Mining in a global context—can South Africa compete?

by R.A. Plumbridge

I am deeply honoured by your invitation to address your great Institute on this centenary occasion. Mining is a cyclic industry that continuously faces enormous challenges as it wrests the treasures of the earth from an often-reluctant mother nature. Throughout the ages, those challenges have demanded great skill from mining men and women, who are required to blend a mixture of robust determination with art and science.

Pioneer Miners and Scientists

It is not surprising therefore that the first blush of euphoria surrounding the discovery of gold on the Witwatersrand quickly gave way to consternation about the need to increase the metallurgical recovery of gold from the then readily identifiable conglomerate. The rugged pioneer miners had to turn to scientists for their salvation.

It is difficult for us to visualize the circumstances of that time, but let us throw our minds into neutral and try to visualize a society devoid of motorized transport, without modern power utility, without a stable source of clean water, without laboratory facilities, without a research budget and, above all, predating the explosion in scientific knowledge that is such a feature of our modern society. Yes, those pioneer chemists had to rely on the stimulation of the challenges they faced and the very personal interaction with their peers on the ground.

It was in those circumstances that the greatest metallurgical break-through in the history of the mining industry was made. The discovery of the cyanidation recovery process has received universal recognition, but the part played by the great scientists of that time in establishing the learned society that has grown into The South African Institute of Mining and Metallurgy has tended to be blurred by time. I therefore would like to congratulate the authors of the centenary edition of the *Journal* of the Institute for sharpening the focus on the earliest days of the Institute.

I do not intend to dwell on the past. The *Centenary Journal* is prescribed reading for anybody interested in our industry, and must surely dispel any doubts about the outstanding technological achievements of the South African mining industry.

Collegiate Culture

This is an opportunity to pay tribute to all the people who have been part of our industry over the years. In their day-to-day lives they constantly meet and find solutions to challenges that are very real and yet do not receive the limelight except in some dramatic emergency. The collegiate culture of the South African industry is unique. When the chips are down, all forms of discrimination and petty rivalries evaporate instantly. If a human life or a mine life is at stake, the reactions are spontaneous and immediate, with the result that the industry has an internationally admired reputation for dealing with adversity.

On many such occasions, major technical advances are made under great duress. There is no time for the long sophisticated experiments of the research worker. The responsible engineer has time only to draw on his own experience and that of his peers who are available at the time. Decisions have to be taken and implemented with great speed. There is no time for second thoughts, only for prayer! Let us honour those who have played such a critical role in the life of our mines. It is twenty-five years since the dramatic rescue operations during the flooding of West Driefontein. The successful stemming of the underground floodwaters won international acclaim, and placed the reputation of the South African industry's engineers on a pedestal.

The story of the rescue and recovery operation following the recent shaft accident at Kloof has yet to be fully exposed. When it is, I have no doubt that it will rank high amongst the technical achievements of the industry, and will once again highlight the phenomenal co-operation within the industry and the innovative talent of our engineers.

As a major American investment manager commented over the phone shortly after hearing of the accident: 'I have complete confidence in your ability to successfully complete the rescue as it involves the ultimate cohesive strength of your industry. Nowhere else does that cohesion exist.'

Given all the strengths of the South African industry, you will be forgiven for questioning the doubts about the future that are inherent in the title of my lecture. Since the great euphoria that followed the dramatic increase in the gold price in the1970s and its final blow-out in 1980, the industry has been under increasing pressure and steadily losing its competitive edge. At first this was not recognized but, over the past couple of years, the industry has started to react.

The New South Africa

Exactly five weeks from now, the final vote in South Africa's historic election will have been cast, and we will start moving down the first painful steps of our new democracy. A great responsibility will rest on the shoulders of our newly elected political leaders and, in particular, those who are entrusted with Cabinet posts. They will have in their hands the power to make South Africa into a competitive and winning nation or, alternatively, to consign it to oblivion. To be competitive, one needs investment to be made on a significant scale by the international investment community, all of whom are able dispassionately to weigh up the competitive advantage of a wide variety of countries. What is required to attract the much needed investment? In the first instance, we need to entrench a constitution that will be respected both nationally and internationally. We cannot afford any further constitutional uncertainty, and it is to be hoped that the new constituent assembly will confine its constitutional responsibilities to refining and eliminating anomalies from the interim constitution.

