

*'Give us the tools and we will finish the job', Winston Churchill, 1941*

The highest priority in South Africa is job creation, and this also applies to most of Africa. On a time scale that is critical, this can come about only through international investment and assistance. The BRICS alliance (Brazil, Russia, India, China, and South Africa) is highly significant, and the key is close interaction between the technical specialists in these countries in proposing new areas of joint activity. In mining and metallurgy the scope is large, and much interaction between professional bodies in identifying and defining suitable ventures must soon be forthcoming.

At the WTO and other trade discussions, I believe it will be universally accepted as a non-negotiable right and responsibility for any government to preserve and expand future employment opportunities. Without a job, a citizen is denied the fundamental right of dignity and many other constitutional privileges. The birthright of a nation to use its raw material resources to ensure acceptable job creation opportunities should be afforded the same constitutional status. The concept of 'free marketing' is secondary to these fundamental rights.

This is in no way meant to preclude the supply of raw materials from the third world to first world countries. What it requires is that fair trade concepts include a quantitative recognition of the added value in job creation. The outcome of fair trade must be that it is not possible for a first world country, by more competitive pricing, to prevent local production of added value products in a third world country from the same raw material. There must be reciprocal agreements in job creation potential.

The concept is best illustrated by an example. If we were to sell rhodium to a major automobile manufacturing nation for exhaust catalysts, then it can be considered that the raw material contains an added value in job opportunities. Since we ourselves can produce such catalysts, it is not unreasonable that the two parties could share in this job potential. And neither party would attempt to inflict price structures that would preferentially deny such a potential. Maybe this reciprocity could be recognized by making technology available or undertaking to purchase an agreed quantity of catalysts for incorporation in the domestic production. This may introduce complexity in the negotiations. But once the principle is accepted that a raw material has an intrinsic job creation potential built in, agreement should be possible. Invariably this can be a 'win /win' situation, if only because as the number of jobs increases in an undeveloped nation, so does its import purchasing power. To put it succinctly, the newly skilled workers in a catalyst factory will probably soon start buying imported motor cars.

The above example indicates the potential of agreements of this nature. For South Africa, there are two areas which I believe will be of interest to BRICS and other internationals at many levels—postgraduate, government, and business. They will also have a large impact on job creation in South Africa. In the space available I can do little more than provide an outline of the scope of these projects, which I hope will catalyse some action.

1. Zero waste mining and metallurgy and employment clusters Enough work has been done to demonstrate that the old image of the industry, of waste dumps and environmental degradation and pollution, is outmoded. The cry for sustainability has put pressure on the industry to avoid

toxic waste completely. If one takes the world-wide uproar against the acid mine drainage from the gold mining complexes in South Africa as an example, it is interesting to predict what can be achieved in this regard.

The days of the century-old HDS process using low cost lime to precipitate the toxic metals in a sludge which can be discarded onto a slimes dam are coming to an end. The sludge is not environmentally stable, and the slimes dams are known to leak soluble and toxic material into the rivers and surrounding lands.

There are now processes designed to remove all toxic constituents, producing domestic quality water and recovering the pollutants as saleable products on an economically acceptable basis, although demonstration plants have still to be established. It is now conceptually possible to detoxify contaminated dams and put them to a useful purpose. Good management of effluent solutions to remove all pollutants is now also possible, and the concept of using these effluents profitably is on the agenda. There are now alternative approaches which are now being considered, rather than allowing the waste water to evaporate uselessly.

The establishment of industrial, educational, and other activities is making good progress as a means of job creation and recent news reports from Anglo American indicate remarkable achievements in these areas. However, in terms of manufacturing industries there will have to be some miraculous progress in skills education. The record of the manufacturing industries in South Africa and Africa as a whole is abysmal at 1% of world industries, according to a survey reported in Engineering News.

Fortunately, in agricultural cluster farms where adequate skills are overwhelmingly available and with the very large product markets that exist, a most valuable contribution to sustainability in the mining clusters could be achieved.

There is resurgence in the use of biomass for aviation fuel as an alternative to fossil fuels. Recent news reported the successful use of biofuels from Canolina (the latest plant choice for vegetable oil for biofuel) in Rolls Royce jet engines in an Atlantic crossing. New techniques to convert almost any plant biomass to diesel or alcohol have been announced. The emergence of subsurface hydroponic irrigation (suitable for the use of sterilized sewage effluent) is indicating that small lot agriculture in cluster farming around mines and industries using water from slimes dams could be feasible for producing food and fuel crops. There is little doubt that a detoxified mine effluent could produce enough biodiesel for a mine's internal use and even power generation (both much welcomed in view of the inevitable robotic mechanization in future deep-level mines).

The concept of building hubs of entrepreneurial activities for education, training, and supplying services, equipment, food, and fuels is proving to be most positive. The calculated numbers for biomass production and employment growth in South Africa are so large in terms of jobs and productivity that my impression is that, in terms of sustainability, mining and farming are mutually dependent. However, there is much R&D and collaborative international work to be done (including language classes) in the mining clusters.

The second example, I think appropriate globally is:

2. The complete utilization of waste coal fines In South Africa this would be invaluable in metallurgical centres such as Richards Bay, as well as the coal mining centres. The target would be the production of cell-grade alumina, and aluminium metal itself from co-generated power. Other products would be high grade iron oxides and iron metal powder, silicon carbide cement and elemental sulphur, clean coal, and carbon powder and derivatives. There are billions of tons of coal fines available, and much scope for added value and other activities, including cluster farming for biomass and biofuels production using existing technology. There is readily available water and land from restored open pit mines.

May I suggest that a possible way forward is to convene conferences to put flesh on these two skeletal examples and the many others that must emerge if we are to meet our employment targets.