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# Technology adoption in mining: a multi-criteria analytical tool for emerging technology selection for surface mines

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**ABSTRACT**

The integration of technologies across the mining value chain is becoming critical because it is recognized as a process enabler. Recent studies have argued for a dire need for a technology roadmap and strategy to help facilitate technology adoption and implementation in order to solve mines' productivity challenges and consequently, contribute to operational cost reduction. Hence, this research aimed to identify the best possible technologies applicable to an operation, based on the chosen criteria. In keeping with this aim, this study focused on investigating adoptable technologies for a mining project, developing a conceptual framework for the analytical process and validating the framework using a hypothetical case study. The case study comprised of a technology decision problem, the result of which consisted of six technology alternatives, four criteria and one decision maker.

The Multi-Criteria Decision Making (MCDM) operation research methodology was used in the process. Of the several MCDM techniques available, the fusion of the analytic hierarchy process (AHP) and preference ranking organisation method of enrichment (PROMETHEE) techniques were employed for this study. This is due to their ability to scientifically solve problems involving quantitative and qualitative analysis. The AHP was used to determine the hierarchal weight of each decision-making criterion and its consistency while the PROMETHEE method was used to carry out the overall process evaluation. Additionally, the fuzzy set theory was infused into the hierarchical structure analysis to evaluate the quantitative economic criterion to curb uncertainty and imprecision.

The results of the analysis show that the technology alternative A3 – Artificial Intelligence (AI) – is the most preferred alternative. This is due to the technology's net flow value of (0.2493) which outranks other comparative technologies. The approach proposed in this study can help provide the basis for any technology adopting mining company to build its technology business case, strategy and or roadmap to achieve the desired outcome.