communication performance will then be evaluated using standardized assessments and expert panel reviews. All collected attributes will be structured and normalized to facilitate their integration into a unified decision matrix for subsequent MCDM analysis.

Table 1. Candidate parameter description for CPM selection

No.	Category	Criterion	Possible Options/Scale
1	Technical & Professional Background	Total years of experience	0–45 years
		Years of experience as a project manager	0–30 years
		Years of experience in similar projects	0–30 years
		Project success rate	0–100%
		Technical competency score	0–100 points
2	Educational Background	Highest academic qualification	Diploma – B.E – M.E – PhD
		Field of specialization	Civil – Mechanical – Electrical
		Professional certifications	None – PMP – PRINCE2 – Six Sigma
3	Demographic Features	Age	25–70 years
4	Managerial Abilities	Leadership ability score	0–100 points
		Team management capability	0–100 points
		Risk management ability	0–100 points
		Decision-making skill	0–100 points
5	Communication & Soft Skills	General communication skill	0–100 points
		English communication skill	0–100 points
6	Affective Computing Outputs	Emotional Intelligence Score (EIS)	0–1 (Fused Score)
7	Overall Evaluation	Overall MCDM score	0–1 (Composite Score)

3.2 Affective computing component

The affective computing component of the framework is designed to extract emotion-related indicators from facial data captured during structured interview scenarios. To enhance the granularity of emotion modeling, a hybrid multi-learning approach is adopted, integrating categorical emotion labels with PAD [11] annotations. Categorical labels capture discrete emotional states (e.g., joy, anger, and sadness), while PAD provides continuous measures of emotion intensity and subtle variations within each category. For instance, Joy can manifest as calm contentment or intense elation, which categorical labels alone cannot distinguish. By incorporating PAD dimensions, the framework preserves interpretability while enabling quantitative assessment of emotional intensity, a critical input for evaluating emotional intelligence (EI) criteria, which are otherwise subjective.

PAD-based emotional intelligence annotation. Fourteen emotions were selected to capture the full spectrum of affective states relevant to project management and interpersonal evaluation: amusement, anger, anxiety, interest, joy,

sadness, surprise, disgust, fear, trust, anticipation, love, shame, and pride. Covering positive, negative, and motivational states, this set ensures comprehensive representation across valence and arousal dimensions critical for assessing emotional intelligence. The selection is grounded in the Geneva Emotional Competence Test (GECe) [12], a validated tool for measuring workplace EI, ensuring that the chosen emotions reliably reflect affective responses central to professional decision-making and interpersonal effectiveness.

Each emotion is mapped to a three-dimensional PAD vector, where Pleasure (P) reflects valence, Arousal (A) represents activation, and Dominance (D) indicates perceived control or influence. Expert-annotated PAD values serve as reference points for model training and allow the translation of facial expressions into numeric EI indicators, providing an objective foundation for candidate assessment. By converting subjective emotional competence into quantified scores, the framework supports multi-criteria decision-making in candidate selection, linking emotional expression directly to measurable EI criterion.

Facial emotion recognition. Facial emotion recognition will be conducted through a multi-stage pipeline designed to capture both static facial characteristics and dynamic emotional variations as depicted in Figure 2. The proposed pipeline integrates facial preprocessing, deep feature extraction, optical flow-based motion analysis, and temporal aggregation to support robust emotion modeling in interview-based assessment scenarios. This pipeline is platform-independent, allowing implementation on desktop or mobile devices for flexible, real-time emotion assessment.

