Incorporation of Price, Reserve, and Cost Uncertainty Measurement in Real Option Valuation

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The income and expenses of a mining project determine the project's profitability. The income of the cash flow model is calculated by multiplying the selling price of the mineral and the reserves. Expenses represent the outcome-related section of the project. However, these three factors of profit determinants are highly uncertain. Real Option (RO) methodology was developed to account for these uncertainties. To date, the practice of this method has been limited as its application in mining needs to be more adaptable, especially regarding uncertainty drivers. Recently, the trend of RO research has been dominated by the effect of price and geological uncertainty, which affects the income of the mining project. Additionally, no research has been conducted to combine the uncertainties of both the income and expenses of a mining project. The Black Scholes Method and Lattice Valuation are two common RO approaches that measure a project with uncertainty. In this research, the stratified state aggregation (SSA) technique was used to determine the value of a mining project which considering economic, geological, and technical uncertainty. The SSA simulation approach is based on a Monte Carlo simulation. It is flexible in method construction, particularly in its adaptability to real-world uncertainties. The case study was conducted at a tin mining project at PT Timah Tbk, Indonesia, a short-term mine planning underwater mining projects. Price and cost uncertainty drivers have been calculated using the nature logarithmic of the historical data, while geological uncertainty has been measured using conditional simulation.In summary, uncertainties in mining can be modeled using RO; hence the SSA approach is conducted to evaluate multi-uncertainty as well as multi-stage mining. The incorporation of the uncertainty measurement is demonstrated, especially the income and expenses of cash flow parameters. Moreover, these uncertainties can be overcome by the management's flexibility to either hold or abandon the project.

Keywords : Project Valuation, Real Option Analysis, Uncertainties Valuation, Stratified State Aggregation