President's Corner

# Treating the mineral asset like an asset

The papers in this edition are all related to Mineral Resource Management, the field in which Professor Richard Minnitt practised for many years in the Chair in Mineral Resources at the University of the Witwatersrand. Professor Minnitt has followed the great luminary, the late Danie Krige, in pioneering many aspects of this field, especially in the areas of geostatistics and mineral evaluation. It is most fitting that this special edition be dedicated to this area, and to Professor Minnitt.

The field of Mineral Resource Management is one which has developed over the last two decades, with its initial development (in a South African context) finding its roots in what was then the Gold Division of Anglo American. The initial premise was that work in the fields of geology, evaluation, mine surveying and mine planning was conducted in 'silos', and was normally seen as a 'service' function to mining.

This relegation to a service function meant that the work done by these departments was seen as purely technical and carried out at a low level in the organization. Work in rock engineering, ventilation, and safety was similarly subordinated.

The result of this perspective was that these departments submitted reports on observations, and made recommendations, which all too often went unheeded, rendering these departments ineffective.

The advent of value chain thinking, coupled with the application of Levels of Work Theory, as developed by Elliott Jaques in his book entitled *Requisite Organization* (Cason Hall & Co., 1989) and developments in mining technical information systems created the idea that Mineral Resource Management (MRM) as a concept would on the one hand break down the functional silos and create an integrated approach to technical services, and on the other hand would elevate the profile and accountability of MRM.

Benchmarking against international operations indicated that in technical services departments such integration already existed, and the levels of competence and professionalism were considerably higher than had been the case traditionally in South African operations. Companies such as Codelco and BHP Billiton populated these departments with competent senior mining engineers and general managers, and focused on areas aligned to the full value chain, such as business planning, mine design, optimization, metal accounting, and geometallurgy. It was also observed that these departments were considered as the 'brains trust' of the operations, with mining departments having little discretion in terms of 'where to mine'.

These observations and conclusions were the basis for establishing MRM at mines and creating MRM departments in South Africa. At the same time, academic research and developments resulted in the establishment of postgraduate courses in MRM at the University of the Witwatersrand, and in Mineral Throughput Management at the University of the Free State.

As all of this work progressed, so it started to give direction to the further development of MRM technical systems, with an increasing emphasis on economics and optimization.

So where is MRM now? It is my opinion that while good progress was made in developments in MRM, and excellent studies and research have been done in various areas of technical focus (as illustrated by the papers in this edition), there is much work still to be done.

The concept of MRM may have reached its limit, and a transition to Mineral Asset Management would seem to be appropriate.

It is obvious that the principal asset of a mining company is the Mineral Resource over which the company has rights. Within this asset is the metal or commodity that should be identified, scheduled, extracted, and beneficiated in order to realize optimum value from the underlying asset.

This focus on 'treating the asset like an asset' leads one in the direction of asset management principles, wherein one would apply the same asset management principles to this principal asset as one would to an asset such as a haul truck. Let us consider some of these.

Assets should be the subject of life cycle costing. When applied to the mineral asset, this should cover the entire process of discovery, feasibility, design, scheduling, development, operation, and closure. A life cycle costing approach seeks to derive the maximum value from the asset over its life through the optimal combinations of capital, operating levels, operating costs, and profitability, under constantly varying revenue conditions. This approach recognizes that the old 'cradle to grave' approach to the life of mine through a once-a-year rework is obsolete, and that a more dynamic approach is required which constantly re-evaluates whether the extraction strategy is still appropriate, and when the asset should be either sold or replaced. This approach should also ensure that the right metrics are applied at the appropriate stage of the life of the mine. Clearly, long-term measures are not appropriate when the asset is in a harvesting or closure phase.

# President's Corner (continued)

The question arises as to whether the traditional metrics applied to the life of mine, in terms of net present value (NPV) and internal rate of return (IRR), are still appropriate. This consideration leads to a conclusion that these metrics may be too 'constant' in that they rely on a set of considerations that are static rather than dynamic, unless constant re-planning and valuation is done. Alternatively, an economic value added (EVA) approach (short term), coupled with market value add (MVA) (long term), combines short-term cash flow optimization with long-term value, based on value-adding decision-making, and incorporating risk and volatility.

In each phase, critical asset management value-adding questions should be asked, such as:

- Is the asset available? This means the development of appropriate metrics and controls to ensure that planning has resulted in sufficient mineable face length being available, and that sufficient flexibility has been created in the orebody, to ensure that short- and medium-term plans can be realized.
- Is the asset being utilized optimally? This will place focus on the mining process, mining efficiency, and all the leading indicators of productivity. In this case, productivity includes a holistic approach covering capital, people, systems, and assets.
- Is the asset reliable? Answering such a question requires that sufficient work has been done to ensure that those aspects that make the asset unreliable are addressed. This could include the level of geological uncertainty, the risk of interruption due to seismicity, potential for the loss of the asset as it is extracted and transported, and the reliability of all relevant data related to the asset and its use.
- What is the mean time between failures? This involves the development of controls that monitor the mean time between failures due to geological interferences such as dykes, potholes and washouts, and other unwanted events. These measures indicate the appropriate levels of flexibility required.
- Is the asset optimized?

The issue of optimization is where the topic becomes really exciting. One of the tools in the toolbox of the Mineral Asset Manager is the grade-tonnage curve and the use and application of cut-off grades. Traditionally, mines have worked with the pay limit, as espoused by Storrar (*South African Mine Valuation*, Chamber of Mines, 1977). The pay limit has been used as a measure to define Mineral Resources and Mineral Reserves, usually on an annual basis and mainly for shareholder reporting. This does not serve as an optimization tool. Cut-off grades, on the other hand, allow more focused application to specific mining areas where costs can be accurately allocated. This has been used for short-term optimization through estimating available reserves and mining mix, under varying price conditions.

Kenneth Lane (*The Economic Definition of Ore*, Mining Journal Books, 1988) extended the use of cut-off grades to long-term optimization and dynamic optimization. Juan Camus in his book *Management of Mineral Resources* (SME. 2001) examined the work of Lane, and realized that Lane's dynamic cut-off grade optimization was actually based on the EVA equation. He used this equation to perform optimization by maximizing the cash flow of short-term extraction (by varying volumes, grades etc.) and optimizing the value of the remaining life of the asset.

This created a very important linkage between cut-off grades, EVA, MVA, and optimization.

This two-stage, iterative optimization process intuitively suggests another important link, which is that to real option analysis. This is because the Black-Scholes formula for real option evaluation splits the value of a real option into the value of the remaining asset and the capitalization required to be applied to it.

So, what does this mean?

It creates an opportunity, in that the use of an EVA/MVA based optimization tool currently relies on an iterative, manual calculation. Thus, the need to develop this into a useable model provides an opportunity to link this directly to the grade/tonnage curve and asset management.

Secondly it provides a fascinating problem for a postgraduate study, to identify the missing link between dynamic cut-off grades, EVA and MVA, and real option analysis.

Third, these should become important tools in the toolbox of the modern Mineral Asset Manager.

These opportunities, as well as the establishment of new Mineral Asset Management metrics, are easier to develop now because of the greater level of real-time data that is possible and available.

These initiatives should all help to contribute towards restoring confidence of investors, who have seen a paucity of dividend returns from local mining stocks over many years.

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