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Mining in the era of environmentalism

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SYNOPSIS

Environmental activists have targeted the mining industry in an attempt to prevent development, which has resulted in the industry's becoming defensive and retro-active. This paper argues that mining managements should go on the offensive and champion the environment through leadership in environmental policy and research and development, rather than reacting to anti-mining campaigns. In the formulation of an environmental policy for the mining industry, a clear understanding of the concept of sustainable development is of paramount importance.

SAMEVATTING

Omgewingsaktiviste het die mynbedryf uitgesonder in hul strewe na die inperking van ontwikkeling, met die gevolg dat die bedryf defensief en retroaktief geraak het. Mynbestuur moet egter proaktief optree en gesien word as leiers in omgewingsbeleid en navorsing. Vir die doel is 'n grondige kennis van die konsep van wat gehandaaf kan word, uiters belangrik.

INTRODUCTION

Environmentalism, i.e. conservation of the environment, has become a prominent feature of mining management during the 1990's. The environment, like mineral raw materials, is being recognized as a depletable scarce resource that warrants rational management to ensure optimal utilization. Optimality here refers to the maximizing of benefits to the society concerned. Optimal utilization of a depletable resource is not necessarily zero utilization, but rather the most appropriate allocation of the resource to ensure that the benefits to society are maximized while the costs are minimized.

By their very nature, most primary activities such as agriculture and mining degrade the natural environment and thus stand in opposition to environmentalism. Mining, in particular, has been targeted by environmental activists attempting to prevent development, which has resulted in the industry's becoming defensive and retro-active. Mining companies are forced to concentrate more on environmental protection as a strategy for survival in the new 'green' era, and to ignore the environmentalist lobby is to invite political backlash in the form of more stringent legislation on licensing and anti-pollution regulations.

SUSTAINABLE DEVELOPMENT

Rational members of the public will support a mining industry that has committed itself to the protection of the environment. Sustainable development—socio-economic progress without the destruction of the environment—can be achieved through proper management techniques. It is the duty of mining management to prove that sustainable development can, in fact, be achieved through the betterment of living standards without excessive environmental degradation.

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The practical implication of sustainable development is that it must allow greater human utility of resources while simultaneously conserving the natural-resource base. One might argue that sustainable development is a contradiction in terms, but it can be realized through greater productivity in resource-consuming activities by an improvement of the output–input ratio. Through advances in resource-saving technology, it is possible for a country to grow economically while conserving natural resources to support future life.

Kahn[1] argues that sustainable development is incompatible with poverty, and that meeting the basic needs of all members of society is a prerequisite for sustainability. In over-populated developing countries, pressure on the environment can be reduced through the provision of cheap, efficient sanitation, clean running water, and low-cost, easily-accessible fuel. Without these basic services, people will degrade the environment in the quest for survival, while the benefits of environmentally sound practices will be viewed with scepticism.

In a consideration of the crucial role of productivity and technological advancement in the attainment of the sustainable development mentioned above, training and education of manpower must rank as equally important prerequisites. If any society is to achieve sustainable development, it must have a level of manpower competence to apply resource-conserving technology while maintaining economic development. Skilled people are needed to manage engineering services and thus maintain the quality of life. The provision and maintenance of engineering services is not only a means of pollution and erosion control, but is also a starting point for continued economic upliftment and progress[2].

The concept of sustainability in the primary sectors of the economy raises a number of questions. How can a country like South Africa achieve sustainable development when its economy depends on the fortunes of the mining industry? In the context of biologically renewable resources, sustainability would involve the harvesting of no more than the regenerative capacity of the resource in question, e.g. pelagic fish. The extraction of minerals, on the other hand,

is exhausting a fixed stock of mineral deposits and cannot be maintained indefinitely. Environmental problems of pollution and land degradation associated with mining activities furthermore oppose its sustainability.