Against the background of a respected constitution, it is critical that the country's legal structures are reinforced, and that fundamental issues, like sanctity of contract, are not challenged for political expediency. Some of the political activities of the recent past have regrettably led to a breakdown of law and order. One of the first priorities of the new government will be to re-establish that cornerstone of any civilized society. Without a major commitment to law and order and a free and fair judicial system, foreign investment will turn away.

One of the great inheritances of the new government is an internationally respected financial system. We have a highly developed set of world-class financial institutions from the South African Reserve Bank to the major commercial banks and insurers. These institutions must be allowed to develop and adapt our financial system to changing circumstances. This does not mean to say that some review of our financial system is not required. What is required is less regulation and constraints, not more. For example, we need to address swiftly the phasing out of exchange control and the dual exchange-rate system. This was recommended years ago by the De Kock Commission, and the Commission's rationale is as valid today as it ever was. With the elimination of political uncertainty and a welding together of a united nation, these controls must be phased out to allow us to become competitive with the progressive emerging nations.

Perhaps the most difficult thing for the new government is going to be to allocate priorities to the political, economic, and social aspects of its future policies. There is no doubt what the ordinary man and woman in the street wants. In very simple terms, they have only two priorities: the establishment of law and order, and the provision of employment opportunities. The first is a precondition for economic growth, and the second is the natural consequence. It is imperative that economic growth becomes the top priority, thereby encouraging investment, not only by South African companies, but also by foreign investors in wealth-creating projects. Such projects will provide long-term employment and, if profitable, will provide taxes to enable the government to enhance essential social infrastructures. Thus, the government must be encouraged to adopt enabling economic policies, and not control structures, which have been shown to fail throughout Africa. As the Minister of Mines of Zimbabwe said publicly at the end of last year, 'We have learned that it is imperative for government to get out of the way'. Recent signs of an improvement in the Zimbabwean economy bear testimony to this change of attitude on the part of one of the more socialistic governments in Africa.

From the South African point of view, we have to bridge the gap between the developed sector of our economy and the developing sector. We have to recognize that millions of our people are under-educated, and most of them will remain so for the rest of their lives. For these people to become productive citizens, we need to provide them with employment opportunities, albeit at wages that are comparable with those elsewhere in the developing world, and then the onus is on us in industry to train them to the limits of their individual talents.

We cannot afford to pay lip service to training—everybody must play their part and, in particular, there is a vital role for the engineers in industry to increase their input into the design of training schemes to ensure that they are appropriate in relation to the requirements of their industry and the aptitude of the individuals.

The South African Mining Industry

Turning now to the mining industry specifically, there is one major issue that we have to resolve with the new government in the immediate future if this industry is to have any chance of expanding. I refer here to the ownership of mineral rights and mining title. The international mining industry is highly sensitized to this subject. Any threat to title sends cold shivers down corporate spines. These threats can come from different sources: from governments themselves, or indirectly as a result of pressures from environmental groups, etc. What is apparent is that any attempt to change title conditions has an immediate effect on exploration. One has only to look at the recent decline in exploration in North America and countries such as Papua New Guinea to recognize how quickly mining companies react when title is threatened. It is to be hoped that the misunderstandings regarding the ownership of mineral rights in South Africa will be laid to rest as quickly as possible. The mixed system of State and private ownership of mineral rights has served this country well in the past, and has undoubtedly been responsible for the development of the deep-level gold-mining industry as we know it today. Such a development could not have taken place in any concession-based system.

I would now like to turn to the broader issues of management within our industry because it is here, I believe, that the greatest changes have to take place. It is essential that an industry such as ours should operate on a holistic, multi-disciplinary management system. The modern manager has to draw together people from a wide variety of disciplines, and has to deal with management issues that go way beyond anything his predecessors faced.

Environmental Management

Let us look at environmental management as an example. The historical perspective of the South African industry revolved around a cosy relationship with regulatory authorities and a great deal of good faith. Suddenly, international pressures spilt over into South Africa, and the regulatory authorities have been stunned into legislating for rapidly increasing standards while many in industry have been caught flat-footed. We have lost the initiative, and have not participated in the establishment of appropriate and affordable reference points. If we are not careful, the whole industry could grind to a halt because of the establishment of a series of extreme first-world standards that have no relevance to our circumstances. We already face such a position in regard to radio-active waste products. The need to establish environmental structures within our management systems is critically important, and here it is relevant that we need to bring together our lawyers, engineers, and scientists to create management teams that can establish policies, guidelines, and operating standards for our industry. Above all, we need to be able to interact with the various pressure groups on an informed basis.

