ABSTRACT

The management of closure costs is a current challenge for mining companies. A poor management of closure costs can lead to the abandonment of mines and the generation of environmental liabilities. Mining companies, regulators and investors share a common interest in ensuring that mine closure costs are accurately identified. There are many empirical methods for estimating mine closure costs, most of them are based on operational experience, historical mine closure costs, contractor quotes, or based on designs and assumptions made even before the construction of a mine. The objective of this study is to address the cost estimation and the identify the critical variables that influence closure costs with new robust techniques based on probabilistic prediction models to reduce the uncertainty in the estimation of costs in mine closure. The case studies for the analysis include six (06) mining and metallurgical waste deposit areas expected for closure. These deposits contain acid sludge, neutral sludge, and tailings. Methods such as singular value decomposition (SVD) and principal component analysis (PCA) were used to identify and weight the independent critical variables in the cost estimation. For prediction methods, regression models of multiple variables are evaluated such as multiple linear regression, decision tree, ensembled decision tree, support vector machines (SVM) and Gaussian regression process (GRP). In this thesis, the base models of the multiple linear regresion and SVM are found to result in a low error indicator RMSE and shorter computation times compared to the other models. This methodology can be applied to other closure scenarios since it integrates modern tools and techniques to support robust and objective decision□making in cost management in mine closure projects. The investigation of these probabilistic methods in mine closure management is limited, and the application in cost estimation does not exist, so this work is innovative and demonstrates the potential of using 'machine learning' as support tool in decision-making in mine closure management. It is recommended that future research and applications integrate this methodology with optimization models in mine closure management.