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 commentary 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 Wesselo 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 underground mines in South Africa, where the danger of rockbursts 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.

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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 slimes 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.

R.E. Robinson

We have come to the end of another year, and it is the time to slow down and take stock of the 12 months that have passed and to look forward to the year ahead. In the South African mining industry a very traumatic 2012 has been followed by an uncertain 2013. I would like to think that 2014 will be more positive. There are many positive indications, and we should dwell on these since the negatives have a tendency to obscure the positives.

I attended the 2013 MineSafe conference in my capacity as SAIMM President, and I have to say that the way safety in the mining industry is approached is really inspiring. I was taken aback by how many mines had a 12-month period without a single injury. Zero Harm is not a dream, it can be reality.

Looking at how the stakeholders in the mining industry approach safety makes me think – if only the same approach was used for the economic and social aspects of the industry. The SAIMM is a proud co-organizer of the MineSafe conference and this will continue to be the most significant mine safety event each year in South Africa. I was, however, disappointed at how few metallurgists attended the conference. As a metallurgist I appreciate that mine safety concerns mining engineers and metallurgists, and both groups contribute to the safety improvements that the industry has seen. I will therefore be encouraging my fellow metallurgists to attend and to contribute to MineSafe 2014.

South Africa is a significant player in the global mining industry, with the world’s largest mineral resources by value. South Africa is in the world’s top ten producers of gold, platinum, coal, iron ore, manganese, chromium, vanadium, nickel, titanium, zirconium, and diamonds. Technical practice and innovation in the mining and metallurgy disciplines are world class. Underground mining in South Africa has no equal, and we are the global benchmark for underground mining. For metallurgy we can tick all the boxes for processing intensity for all the commodities. We produce high-purity metals and minerals. We produce mild steel, stainless steel, and ferroalloys. Therefore, it is correct to say that the South African mining industry has a solid production and technical foundation.

To build on this foundation we have to improve our competitiveness. There are, of course many, definitions for competitiveness. From a mining industry perspective we need to produce metals and minerals that are in demand. We need to produce a wide range of commodities, which introduces economic flexibility. These two aspects are satisfied currently and should continue to be so. Ideally the cost of producing metals and minerals should be targeted for the lowest quartile. Reducing cost is not only about reducing consumption and finding cheaper consumables, it is also about improving efficiency.

One aspect of efficiency that does not receive enough attention is the question of operational stability and consistency. Is there always enough ROM ore stockpiled so that there are no unnecessary plant shutdowns? Is ROM ore grade and particle size consistent so that plant operation can be stable? These two questions involve effective and continual communication between mining engineers and metallurgists. Is the plant designed such that consistent stable operation is possible? This is about process design flexibility, because metallurgists should be well aware that the ore does not always behave the way you expect it to, and you cannot always blame the mining engineers! Is the plant designed such that equipment availability is maximized? This involves effective and continual communication between metallurgists and maintenance engineers. All these aspects around efficiency ultimately point to one over-riding conclusion – consistency depends on teamwork!

This leads me to my proposed New Year’s resolution for the South African mining industry, teamwork. Geologists, mining engineers, metallurgists, and maintenance engineers need to come to the mine efficiency party and they need to embrace teamwork to realize the goal of stable and consistent mine operations.

To close I would like to wish all SAIMM members and their families a safe and enjoyable holiday. May you return to work safely in 2014 and look forward to a positive and productive year.

M. Dworzanskowski
President, SAIMM