Journal Comment

Portfolio Potential

'What have I done to achieve longevity?
Woken up each morning and tried to remember
not to wear my hearing aid in the bath
Robert Morley, 1908–1992

The papers in this issue cover a variety of topics from a number of contributors with no common theme such as a conference topic. To provide some coherent interest, I have chosen a theme inspired by a review paper from Finland which can be related to almost all of the papers. This is 'A review of real-time optimization in underground mining production' by Z. Song *et al.* of the School of Engineering at Aalto University.

As may be expected from this highly respected school, this paper contains a comprehensive account of the advances that have taken place in the mining and mineral processing industry, whereby virtually all aspects can be analysed by computer modelling and submitted to real-time analysis and optimization as a basis for strategically planned operations.

The excellent review needs little elaboration. I choose to rather look at the next platform in such cybernetic space, namely strategically coordinated research and development (R&D), which is now becoming essential in this country and many others. This fits in with most of the other papers in this issue, which are, as usual, contributions to the forefront of R&D. We need many of these, but they have to be coordinated into national and international portfolios to achieve the primary economic and social targets. Such portfolio planning calls for the equivalent IT concepts and computerized decision-making models so successfully employed by private and corporate entities for bankable feasibility studies.

The basis for such an approach was laid down in a paper that was presented at the last Commonwealth Mining and Metallurgical Congress held at Sun City in 1995.

Portfolio Planning is a phrase from an octogenarian. Let me use more modern terms borrowed from an inspiring John Orr memorial lecture by Clem Sunter, namely Innovative Entrepreneurial Scenario Planning, which is the same as Risk Venture Planning. The achievement of 'breakthrough' innovations is subject to the uncertain statistical random dangers, as at most commercial operations. This demands the equivalent of the DCF and NPV statistical evaluation.

In R&D this is conventionally called 'critical path planning'. This approach is used to identify sequential or parallel innovative concepts that might prove to be successful, or stumbling blocks, or potential failure points.

Experienced researchers and strategists have an ability to propose alternative options to overcome such failure nodes. In very general terms, the greater the number of options, the greater the probability of success. However, the purpose of this Comment is not to provide a thesis on portfolio analysis, but rather to consider some examples from this issue.

The authoritative paper 'Towards an understanding of dynamic demand on ground support' by Yves Potvin and Johan Wesseloo of the Australian Centre for Geomechanics is a highly erudite study on rock stress, shock waves from seismicity, and rock pillar and rock piles support systems. This is vital to deep level mines in South Africa, where the danger of rockbursts induced by the shock waves catalysed by blasting at stope faces can be severe. However, a full understanding and ultimate answer is not yet forthcoming. For the first time, I encountered the word 'indeterminacy' used in a paper and in references to indicate that with the present state of the art the problem cannot be resolved, not even in terms of stochastic estimates.

Does this constitute a stumbling point in deep level mining in South Africa?

Not necessarily. The narrow tabular gold reefs of the Witwatersrand represent perfect examples where the statistical modelling of the current blasting practice to specify high- from low-shock characteristics, (as demonstrated by Sellers in recently published articles) is of importance. Selective blast mining as described in the June issue is proposed to eliminate shock wave blasting, which is replaced by millisecond sequential cast blasting—like a roll of drums rather than a cannon shot.

Applying the statistical models for determination of payability cost curves, including gold losses calculated from mine call factors, can reveal some fascinating options indicating a high probability of success in minimizing rockbursts, and greatly reducing costs of mining and improved overall recoveries of gold.

The temperature at the stope faces and the cost of ventilation is a significant variable in the equations. There is a paper in this issue, giving well calculated figures. But, as is typical in the new platform, there are R&D options to minimize such costs, as reported in previous issues of this Journal.

And so it is with the other research papers in this issue. There are no great breakthroughs but each contribution expands the index of potential options.

There is, almost inevitably, a paper on flotation, reporting on the influence of particle shape factors on mineral separation. Perhaps an option to consider on the platinum UG2 reefs...

There are two papers that could make a contribution to job creation.

One paper, with authors from Malaysia and Iran, deals with the influence of coke particle size on the thermal profile during sintering of iron ore, and hence on the sinter properties. There are interesting deposits of coking coal being developed in an area of South Africa where job creation opportunities are a priority.

A most intriguing paper from China is 'Particle collision during the tribo-electrostatic beneficiation of fly ash based on infrared thermography', by H.S. Li *et al.* of the School of Chemical Engineering and Technology, China University of Mining & Technology.

This is a method unknown to me, so I was pleased to include this as an option. The application described in this paper is for the separation of fine unburnt coal from fly-ash. The coal constituent is a source of energy and the ash byproduct is calcium aluminium silicate, which has several commercial uses including as a substitute for Portland cement. Both materials have a worthwhile carbon credit potential and are options in a coal R&D portfolio.

The last paper is one I rate highly in the theme of national importance, particularly in terms of the three most urgent R&D targets, namely poverty alleviation (jobs), education, and community coalescence—hopefully by creating mutually collaborative sustainable mine cluster villages.

This is a paper by environment experts with obvious familiarity with statistical modelling methods and agricultural expertise.

The paper is 'Application of ecosystem function analysis (EFA) in assessing mine tailings rehabilitation: an example from the Mhangura Copper Mine tailings, Zimbabwe', by Gregory Dowo, Shakkie Kativu, and David Tongway.

Journal Comment *(continued)*

I am prompted to select this paper for comment for several reasons. Papers from Zimbabwe, where a new branch of the Southern African Institute of Mining and Metallurgy has been established, are of especial interest, and even more so when from a group of university biologists with obvious interests in environmental botany. This is endorsed by a contributing author from Australia, where the Pratt Organization was a leading protagonist in the development of agricultural methods of hydroponic fertigation, (HPF).

This method – more commonly known as drip irrigation – will, I believe, be the basis of a new era of small-lot farming based on the digital computer evolution similar to that highlighted in this issue of the *Journal*. This can be catalysed by a small group of plant biologists skilled also in computer modelling who can provide options for creating large numbers of good income-generating activities for relatively unskilled farmer families by producing crops on non-agricultural areas such as slimes dams. Irrigation water is the key, of course. HPF offers three options; domestic effluent, treated mine water, and rainfall.

In the area surrounding the Mhangura mine I calculate for the waste slimes dams a productivity level for growing maize throughout the year of the order of 100 tons per hectare per annum. At this level, a mine village farming cluster could be a model option for Africa, making sense of sustainability targets provided attention is given to depositing toxicity-free slime dams. But this calls for pioneers to initiate an R&D portfolio programme.

I am a lone voice in advocating such a concept and I will listen attentively for a call for more details.

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