Mining and sustainable development: measurement and indicators

by Phillip Crowson

All mineral deposits are finite. Their exhaustion may happen within a relatively short period of time, or over an extended period, even of centuries. In this narrow sense, of the ultimate exhaustion of individual mines, no mining activity is sustainable. That is, however, a very restrictive definition of sustainability. Mining as an economic activity should be considered more broadly.

This article is taken from a much longer paper prepared for the International Council on Metals and the Environment (ICME). Its purpose was to provoke discussion within ICME about the measurement of sustainable development in the minerals industry, and to suggest possible indicators.

Phillip Crowson, board member London Metal Exchange, former chief economist Rio Tinto plc. Fax: +44-1737-249 643.

The most widely accepted definition of sustainable development is that of the United Nations' World Commission on Environment and Development of 1987 (the Brundtland Commission). It is development which 'meets the needs of the present without compromising the ability of future generations to meet their own needs'. This deceptively simple statement has subsequently been burdened with a complex variety of interpretations. A wide range of vested interests has climbed aboard the 'sustainable development' bandwagon from all directions of the compass, almost to the point where the original concept has been totally forgotten. It is based on a fine balance between the distinct needs of development and environmental protection. Much discussion, especially within and about the mining industry, concentrates unduly on environmental considerations rather than on the developmental. That is a distortion, if an understandable one, given the various complex interlocking and overlapping dimensions involved in any practicable application of the concept.

The varying dimensions

Before we can even begin to measure sustainable development in the minerals industry we need to disentangle these dimensions. There are at least three worth considering, the geographical hierarchy, the production to end-use continuum, and the trade-off between development and environment.

The geographical hierarchy

Local considerations are very different from regional or national concerns. Those may in turn differ considerably from global requirements. There are complex trade-offs within each level of this hierarchy, let alone between the levels. The further we move up the hierarchy from the locality of an individual mine to the global level, the more likely it is that some groups will suffer from development of any type, let alone from minerals extraction. Their losses will contrast with gains to society at large. In nearly all instances, a requirement that no individual should suffer losses would prohibit any development whatsoever. That would, in turn, completely compromise the ability of the world's future population to meet its needs.

The main global environmental concerns, namely climate change and greenhouse effects, are very different from the local worries at the other end of the hierarchy. They require different measures, different approaches, and different solutions. They are mainly, but not exclusively, issues for the energy minerals and downstream industries, rather than for the minerals industry, as it is normally defined.

The production to end-use continuum

Mining, per se, is a process with strictly local effects, but it is carried out for the products it yields. The continuum stretches from mining, through primary processing, to fabrication and use of the ensuing products. There is often most environmental concern about pollution from downstream processes, or from by-products, rather than from primary products. Many of the environmental concerns about the usage of individual products, and any policy measures taken to deal with them, are important for the mining industry's future, but they again lie outside the mining industry, strictly defined. The mining industry itself is not directly responsible for how its ultimate products are processed or used. It is reasonable to measure only those things it might influence. Naturally, that is a different set of factors from those affecting smelters, refineries, and metal processors. Thus, issues concerning end uses and life cycle analysis, although important, are beyond the province of the mining industry itself.

As we move along the continuum from mining towards end use, so global considerations become more important relative to local concern. The geographical hierarchy and the production to end-use continuum interact. Society only values mining for the properties of the products it produces, and the wealth it creates, rather than in its own right. In that regard the inputs required to satisfy a given standard of living are continuously evolving. Changing technology in both the supply and demand of mineral products, and shifts in the relationship between prices and costs, mean that the materials composition of any living standard is never static. For example, the Stone Age gave way to the Bronze Age, which was then superseded by the Iron Age, and so on.

The development/environment trade-off

The trade-offs between maximising rates of economic development which raise present day living standards and any consequent adverse impacts on the abilities of future generations to maintain similar or better standards lie at the heart of the whole debate about sustainable development.

This is essentially an issue of welfare economics, but it has been broadened well beyond that into a strong emphasis on environmental considerations. The trade-offs apply throughout the other two dimensions. As a broad generalisation, however, developmental factors become relatively more important at the global, international, and national levels of the hierarchy, and at the production end of the continuum. In contrast, environmental issues become much more important at the level of the individual operation. In that context the environment embraces a whole range of social concerns. Yet we must never forget that the basic requirement of any mining operation is to create wealth, or add value in more common parlance. The proper definition of that wealth partly resolves the trade-offs.