The physical exhaustion of an ore deposit will normally lead to an increase in production costs resulting from the mining of lower-grade and less-accessible ores. The mining of progressively lower-grade deposits will result in increasing levels of environmental degradation because larger volumes of material will have to be mined and processed to yield the same quantity of mineral commodity. On the assumption of comparable yield factors, 10 t of gold ore assaying 5 g/t should yield a similar quantity of gold to that from 1 t of ore with a grade of 50 g/t. The degradation of the environment caused by the low-grade operation through the volume of material it disturbs will thus be ten times that of the higher-grade operation.

Before absolute physical exhaustion occurs, mining and environmental costs will become too high to sustain profitable extraction from a particular mine. During 1991 and 1992, a number of South African gold mines have suspended operations in unprofitable sections while considerable gold resources are still locked up there. Practical experience has shown that the sustainability of mining has an economic rather that a physical limit.

Countering the cost pressures that might lead to mine closures are the discovery of new deposits, and technical innovation, which converts formerly uneconomic resources into economically exploitable reserves. As a result of exploration activities, new mineral deposits are continuously being discovered world wide. These new deposits may be located in areas that are environmentally less sensitive than existing operations, reducing the costs of rehabilitation. New exploration techniques allow geologists to explore areas previously considered barren in terms of mineral potential.

Technological advances in mining plant and equipment continue to improve operational efficiency. The use of large draglines nowadays allows mining companies to mine coal deposits as open-cast operations, removing 100 per cent of a coal seam, whereas earlier underground mining of the same deposit would have left more than 50 per cent of the coal in the ground. Production costs per tonne of coal extracted can thus be lowered considerably. Modern backfill and refrigeration technology allows gold miners to mine up to depths of 4000 m, while not long ago deposits at those depths were considered uneconomic.

Sustainability of mining activity has thus become a function of exploration effort and technological innovation to ensure economic viability. Furthermore, it is a function of environmental protection through the rehabilitation of mined-out areas and the lack of mining in environmentally sensitive areas. With effective legislation to ensure adequate rehabilitation of mined-out areas, sustainability will also reflect the ability to pay for the environment. As long as the revenues generated by mineral sales can accommodate the costs of exploration, production, and rehabilitation, mining will be sustained. Sustainable development in mining can thus be thought of as a function of the behaviour of mineral markets.

The decline in the terms of trade of the poorer mineral-exporting countries of the world has serious consequences on their ability to conserve the environment. Declining or stagnant commodity prices put pressure on profit margins, which makes it less likely that vast sums of money will be spent on environmental rehabilitation.

Exporters of mineral commodities in the developing countries should not look to the industrialized countries for financial handouts, but rather argue the case for realistic prices for their exports, which will include costs to the environment. These costs will consist of the whole spectrum of environmental expenses from the initial assessment of the environmental impact to the ultimate rehabilitation of the worked-out mine.

WELFARE AND ENVIRONMENTALISM

Concern for the environment is a function of the level of welfare of a community. With increased levels of welfare, members of the community have more leisure time and material resources, which can be consumed in recreational activities. This leads to a recreational demand for the environment that is not present in poorer communities, where virtually all the resources are consumed in the quest for subsistence. Environmental concern ranks very low in a community where living is a constant battle for survival. At the other end of the welfare spectrum, the affluent are understandably concerned about actions that may jeopardize their quality of life by degrading their living and recreational environment. High levels of stress associated with high-income occupations may result in the recreational value of nature becoming more than the mere provision of leisure activities.

For any community to attain the level of welfare at which it can enjoy environmental recreation, it first has to go through a period of primary welfare creation, which invariably involves some form of environmental degradation. Once a certain level of economic development has been achieved, that society possesses the knowledge, technical ability, and economic means to curtail and restrict excessive utilization or pollution of the environment.

Pressure from environmentalist activists may result in the rejection of economically viable mining projects, constituting a retrogressive transfer of wealth from the poor (those who will forfeit employment opportunities in an economically depressed region) to the rich (those who are in a position to enjoy environmental recreation). The current political climate in South Africa, with the demand for the redistribution of wealth from the rich to the poor, creates a bias towards economic development, favouring the establishment of new mining projects.