Safety and Health Management

Safety management is another area that requires major attention. Mining is a hazardous occupation, but we have to remain committed to a quest for zero accidents. This will not happen on its own. However, by improving the engineering of our operations and encouraging greater engineering input into our training schemes, we can bring about significant advances in the safety management of our deep-level mines. We need a greater commitment, for instance, to the implementation of backfilling. Too often we pay lip service to this major breakthrough in regard to both ventilation and safety in our deep-level mines.

Safety, of course, takes us into health management as a whole, and again we need to recognize a holistic approach to health management. The health management programmes of the industry provide a wonderful example for the development of health management on a national basis, but there are challenges that we have to meet. It is a well-known fact that the people who die in our industry from mine accidents are but a fraction of those who die from other causes. We need to concern ourselves with educating people to the dangers of violent assaults and motor accidents.

Above all, we have a massive problem, which is gathering momentum, in regard to the spread of HIV within the South African community as a whole, and the mining industry in particular. Recent statistics indicate that a cohort of mining people who have participated in a prevalence study since 1990 have reflected an increase in the percentage who are HIV positive from 1,3 per cent in 1990 to 8,7 per cent in 1993.

The implications of this pandemic for our industry is enormous. We need to know far more about the progression from HIV positive to full-blown Aids, and its impact on the work capacity of our employees. We need to find new ways of increasing the awareness of the dangers of HIV and, finally, we will have to train a completely new cadre of people to counsel those who are unfortunate enough to become HIV positive. We cannot brush aside the human tragedy that is involved, but we can provide the counselling and support that these people will require.

Management of Vital Resources

At the heart of the management of any mining enterprise anywhere in the world lies the key issue of the management of the following three vital resources:

- mineral resource
- capital-asset resource, and
- human resource.

The success or otherwise of a mine depends upon an understanding of these resources and management's ability to manage the interplay between them to provide a level of productivity that is both technically and financially competitive.

Mineral Resource

We have great geological expertise in South Africa, which has remained up-to-date with state-of-the-art technical developments. When one looks at the performance of our geologists in an international context, they certainly are amongst the best technically, and yet their international counterparts have a much finer focus on the discovery of mineral resources and their conversion into ore reserves. We still have a tendency to pursue exploration for geology's sake. We certainly have a lot to learn when it comes to proving definitive ore reserves in the international context. For example, we still do not have a clear-cut perspective on the differences between resources and reserves. Mining is a high-risk business, and we need to bring our thinking into line with that prevailing internationally when it comes to reserve definition.

Once we commit ourselves to mining, we expend an enormous amount of capital in opening up areas for stoping. In the name of flexibility, we open up far more areas than are necessary at any particular point in time, with the result that our face utilization is extremely low by global standards. We have to recognize that, once we have opened up an area, it is available, or should be available, for 24 hours a day, 7 days a week. It is the choice of management whether that face is fully utilized or not. Given the capital investment in that face, it should be worked for every possible hour of every day.

While in certain circumstances blasting may curtail availability, that should be the only significant constraint. Our support systems should keep the face open in all but exceptional circumstances.

While there is a recognition of the importance of continuous mining, I do believe that a major adjustment in thinking is required of mine management. We need to re-engineer how we conduct our operations, particularly on hard-rock mines. Collieries have historically had a more pro-active approach to tackling this fundamental problem, but most underground collieries still mine for only eleven out of the available twenty-one shifts in a week. Continuous mining is an imperative if our coal-mining industry is to regain some of its competitiveness *vis-à-vis* its international competitors.

Capital-asset Resource

Probably the most capital-intensive asset in any mine is its physical equipment. Our engineers have focused their attention to a great extent on enhancing the technical excellence of the equipment that we use.

Our international competitors have a different approach. They look far more rigorously at cost efficiency, and particularly the availability of any piece of equipment. Indeed, equipment availability is absolutely paramount to the thinking of managements of all the modern open-cast mines around the world, where it is expected that the equipment will be available for at least 93 per cent of the day. Once the availability drops to 85 per cent, drastic action is taken, and either the maintenance team or the equipment concerned is jettisoned. If the South African mining industry is to be competitive in the future, it has to bring itself into line with international standards in this regard. We simply cannot afford the excess capital expenditure that is required in providing standby capital assets.