Their complete resolution is not, strictly speaking, a function for mining companies. It is the responsibility of all levels of government, as the custodians of the interests of society, both present and future. Where governments are fully representative of their populations (that is freely elected by universal suffrage), the mining industry, like other interested parties, should merely draw attention to the implications of specific policies, but leave decisions to governments. It is not the task of mining companies to replace or usurp the functions of elected public authorities. Paternalism may enhance management's sense of well-being, but in the long run brings few benefits. Companies should, however, properly evaluate, and account for, the full impact of their operations. Where governments are not fully representative of society, but of specific sectional interests or factions, or they are not freely elected, companies face more complex conflicts and decisions. As a general principle, the proper approach for companies under such conditions is to operate on the same terms as they would if an elected government were in power. At all times they should look to best international practice.

The dimensions combined

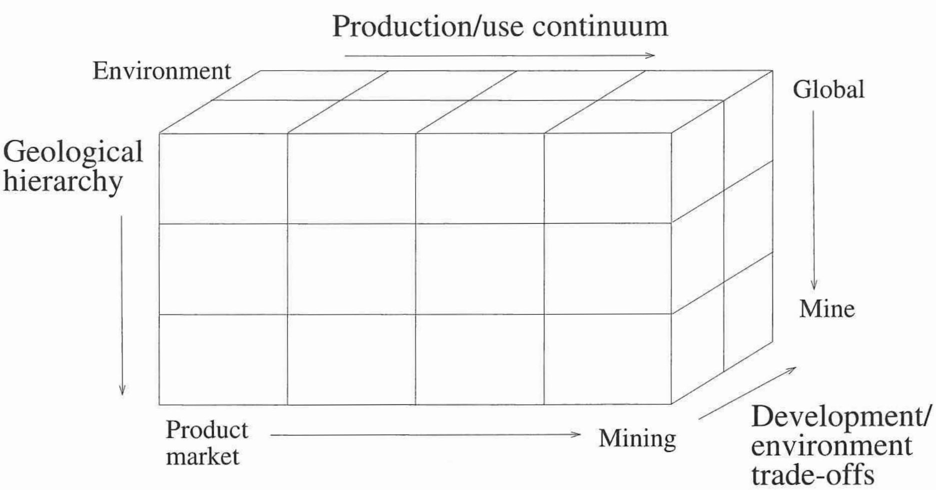
The three dimensions can be simplified, and represented schematically as in Figure 1. Before any measures of sustainable development can be properly outlined, we have to distinguish at what level we are involved. Looking mainly at the mining end of the continuum may simplify the analysis, but the remainder of the continuum should always be borne in mind. The subsequent analysis is mainly in terms of the geographical hierarchy.

Because the very definition of sustainable development will vary with the different levels of the hierarchy, the appropriate indicators of sustainability will also vary. Moreover, and importantly, the same indicator will not necessarily cumulate from one level to the next.

The global availability of minerals

Individual companies cannot directly influence global mineral balances and availability, but these are important indicators of the industry's sustainability. That individual mines are based on finite ore reserves does not automatically mean that the world will run out of exploitable mineral resources in the foreseeable future. The issues are explored in 'Mineral Resources. The Infinitely Finite' (by P. Crowson, ICME, February 1992). The crustal abundance of mineral elements clearly sets a finite boundary to their ultimate availability. That boundary is, how

Figure 1. The dimensions combined



ever, generally still far distant. Changing technology and economics conspire together to retain a balance between prospective demand and available resources.

The elastic nature of global mineral resources and reserves does not, however, nullify the fact that a significant proportion of the world's annual production of minerals is entirely consumed soon after it is produced. Not every mineral product, in every use, is recyclable. That means that part of the global stock of natural capital is consumed each year. One measure of the sustainability of the global mining industry is the extent to which it offsets this net annual depletion (i.e. after allowing for recycling). In this context annual depletion has little, or nothing, to do with the depletion allowances granted under some tax regimes as an offset to tax bills. Those are seldom, if ever, based on calculations of the extent to which the stock of minerals is being eroded by use.