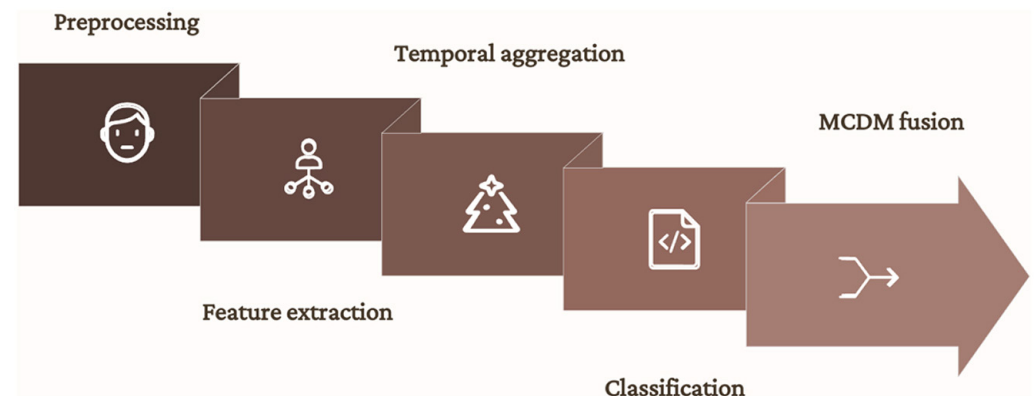


Fig. 2. Facial emotion recognition pipeline of the proposed model

Facial preprocessing is proposed to be performed using the OpenFace [13] toolkit, which enables face detection and 68-point facial landmark extraction. Face alignment and data augmentation techniques, including rotation, scaling, and translation, will be applied to improve robustness against pose variation and environmental noise. These steps are intended to simulate real-world interview conditions and reduce potential overfitting.

Following preprocessing, facial feature extraction is proposed to employ a convolutional neural network (CNN) using a transfer learning strategy. A pre-trained CNN architecture is intended to be initialized to leverage generalizable facial representations learned from large-scale datasets. The network is then proposed to be fine-tuned using the existing interview facial dataset to learn task-specific features relevant to emotion recognition. Within this framework, the CNN is designed to

jointly predict categorical emotion labels and continuous PAD values, enabling a multi-task learning approach that integrates both classification and regression objectives. Specifically, categorical emotion prediction is proposed to be optimized using a cross-entropy loss function, while PAD dimension estimation is optimized using a regression-based loss function, such as mean squared error. The combined loss formulation is intended to preserve categorical interpretability while simultaneously modeling emotional intensity and control levels captured by the PAD dimensions.

To further enhance sensitivity to subtle emotional cues, optical flow analysis based on the DeepFlow [14] algorithm is proposed to estimate facial muscle movements across consecutive video frames. This component is intended to facilitate the detection of micro-expressions and rapid emotional transitions, which are particularly relevant in interview and problem-solving contexts where emotional states may fluctuate over time.

Finally, temporal aggregation mechanisms are proposed to address emotional variability across interview sequences. Sequential modeling techniques, including CNN–LSTM architectures and sliding window strategies, are intended to capture dominant emotional patterns and derive stable, representative emotion intensity values over time. These outputs include both categorical predictions and PAD-based intensity indicators, which are then translated into quantitative EIS for each candidate.

3.3 Integration with MCDM Component

The emotion intensity values and emotional intelligence indicators generated by the affective computing module are incorporated into the MCDM framework as evaluation criteria. A hierarchical decision structure is proposed, consisting of main criteria and sub-criteria representing technical, managerial, communication, and affective dimensions. Emotional intelligence and emotion intensity are explicitly positioned within the hierarchy to complement conventional assessment measures.

Established MCDM techniques, TOPSIS [15] and VIKOR [16], will be employed to process the integrated decision matrix and generate candidate rankings. These methods are selected due to their demonstrated capability to handle multiple, potentially conflicting criteria while producing transparent, interpretable, and robust ranking outcomes. TOPSIS excels in identifying candidates closest to the ideal solution by considering both positive and negative criteria simultaneously, whereas VIKOR emphasizes compromise solutions, balancing trade-offs among competing criteria and facilitating consensus-based decision-making. The integration of these MCDM techniques is motivated by the premise that candidates with higher emotional intelligence, quantified through PAD-based (Pleasure–Arousal–Dominance) affective indicators, are more likely to exhibit competencies like effective leadership, communication, and decision-making, widely acknowledged as critical in construction project management yet insufficiently captured through conventional assessment methods alone.

