

Journal Comment

Sustainability: Environmental, economic, and social

The title of this *Comment* is taken from the excellent recent paper by M. Mostert of SRK, in the *Journal of the SAIMM* (vol. 114, November 2014.). The paper was both relevant and significant to my previous contributions on strategy and tactics that I compiled for a SAIMM conference that regrettably never took place. Mostert's paper advances the quantitative aspects of this topic. Sustainability is quantified in terms of the calculation of net present value (NPV) and other valuation criteria. The cost of electrical power and the possibility of co-generation of power and the relationship with the many global warming environmental aspects are meaningfully discussed. The inclusion of the remarkably large carbon credits in the NPV of the Beatrix Mine was for me fascinating, and like the whole paper it was very relevant to the mine cluster strategy concept that I prepared some 18 months ago. It deals with the main topics of sustainability, economics, environment, social integration, schools, and education in general. This is so because the mining cluster and all other clusters involving communities of employees have to survive and remain supported by stakeholders. They need profits from the sale of goods and services, both locally and from export, to make up a quantifiable value for the educational and community services of the cluster.

My strategy and tactics paper was tabled at the Platinum Conference in November 2014, the proceedings of which are still to be published. It deals with the undertaking of some innovative steps to establish mining clusters with the objective of supporting marginal mines and ensuring where possible the sustainability of existing operations. This is to be achieved by creating a socially mixed community of mine personnel with educational and independent income earning capabilities that extend into the future. It is focused on employment creation where small-lot farming plays an important role. The paper is available for those readers who might wish to research the options. In this compilation I list the keywords (action steps) that are related to innovation and R&D.

Keywords for mining and metallurgical concepts

Gold

- Selective blast mining: economic evaluation for all cost-curve data, already available in a previous *Journal* publication

- Rectification of statistical sampling for mine call factors
- Development of millisecond shock tube systems with delay detonators
- Narrow slot cutting in hangingwall using hydraulic technology or diamond cutting wire
- Underground roll crushing of reef material
- Mine shaft pressure leaching to recover all toxic metals by CCIX to achieve zero toxic waste dumps
- Underground hydraulic compaction of waste rock
- Stope drilling automation with hydraulic supports.

Platinum

- Demonstration plant for the KELL hydrometallurgical process for platinum and base metal recovery
- Alternative chlorination for the KELL process leading to total metal recovery without roasting (three alternative options)
- Recovery of chromite (WHIMS) to provide non-toxic dams for agricultural use.

Other minerals and metals

- Improved hydrometallurgical processes for low-grade base metals, e.g. at Black Mountain, Gamsburg, Nkomati Nickel
- Bipolar cell combined with the platinum fuel cell to produce reagents for downstream use in hydrometallurgy and the chemical industries
- Coal fines treatment and utilization with zero waste (multi-options for the production of Fe, Al, S, SiO₂, and uranium)
- Carbon capture using chemically generated CaCO₃ (multi options)
- Rare-earth metal recovery from fertilizer processing – lithium, potassium, and other strategic materials
- Conversion of gypsum to building materials.

Cluster agriculture

- Hydroponic fertigation (HPF): overseas expert consultations
- HPF automation survey: cost reduction
- Crops for biofuels (ethanol and aviation fuels): potential stakeholders such as SAA and Boeing
- Food and industrial crops (Department of Agriculture a stakeholder)
- Crops supporting automation in mines and industry
- Automation of drip systems: seed rolls, computer protocols
- Use of domestic effluent. R&D with DWAF and municipalities.

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Education and teachers (obvious stakeholders are the DOE, school investor entrepreneurs, universities

- Research on computerized teaching at primary school level
- Establishment of language laboratories with international exchange visits in languages and cultures
- High school curricula with innovative interaction with careers and experimentation
- Technical college level cluster centres: mentors and professional institute supervision
- Success criteria and economic sustainability values
- Teachers' new careers prospects, status and salary: analysis for sustainability valuation.

Social integration and activities

- Sport and entertainment, stakeholders are sport sponsors and controlling bodies
- Tourism attractions e.g. game, walking and cycling and 'ox wagon' trails, mineral collections and jewellery making, music and concerts, hospitality facilities, exchange scholars, visitors, and employment
- Special training in animation presentations via concerts for music, culture, history, dances
- Using virtual reality computer systems for innovative presentations.

Action steps and comments

The concepts contained in the keyword list are by no means all my own work. Many were derived from my association with a number of projects and activities with a variety of organizations.

Some have been derived from news in the media such as the Martin Creamer publications.

The intention is to publish and make available the keywords to the SAIMM and its readership who may consider assembling a forum of people who might be interested in getting further details and who wish to undertake research or further studies on them. If considered of importance, then sponsorship of a portfolio project can be considered with those who wish to become stakeholders, as suggested by Mostert, where carbon credits for biofuels are economically attractive.

Many of these concepts are being pursued and have been taken from press releases by active participants, in which case they may wish to include a mine cluster in their thinking.

For example, with regard to biofuels for use in aviation there are a large number of major companies

promoting urgent research as this topic is considered economically important. According to recent press releases, SAA is contributing to a portfolio of projects for using agricultural products, including tobacco, for aviation fuel. Mazda and Mitsubishi have announced bio-produced body parts for their current automobile manufacture. Japanese researchers have announced a process for the recovery of uranium from coal in the Springbok Flats deposits.

Many government departments are actively financing work. Blade Nzimande, the Minister of Basic Education and Training, has announced in several public speeches the expenditure of many billions in setting up training facilities for teachers. Similar facilities for agriculture and the hospitality industry are just as important in generating new approaches to achieve rapid success. The road to success is to avoid focusing investment on single hunches, but to have a suite of well-considered options. This is where the SAIMM membership and its conferences and publications can make a significant contribution.

It is believed that the mining industry, with prompting from the SAIMM, can catalyze such activities.

Although mining and agriculture are not happy bedfellows, they have much in common. They are both well-proven industries and can employ millions of South Africans. It is believed that the first successful mining cluster will result in a snowball effect that will initiate many other clusters.

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