The simplest approach is to dodge all the problems involved in measuring this depletion, and to plot the evolution over time of the ratio of reserves, or the wider reserve base, to primary production. The reserve ratios can either be calculated on a static basis, as reserves divided by current production, or on a dynamic basis, as reserves divided by estimated future demand. Such calculations can be carried out for each individual mineral, and for the minerals industry as a whole. The latter can be done by valuing both reserves and production on common prices, such as the averages in constant dollars of the past decade, or even last year's averages. Admittedly the available data on reserves and resources are far from perfect, but we are here examining the principle rather than the practice. Over the past forty years estimated reserves of most metals have grown at least as fast as production. The mining industry has been able to meet the needs of existing users in full, and ensure that supplies remain adequate for future users.

An essential complement to such estimates of the adequacy of reserves is an analysis of the long-run behaviour of prices. Have changes in the ratio between reserves and demand been accompanied by rising or falling prices? To the extent that real prices have risen over the long term, abstracting from their inevitable cyclical variability, future availability is being achieved at an increasing real cost. Where real prices have remained static, or they have fallen, which is what has happened for most non-ferrous metals and, indeed, for most minerals, technological and managerial improvements have, prima facie, offset the effects of depletion, falling ore grades, and the growing inaccessibility of deposits. The underlying assumption is that prices properly and accurately reflect underlying marginal costs, which might be a somewhat heroic simplification. Furthermore, movements in real prices may simply reflect changing costs of inputs which are unrelated to their marginal costs over long periods, or the application of ever increasing amounts of capital. Mineral supplies are not necessarily sustainable in the long run If they have been purchased at the cost of exploiting workers through reducing real wages, through failing to replace invested capital, or by ever more intensive inputs of energy. Thus, measures of the industry's productivity for each main input, labour, capital, and energy should supplement the information about trends in prices. Rates of return are one indicator of the productivity of capital, but they do not fully reflect the amounts of capital invested. The calculation of global measures of the minerals industry's productivity is complicated by wide differences between countries and sectors, and by varying discrepancies between official exchange rates and underlying purchasing power. That something is difficult does not, however, invalidate its importance.

These issues of the life of resources, prices, and productivity are, from the viewpoint of the mineral industry's sustainability, strictly global. National debates about the life of reserves, such as those which periodically surface in Canada, are really about national economic policy. Individual countries always have the option of producing or importing minerals, depending on their evolving comparative advantages. To ensure that known and readily exploitable resources grow in step with rising demand has always required the mining industry to seek new frontiers, both geographically and technically. There is no iron law which determines that individual countries should always produce specific minerals. Ultimately, that is physically impossible, given the finite nature of individual deposits. Those who argue for national, rather than global, replacement of ore reserves overlook the nature of min-

Table 1. Estimates of reserve lifes of non-ferrous metals

	Reserve base (mt) global	Assumed growth rates (per cent p.a.)	Reserve life in years	Implied per cent annual depletion of reserve base
Copper	610	3.0	31	3.2
Lead	120	1.5	18	5.6
Nickel	110	4.0	40	2.5
Tin	10	1.0	40	2.5
Zinc	330	2.5	30	3.3

ing as an economic activity. Society needs minerals, but mining companies exist primarily to create wealth. They are not restricted in that role by national boundaries, nor by their continued concentration on specific types of mining in particular locations.

Depletion and recycling

Individual ore deposits are eventually exhausted, and they have to be replaced by new discoveries. The precise amount of metal that can be extracted from a given ore deposit depends on the available technology and the relationship over time between prices and costs. It is only known with certainty once the mine has finally closed. Even then, later generations may re-visit the deposit with improved technologies and garner further metal.

The World Bank is developing methodologies for measuring the annual depletion of mineral deposits. Its initial approach was unduly simplistic, but it had the merit of ease of calculation. It assumed that the costs of extracting and marketing raw materials, including interest on capital employed, account on average for half of world market prices. The other half of the proceeds was treated as the value of the natural assets sold, or depletion. This appears much too a high a share. Data on copper from the RTZ Mine Information System suggest that cash costs alone account for just over three fifths of the turnover of the median copper mine. The mean share is not wildly different, based on the averages, in real terms over the business cycle, using a year of low prices (1986:74 per cent), a year of high prices (1989: 51 per cent), and a year of more modest prices (1991: 62 per cent). This is before allowing for capital charges of any type. If these were cents 20 per pound in real 1993 terms, then the shares of all costs in turnover were 100 per cent in 1986, 65 per cent in 1989, and 78 per cent in 1991. This gives an average of 81 per cent, or just over four fifths. In practice, the median capital costs on a replacement cost basis are probably higher. Calculations such as these, based on detailed analysis of the mining industry's costs up to the point at which a generally saleable metal is produced and sold, can be extended to other metals, and over a longer time span, and further refined.