4 DISCUSSION

This study contributes to the ongoing effort to improve construction project manager evaluation by demonstrating how affective computing can be meaningfully embedded within a MCDM framework. While previous studies have consistently

highlighted the importance of technical competence and managerial experience, emotional and behavioral dimensions have often remained implicit or subjectively assessed. The findings of this research reinforce the view that emotional intelligence is not merely a complementary trait but a measurable capability that can be systematically incorporated into formal decision-support systems.

A key methodological contribution of this work lies in translating affective behavior into quantifiable decision inputs. Rather than relying on self-reported emotional intelligence scores or unstructured interview impressions, the proposed framework captures facial expressions during standardized interview scenarios and maps them to both categorical emotions and continuous PAD-based intensity measures. This dual representation allows subtle emotional variations such as differences in emotional regulation or dominance under pressure to be captured in a way that categorical labels alone cannot achieve. As a result, emotional intelligence is operationalized as an observable and continuous construct, strengthening its role within structured evaluation processes.

The integration of these affective indicators into TOPSIS and VIKOR further enhances the practical relevance of the framework. By positioning emotional intelligence alongside technical, managerial, and communication criteria, the selection process more closely reflects the realities of construction project leadership, where decision-making, stress management, and interpersonal interaction occur simultaneously. The use of complementary MCDM techniques enables decision-makers to examine both ideal-solution proximity and compromise-based rankings, thereby supporting balanced and transparent hiring decisions rather than single-method outcomes.

From a managerial perspective, the proposed approach offers a pragmatic solution to long-standing challenges in project manager selection. Construction firms often rely heavily on experience-based judgment, which, while valuable, can introduce inconsistency and bias. By embedding affective computing within a structured decision framework, the proposed system supports more consistent and defensible evaluations without eliminating managerial discretion. Its platform-independent design also allows assessments to be conducted flexibly using desktop or mobile devices, making the framework suitable for both centralized and remote evaluation settings.

Beyond immediate application, the framework provides a foundation for future research into intelligent and human-centered decision-making systems. Its modular structure allows additional affective modalities, alternative deep learning architectures, or different MCDM techniques to be incorporated with minimal disruption. This adaptability is particularly valuable in construction management research, where project contexts, organizational cultures, and technological maturity vary widely.

Several limitations should nonetheless be acknowledged. Emotional expressions can be influenced by cultural norms, individual differences, and situational factors, which may affect the generalizability of affective indicators. Although PAD-based modeling reduces some subjectivity, reliance on facial cues alone may not fully capture internal emotional states. Future studies could strengthen the framework by incorporating multimodal signals such as speech, gesture, or physiological data; validate the model across larger and more diverse samples; and explore adaptive MCDM annotation schemes. In particular, the use of dynamic MCDM weighting and uncertainty-aware soft-label PAD annotations, where emotional states are represented as ranges rather than fixed values, may better accommodate cultural variation, individual differences, and situational influences, thereby improving robustness and generalizability.

5 CONCLUSION

This study presented an integrated affective computing and MCDM framework for construction project manager selection, addressing key shortcomings of traditional, static evaluation approaches. By combining deep learning-based facial emotion analysis with PAD-based emotional intensity modeling and established decision-making techniques, the framework enables a more holistic and objective assessment of candidates across technical, managerial, communication, and affective dimensions.

The primary contribution of this research lies in demonstrating how emotional intelligence can be operationalized as a measurable and actionable criterion within a formal decision-support system. In doing so, the proposed approach strengthens both methodological rigor and practical relevance, offering construction organizations a more balanced and transparent basis for managerial selection. Future research may extend this work through multimodal affective analysis, longitudinal validation, and large-scale deployment in diverse construction environments.

