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A comparison of various modelling techniques to optimise production rate on a platinum mining project

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ABSTRACT

Every business aims to create an optimal economic value for its shareholders. The production rate is one of the critical drivers of value in the mining business. Several approaches have been developed to determine the production rate for mining operations. This study applied three approaches for determining production rate, namely the tonnage-based, microeconomic and marginal-analysis modelling methods. These methods were applied on a platinum project, and the production rate results from the three methods were used to determine the life of mine (LOM) production profiles, capital expenditure (CAPEX) and operational expenditure (OPEX). These results were then used as inputs into a discounted cash flow (DCF) model. The DCF model results were compared and analysed to determine a production rate determination method that results in an optimum production output rate for the project.

The study revealed that the tonnage-based modelling technique resulted in the highest production rate of 410-kilo tonnes per month (ktpm), the highest CAPEX of USD957.24 million, the lowest OPEX of USD75.37 per mined tonne, the highest net present value (NPV) of USD63.12 million and the highest internal rate of return (IRR) of 12.85% over a 40-year LOM. The microeconomic modelling technique ranked second with a production rate of 270 ktpm, CAPEX of USD 726.24 million, OPEX of USD 76.68 per mined tonne, NPV of USD 3.46 million and IRR of 10.17%. The marginal-analysis modelling technique ranked last with a production rate of 230 ktpm, CAPEX of USD 658.76 million, OPEX of USD 77.83 per mined tonne, NPV of USD -10.69 million and the lowest IRR of 9.47%. Mineral Resource tonnage-based modelling may be further investigated in other commodities other than platinum or other multi-element/polymetallic mineral deposits in line with the South African mining industry. This will result in the formulation of industry-specific calibration in the South African mining industry.