Mine managements, however, should realize that the international community will scrutinize all new projects on environmental grounds, and that the market for the final product will be jeopardized if the project is viewed as environmentally unacceptable. The threat to brand diamonds as 'environmentally unfriendly' was enough to force the Botswana Government in 1991 to abandon the proposed dredging of the Okavango Delta in order to supply the diamond mines with water.

CONCLUSION

Gertsch[3] is of the opinion that the mining industry should go on the offensive and become a champion of the environment through leadership in environmental policy and research and development, rather than merely reacting defensively to anti-mining campaigns.

Through a concerted effort of public relations and education, the mining industry should inform the public and the governing authorities of its economic importance and of the role that it plays in environmental rehabilitation. The industry's image can be changed from that of a despoiler to that of a provider and conservator, countering irrational attacks by activists playing on emotional issues that are often distorted out of their context.

REFERENCES

1. KAHN, F. Sustainable development—a socio-political perspective. Randburg, World Environment Day Symposium, 4th Jun., 1992. 16 pp.
2. BEAUMONT, R.D. Third World development and the environment. *Ibid.*
3. GERTSCH, R.E. Protectors of the environment: A strategy for the industry. *Mining Engineering*, vol. 43, no. 11. 1991. pp. 1306–1307.

The South African Institute of Mining and Metallurgy and the environment

The Environmental Planning Professions Interdisciplinary Committee (EPPIC) was formed in 1974 in response to a general criticism, expressed at a Planning Conference held the previous year, of a disregard of environmental matters by the professions.

Membership of EPPIC was open to those professional institutes whose members commonly initiate, plan or act as principal agent in the execution of developments which could have significant impact on the environment. The SAIMM became a founder member of EPPIC and has been represented on its Central Committee since inception.

Three years ago, the SAIMM set up a Committee for the Environment under the chairmanship of its delegate to EPPIC to advise on environmental matters. The first task of this committee was to consider a Mission, Policy, and Strategy towards the Environment, which can be summarized as follows:

MISSION

To be the recognised professional forum for Mining, Metals, Minerals and the Environment.

POLICY

The South African Institute of Mining and Metallurgy commits itself to professionalism and objectivity in its approach to conservation of the environment.

This policy is based on particular premises:

- the Institute shares national and international concern about global environmental issues
- the Institute recognizes that its members, as leading professionals and practitioners in mining and the extraction and processing of metals and minerals, must minimize adverse effects of their activities on the environment while promoting those that are beneficial
- the Institute endorses the sustainable utilization of natural resources and the application of the principles of integrated environmental management
- the Institute encourages:
  - research in fields relevant to environment planning and management
  - educational programmes to develop better understanding of environmental management
  - awareness of environmental issues and an environmentally responsible approach to professional and practical work.

STRATEGY

To achieve its Mission and to execute its Policy, the Institute aims to:

- raise the level of awareness and responsibility of its members towards the environment through:
  - education and training
  - the SAIMM Journal
  - support for EPPIC awards and by initiating appropriate SAIMM awards
- be aware of other forums, organizations or groups concerned with conservation of the environment
- promote public relations
- set up Special Interest Groups on the environment especially at Branch level
- liaise with other mining-related associations
- approach tertiary educational institutions to promote courses in IEM and to gain contact with students
- liaise with Government Departments and other authorities in regard to environmental regulations and protection
- be in a position to take a stand on environmental issues.

The history of the Institute's relationship with and contribution to EPPIC, and the activities of its Committee for the Environment are recorded in successive annual reports presented at the Institute's Annual General Meetings and subsequently published in the Journal.

Stack sampler 'fingerprints' polluters*

A unique dilution-stack sampler, which is able to take representative samples, has been designed and manufactured at Mintek in collaboration with Eskom and the Schönland Research Centre at the University of the Witwatersrand.