6 ACKNOWLEDGEMENT

This study was supported by the Ministry of Higher Education (MoHE) of Malaysia through the Fundamental Research Grant Scheme (FRGS/1/2022/TK01/UUM/02/1). Our sincere thanks to RIMC UUM and UUM for the monetary and other assistance that propelled us towards the finishing line. We also express our utmost gratitude to all parties, directly or indirectly, for completing the study.

7 REFERENCES

- [1] U. Elraaid, I. Badi, and M. B. Bouraima, "Identifying and addressing obstacles to project management office success in construction projects: An AHP approach," *Spectrum of Decision Making and Applications*, vol. 1, no. 1, pp. 33–45, 2024. <https://doi.org/10.31181/sdmap1120242>
- [2] F. Torfi and A. Rashidi, "Selection of project managers in construction firms using analytic hierarchy process (AHP) and fuzzy topsis: A case study," *Journal of Construction in Developing Countries*, vol. 16, no. 1, pp. 69–89, 2011. https://eprints.usm.my/42162/1/JCDC_16_1_ART_4_69-89_.pdf
- [3] T. Avramova, T. Peneva, and A. Ivanov, "Overview of existing multi-criteria decision-making (MCDM) methods used in industrial environments," *Technologies*, vol. 13, no. 10, p. 444, 2025. <https://doi.org/10.3390/technologies13100444>
- [4] M. A. M. Fateh, A. N. Supian, and C. S. Goh, "Managing emotional intelligence of construction players during COVID-19 in Malaysia," *Journal of Construction in Developing Countries*, vol. 29, no. 1, pp. 191–210, 2024. <https://doi.org/10.21315/jcdc-04-23-0036>
- [5] M. A. Mansor, "Multi-criteria decision making for prioritizing project manager skills according to construction project success factors," *Engineering, Technology and Applied Science Research*, vol. 15, no. 2, pp. 21861–21875, 2025. <https://doi.org/10.48084/etasr.10083>
- [6] M. N. M. Nawi, M. F. Omar, R. A. Odeh, A. G. Hanafi, F. A. A. Nifa, and M. K. I. A. Rahim, "A conceptual approach of an integrated multi criteria decision making techniques and deep learning for construction project managers selection problem," *International Journal of Interactive Mobile Technologies*, vol. 18, no. 13, pp. 166–178, 2024. <https://doi.org/10.3991/ijim.v18i13.49119>

