ABSTRACT

The mining environment is characterised by various stakeholders with unique expectations and future uncertainties. In order to make decisions in an uncertain environment that has various stakeholders with differing unique expectations, Multi-Criteria Decision Making (MCDM) methods are used. MCDM methods are sub-divided into Multi-Objective Decision Making (MODM) and Multi-Criteria Decision Making (MCDA) techniques. Given an uncertain mining environment and a multitude of MCDA techniques, it is necessary to analyse how MCDA techniques used in mine planning and related problems produce consistent results. It is also necessary to establish the ideal number of alternatives and criteria to use to increase confidence in the decision making process.

A total of 246 case studies were sourced from journal; symposia; and conference papers. The case studies were narrowed to those with numerical content, leaving 110 case studies. A total of 40 out of the 110 case studies had original decision matrices and these were chosen for analysis. Different alternatives in the case studies were ranked using eight MCDA techniques. MCDA techniques were chosen because they are used to solve problems with a finite number of alternatives.

Analytical Hierarchy Process (AHP); Elimination and Choice Expressing Reality (ELECTRE); Multi-Attribute Utility Theory (MAUT); Preference Ranking Organisation Method for Enrichment Evaluation (PROMETHEE); Simple Additive Weighting Method (SAW); Technique for Order Preference by Similarity to Ideal Solutions (TOPSIS); Vise Kriterijumska Optimizacija I Kompromisno Resenje (VIKOR); and Yager's method were selected. "Similarity percentages" and "average similarity percentages" were calculated for the ranked alternatives.

The 1998 economic meltdown and the 2008 Global Financial Crisis (GFC) resulted in increased use of MCDA techniques. The increased use of MCDA techniques was in response to uncertainties in response to the 1998 and 2008 events. The AHP was the most commonly used technique while Fuzzy set theory was used to address uncertainty. Most MCDA techniques suffer from rank reversal. In order to reduce rank reversal, nine criteria are

recommended for use with MCDA techniques. In addition, a maximum of four alternatives is recommended for use with MCDA techniques.