

A comparison of methods for determining weights of criteria in multi-criteria decision-making problems in mine planning

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ABSTRACT

Decision making in mine planning is characteristically multi-criteria in nature, hence, requires multi-criteria decision analysis (MCDA) techniques to solve the decision-making problems. A bibliometric analysis revealed growth in the use of MCDA techniques in mine planning. This is evident in the increased publication frequency of mine-planning related case studies that have been solved using MCDA techniques, especially post the 1998 global economic meltdown and 2008 global financial crisis. A similar trend can be expected post the COVID-19 global pandemic experienced between 2020 and 2022. Decision making using MCDA techniques involves several steps. Firstly, decision-making criteria and possible different solutions (i.e., alternatives) relevant to the problem are identified. Secondly, weights are assigned to the identified criteria to indicate their relative importance. Thirdly, each alternative is scored against each criterion and the resulting model is solved to rank the alternatives and identify the most preferred alternative. An important step in MCDA involves assigning weights to the criteria because if this step is done incorrectly, subsequent steps will yield an incorrect solution (i.e., wrong choice of best alternative). Despite the importance of assigning weights to criteria, not much research has been done on different methods of assigning weights to criteria. Therefore, this paper compared different methods used to assign criteria weights in multi-criteria decision-making problems in mine planning. To achieve this, a bibliometric analysis was conducted on mine-planning related case studies that had been solved using MCDA techniques to identify methods used to assign weights to criteria. A comparison of the criteria weight determination methods was done to propose future research directions in criteria weight assignment, so that weights of criteria can be determined more reliably. The proposed research directions include the use of hybrid methods and machine learning methods, to account for uncertainty that is inherent to multi-criteria decision-making in mine planning.