- [7] L. F. da Silva, P. S. Gonçalves De Oliveira, G. Grander, R. Penha, and F. S. Bizarrias, “Soft skills fuzzy TOPSIS ranked multi-criteria to select project manager,” *International Journal of Information and Decision Sciences*, vol. 16, no. 1, pp. 19–45, 2024. <https://doi.org/10.1504/IJIDS.2024.10061740>
- [8] S. Moradi, K. Kähkönen, and K. Aaltonen, “Comparison of research and industry views on project managers’ competencies,” *International Journal of Managing Projects in Business*, vol. 13, no. 3, pp. 543–572, 2020. <https://doi.org/10.1108/IJMPB-04-2019-0085>
- [9] R. Kassa, I. Ogundare, B. Lines, J. B. Smithwick, N. J. Kepple, and K. T. Sullivan, “Developing a construct to measure contractor project manager performance competencies,” *Engineering, Construction and Architectural Management*, vol. 32, no. 3, pp. 2003–2021, 2023. <https://doi.org/10.1108/ECAM-12-2022-1122>
- [10] K. Szczepańska-Woszczyzna and S. Gatnar, “Key competences of research and development project managers in high technology sector,” *Forum Scientiae Oeconomia*, vol. 10, no. 3, pp. 107–130, 2022. https://doi.org/10.23762/FSO_VOL10_NO3_6
- [11] A. Mehrabian, “Pleasure-arousal-dominance: A general framework for describing and measuring individual differences in temperament,” *Current Psychology*, vol. 14, pp. 261–292, 1996. <https://doi.org/10.1007/BF02686918>
- [12] K. Schlegel and M. Mortillaro, “The Geneva Emotional Competence test (GECO): An ability measure of workplace emotional intelligence,” *Journal of Applied Psychology*, vol. 104, pp. 559–580, 2018. <https://doi.org/10.1037/apl0000365>
- [13] J. Hu, L. Mathur, P. P. Liang, and L.-P. Morency, “OpenFace 3.0: A lightweight multitask system for comprehensive facial behavior analysis,” *arxiv preprint arxiv:2506.02891*, 2025. [Online]. Available: <http://arxiv.org/abs/2506.02891>
- [14] P. Weinzaepfel, J. Revaud, Z. Harchaoui, and C. Schmid, “DeepFlow: Large displacement optical flow with deep matching,” in *Proceedings of the IEEE International Conference on Computer Vision*, Institute of Electrical and Electronics Engineers Inc., 2013, pp. 1385–1392. <https://doi.org/10.1109/ICCV.2013.175>
- [15] C.-L. Hwang and K. Yoon, “Methods for multiple attribute decision making,” in *Multiple Attribute Decision Making: Methods and Applications A State-of-the-Art Survey*, C.-L. Hwang and K. Yoon, Eds., Berlin, Heidelberg: Springer Berlin Heidelberg, 1981, pp. 58–191. https://doi.org/10.1007/978-3-642-48318-9_3
- [16] S. Opricovic and G. H. Tzeng, “Compromise solution by MCDM methods: A comparative analysis of VIKOR and TOPSIS,” *Eur. J. Oper. Res.*, vol. 156, no. 2, pp. 445–455, 2004. [https://doi.org/10.1016/S0377-2217\(03\)00020-1](https://doi.org/10.1016/S0377-2217(03)00020-1)

8 AUTHORS

Nurul Hafizah Hazwani Hashim is a PhD candidate in Decision Sciences at the School of Quantitative Sciences, College of Arts and Sciences, Universiti Utara Malaysia. Her research focuses on operationalizing emotional intelligence indicators through computational behavioral analytics, structured emotion annotation, and systematic quantification of behavioral criteria for integration into decision-support systems in construction project manager selection. Her work bridges affective computing technologies and multi-criteria evaluation frameworks to enhance transparency and objectivity in project manager assessment. Her research interests include multi-criteria decision-making, AI-assisted behavioral competency assessment, and computational emotion annotation frameworks (E-mail: nurul_hafizah_h2@ahsgs.uum.edu.my).

Sr. Dr. Mohd Nasrun Mohd Nawi is a Professor of Construction Project management at the School of Technology Management and Logistics, College of Business, Universiti Utara Malaysia. He obtained his PhD in Construction Project Management from the University of Salford, United Kingdom. A fully qualified building surveyor, his expertise lies in integrated design and construction management, including industrialized building systems (IBS), modern methods of construction, integrated project delivery, lean construction, and building information modelling (BIM). His research also covers sustainable construction, life cycle costing, value management, building performance, and technology management. He has been actively involved in research, consultancy, and scholarly publication in construction and technology management (E-mail: nasrun@uum.edu.my).

Ts. Dr. Mohd Faizal Omar is a Professor in the Department of Quantitative Sciences, School of Quantitative Sciences, College of Arts and Sciences, Universiti Utara Malaysia. He earned his PhD in decision support systems from Queensland University of Technology, Australia. With a background in computer science, his research expertise includes the design and development of intelligent decision-support systems, computational modeling, and advanced analytical frameworks for complex evaluation and optimization problems. His research interests encompass soft computing, artificial intelligence, analytics, and interdisciplinary engineering applications (E-mail: faizal_omar@uum.edu.my).