Human Resource

Once we have recognized the importance of having our mineral resource and capital assets available for well over 90 per cent of the time, then we can address the parallel issue of their utilization, which brings one directly into the efficient use of the human resource.

We are not looking at individuals working for excessive hours—this should be discouraged. What we have to do is to engineer our activities in such a way that the human resource can work productively throughout each shift. This involves the re-examination of the way in which we mine, and the training of all levels within the human resource to perform their tasks continuously, productively and, above all, safely.

In international open-pit mining, where they aim to have their mineral and physical resources available for at least 93 per cent of the time, the human resource is expected to be utilized for 95 per cent of each shift. What that means is that all the working places produce for an average of at least 21 hours per day throughout the year. While that target may be high in relation to deep-level underground mining, it is one for which we must strive if we are to remain in any way competitive with our colleagues in other parts of the world. It is no use shrugging our shoulders and saying that underground mining cannot achieve that degree of productivity. Such an attitude can only sound the death knell of our great underground-mining industry.

The challenge is essentially an engineering one, and it strikes at the heart of one of the tragic misconceptions in our industry. If management does recognize the challenge, its normal response is twofold: Give us money and additional people. What we need is neither! We want management to use its intellect and that of its whole team. It does not need additional equipment and additional people. What we need is the efficient use of the resources at our disposal. Where this has been attempted, the normal result has been the use of less equipment and fewer people.

Financial Engineers

The challenges that I have been articulating bring into sharp focus one of the weaknesses of our industry, and that is financial management at the operating level. Without belabouring the point, I would emphasize that no top-class management team in the mining industry can operate without the full integration of a vibrant financial component. Financial engineers are an essential part of competitive management.

If one looks at the weaknesses of the mining industry on a world-wide basis, the most glaring is the attitude to research into the marketing and promotion of our mineral products. Hard-headed operators cannot understand why this should be an important aspect of our business. After all, it should be our customers' privilege to buy our hard-won products! The misconception that underlies this thinking has been revealed for many years by the Central Selling Organization on behalf of diamonds. Their pioneering work ranks with the best in any industry anywhere in the world.

The South African gold-mining industry recognized these issues in the early 1970s through the formation of Intergold and, subsequently, participation in the World Gold Council, which has played a major part in the marketing and promotion of gold. The CSO and the WGC use different approaches because their products have different constraints.

Both are highly successful and highly respected world wide. It is, of course, tragic that many gold producers around the world, in fact those producing some 50 per cent of the world's gold production, do not understand the importance of promotion.

Research and Development

Any review of the South African mining industry at this time must lead to concern about its commitment to R & D. The financial pressures of the past few years have squeezed research budgets at a time when research and development have probably been more important than at any time in our history. Now that our R & D efforts have been concentrated within the orbit of the CSIR, I believe it is necessary for the industry to revise the priority that it gives to this area. While ongoing fundamental research is important in the long run, our shorter-term future is dependent on development and, I would add, the refinement of existing technologies. We do not have the time to re-invent the wheel if we are to recover our competitive position in the international mining industry.

I believe that the correct interaction between operational management and our research scientists and engineers is essential if we are to achieve the essential objectives of availability and utilization within our industry. We will have to expose our thinking more forthrightly to our trade unions to carry them with us in the regeneration of our industry. After all, they have, directly and indirectly on behalf of their members, a critical interest in bringing the erosion of jobs in the mining industry to a halt, and reversing that process to create a vibrant, growing mining industry in South Africa.

A Changing Industry

The mining industry outside South Africa was driven into a critical period of self-analysis in the early 1980s, when the great copper industry came under extreme pressure. Major changes have taken place internationally that have converted old lumbering mining giants into tight, highly efficient units utilizing their resources to the maximum possible extent. New mines have grown up, particularly in the gold-mining industry, using new technology, minimum capital expenditure, and many of the standards that evolved in the copper industry. In the past, nobody would have given a 1½ gram-per-tonne surface gold deposit a second thought. Today, that is regarded almost as a bonanza.

The South African mining industry at all levels must change in order to compete. It is my firm belief that the changes can be brought about in the limited time available if the industry applies that mixture of dogged determination and intellectual talent which has characterized its history. Let us recognize the challenges and seek solutions with the sort of urgency that is generated when we face life-threatening adversity.

Dr R.E. Robinson

I feel most privileged to be able to make a small contribution to the centenary celebrations in proposing this vote of thanks. It was, I am sure, a carefully planned programme.