The sampler, the first of its kind in South Africa, was recently tested at Eskom's Lethabo Power Station in the Vaal Triangle as part of the Vaal Air Characterization Study (VACS) being undertaken on behalf of the Department of National Health and Population Development, and will operate at various industrial stacks and other sources of pollution in order to provide accurate chemical signatures of the sources.

According to Mintek's Dr Johan Engelbrecht, who designed the sampler after discussions locally and with experts at the Desert Research Institute at Reno, Nevada, 'Air pollution in the PWV and other areas is reaching unacceptably high levels, due not only to industry, but also to unelectrified urban developments. To date, most of the debate surrounding the problem has been largely qualitative. This study will assist in providing the quantitative information needed for effective corrective action to be taken, if and where necessary'.

The results of the sampling programme will enable specific sources of atmospheric pollution to be 'fingerprinted', so that the relative contribution to the ambient atmosphere of each source can be identified and quantified. Once the profiles have been accurately established, and percentage contributions ascertained, preventative steps can be implemented and the respective polluters can be held responsible for their contribution to the air pollution.

Although the system was designed primarily for the characterizing of stack emissions such as those from power stations and smelters, it is versatile and can also be applied as a re-suspension and ambient air sampler.

During set-up, a pitot tube is used to measure the flowrate of emissions in a stack to enable a representative sample of entrained particles to be taken. This is achieved by varying the setting of two blowers on the dilution-stack sampler. The sample stream is cooled and diluted to simulate the 'ageing' process that occurs as the aerosol is emitted by the stack. The aerosol passes through either a PM10 or a PM2,5 size selective unit, and the particulates collect simultaneously on filters mounted on four sample holders. Mass-flow controllers are used to accurately regulate the flow through the size-selective inlets and are able to compensate for fluctuations in temperature and atmospheric pressure.

The samples are conditioned and weighed at Mintek's Mineralogy Division in a special 'clean' room. Chemical analyses of the particulates on the filters determine the concentration of inorganic compounds and ions. The organic components are determined at the Desert Research Institute in the USA.

According to Dr Engelbrecht, co-operation with industry has been excellent, and the investigation will be extended to the industrial areas of the eastern Transvaal highveld in the near future.

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Courses on acid mine drainage*

Mines could be involved in hundreds of years of treatment under the terms of the new Government requirements for the closure of mines. This emerged from two short courses on acid mine drainage (AMD) by Steffen, Robertson & Kirsten, Consulting Engineers Inc (SRK), which were held at the BIFSA Conference Centre, Midrand. The courses were presented by SRK partners Dr Andy Robertson, Fanie Geldenhuis, John Cowan, and Gordon McPhail.

Fanie Geldenhuis comments: 'The generation of acidic effluents from gold and coal mines is probably the most significant pollution problem for the mining industry in South Africa. Only by understanding how AMD occurs can mines start thinking of methods to control, prevent, or treat it. The acid effluent can pollute surface waters and sterilize streams, and can also contaminate ground water and render it unfit for use. For example, in a very recent White Paper, the Department of Water Affairs (DWA) requested nearly R30 million for urgent measures to clean up some of the pollution in the Witbank/Ermelo area.

'Under the new Minerals Act, all operating mines in South Africa except coal mines have until the end of 1992 to submit acceptable rehabilitation plans to the Department of Mineral and Energy Affairs. Coal mines have until the end of 1993. One of the important aspects of these plans is how polluted water will be handled. This also applies to new mines for which permits are being applied.'

The first day of the course was devoted to the prediction of where AMD will occur from a site based on site investigations, specialized testing, and computer modelling. The second day dealt with the task of controlling the generation of acid, the movement of acidity, and the treatment of effluents. Much of the value of the course lay in the fact that it raised a number of new issues. For example, few delegates were aware that the DWA's requirements for mine closure had recently been incorporated in draft form into the Chamber of Mines' Environment Management Programme Report, which is used by many mines as a guideline for developing closure plans. Some of the DWA's requirements require a great deal of thought. For example, it will be necessary for mines to predict how much acid effluent will be generated, what its quality will be, and how it will have to be treated.

* Issued by Tish Stewart PR Associates.