Two Interesting Contributions

On the one hand, we have enjoyed a most entertaining review of the past century, very ably summarized by Peter Janisch and delightfully presented with his wry sense of humour. It is easy to under-estimate the amount of work involved in perusing all the past publications to produce, in a few pages, a summary of a hundred years of activity. There can be no doubt in anyone's mind that this past century was one of great achievement—a golden hundred years that put South Africa at the forefront of technology in deep-level, hard-rock mining, and in the extraction metallurgy of gold, uranium, platinum-group metals, and several other of the products from our vast mineral resources.

On the other hand, we have been brought down to earth by Robin Plumbridge with his look into the future, full of hope but also with many warnings that we are perhaps losing ground, and that specific and drastic action is needed if the next anniversary celebration is to look back with the same pride of achievement. His lecture was full of the wisdom, experience, and logical deductions of a great leader in a mighty industry.

I sincerely hope that both these contributions will be published so that future generations can look back and compare the predictions and warnings with actuality.

Points of Special Emphasis

In the time available to me, I can pick out only a few components of this lecture that, I feel, deserve special emphasis.

Collegiate Culture

Robin Plumbridge has referred to the 'collegiate culture' that has evolved in the South African mining and metallurgical industry. This is a beautiful phrase. It conjures up the impression of an 'old boys club', not in any derogatory sense, but in the sense that, wherever you go in South Africa, and indeed in the world, if you find yourself in the company of mining and metallurgical people, you are automatically among friends. You will be welcomed with a unique hospitality, but you will also receive every help in exchanging technical information to assist you in any problems.

We in South Africa must nurture this collegiate culture. The world is becoming increasingly competitive, and there are some very large organizations representing the competition. We are a small country but, as a united industry, we can take on the world in our specialized area, and become competitive in selling minerals and their products, and also, most importantly, technology. We must approach the future as South Africa (Pty) Ltd—a joint effort between industry and government, and all the people in the country.

Enabling Economic Structures

Another phrase that deserves special emphasis is that referring to the adoption by the State of 'enabling economic policies, and not control structures'.

There are so many enabling policies than can be adopted, and one can only hope that, whatever government is in power, it will have the courage to phase out exchange control and encourage investment as but one example of enabling action.

National Priorities

In a similar vein, one must endorse Robin Plumbridge's assignment of national priorities, namely the provision of job opportunities, which is second only to the maintenance of law and order. The one is the corollary of the other. Without law and order, there can be no stable jobs, but a man without a job in South Africa can survive only by thieving (or begging).

One wonders whether the politicians and the political economists who seem to play such a profound role in decision-making fully appreciate the huge contribution that the mining industry makes to the creation of job opportunities. I query whether there has yet been an adequately comprehensive input–output analysis of the devastating effect that the closing of a mine can have on the national economy. If this had been done thoroughly, I am sure we would have seen more enabling policies to keep our gold mines in operation for as long as possible.

Lip Service

Robin Plumbridge refers several times to the lip service that is paid to several important factors. Training and education are two of them.

We in South Africa have a tendency to create sub-committees, to indulge in advisory councils, and to hold national conferences to the extent that our lip activities are overworked. We tend, however, to be sadly lacking in terms of positive action, since the education crisis continues unabated and our progress in this regard is minimal.

When it comes to health, safety, and environmental matters, there can be no compromise in terms of positive action. These are technical matters in which detailed technical analysis must point to technical solutions. Emotional lip service is the last factor likely to lead to solutions.

Research

Finally, I must refer to a statement in the lecture that is like heavenly music to someone who has devoted most of his career to research. I quote: 'research and development have probably been more important today than at any time in our history'.

Yet the mining and metallurgical industry is cutting back on research. We are retrenching research scientists and engineers at an alarming rate. Our universities are struggling for post-graduate bursaries, research funding is in desperately short supply, and we are rapidly losing our advanced place in world technology.

What is wrong? Have we been doing the wrong type of research? Is more development work needed? Have our research organizations failed to deliver the goods?

These and many similar questions, must be posed, answered, and acted upon. The Institute must play a prominent role in this examination, and I hope our future generations will be able to look back on major technical and scientific advances from 1994 onwards.

Thanks

I certainly have had a fascinating, entertaining, and thought-provoking evening. I am sure you, the audience, have experienced the same feelings, and I ask you to join me in thanking our two gifted and eminent speakers. ◆

Mr R.A. Plumbridge

Dr R.E. Robinson