The World Bank's initial approach confused the economic surplus, or economic rent, earned from mineral production (i.e. turnover less all costs over a mine's lifetime), with the value of the depletion of the ore reserves. More accurate assessments of depletion require estimates of prospective mine lives. Globally, the life of known reserves can be calculated approximately by relating the total reserve base to demand. If lives were estimated solely on present production rates they would be greatly over-stated, because global demand is expanding. Some rough estimates of the lives of presently known reserve bases of non-ferrous metals are given in the table. The underlying estimates of reserve bases are from the 1996 edition of Mineral Commodity Summaries published by the United States' Department of the Interior.

The estimates are sensitive to the assumed rates of growth of demand. Those used in Table 1 are merely illustrative, but they are broadly typical of the prevailing predictions for the world as a whole. The estimated reserve bases will inevitably change with evolving technology and relationships between prices and costs, and with new discoveries. We can, however, only base our estimates of depletion on what we know today. As a first approximation the reserves should be amortised over their lives. This implies the annual rates of depletion of the reserve base shown in the table's final column. This is a start, but not of much practical help. We need, at the very least, to express them as percentages of production. As this is projected to grow throughout the life of the reserves the appropriate production level is not the present rate, but the average over the life of the reserves. The use of today's rate would unduly load the burden of depletion onto the near term, whereas it should be spread over the full life of the reserves.

Similar calculations to these global estimates can be made for individual ore deposits, and for the mineral inventories of countries. The resulting reserve lives and depletion rates will differ, and probably by wide margins. The use of standard figures for all mineral products and for all countries, can only be a first, rough and ready, approximation.

The reserve lives shown in Table 1 implicitly assume that all future demand will be met from new primary production, and that there is no recycling whatsoever. That is clearly not the case, and

Table 2. Recycling rates for copper

	25 year life		20 year life	
Recovery rate	**100 per cent**	**50 per cent**	**100 per cent**	**50 per cent**
1991	59	39	54	36
1992	64	42	51	34
1993	61	41	47	31
1994	57	38	52	34
1995	58	39	64	43
Averages	60	40	54	36

Source. Metal Statistics, Metallgesellschaft.

full allowance has to be made for what is recycled. Data on the recycling of minerals and metals are just as rough and ready as those available for reserves, but we can still use them. It is not right to compare the tonnage presently recycled with today's production or demand. That will understate the contributions that recycling makes to total supplies. Today's recycling comes from the output of yesteryear, when the products in which metals and minerals are incorporated were first made. Some metal and minerals admittedly goes into dissipative and non-recyclable uses, but a large percentage does eventually return for recycling. The global stock of mineral-based products is infinitely greater than the reserve base alone. The lives of minerals-containing products vary considerably, with the six to eighteen months of aluminium drink cans, and the four to five years of lead-acid batteries at one extreme. The metals contained in buildings and structures, with lives sometimes stretching into centuries, lie at the other. The rates of recovery of the shorter-lived products tend to be much higher than those of the other. Gold is a special case because very little is ever completely lost but it is nearly all relatively accessible for re-use, always provided that the price is right.

In principle, today's recycling of materials should be compared with the levels of output that prevailed when they were first produced. Based on average product lives of twenty and twenty five years, and eventual recovery rates of 100 per cent and 50 per cent, Table 2 shows the percentage recycling rates for copper implied by the reported tonnage recycled, including the direct use of scrap, over the 1991–95 period.

The fluctuations are largely cyclical, reflecting variations in both production and demand, and in the rate of recovery of scrap, which is price-sensitive. There does not appear to have been any clear trend. Although the growing emphasis on environmental protection might suggest rising recovery rates over time, the miniaturisation of many recyclable products points in the other direction. The figures in Table 2 are merely illustrative, and they could obviously be greatly refined. They suggest that an estimated recycling rate of 40 per cent for copper would be fairly conservative. For lead and zinc the appropriate figures are respectively 60 per cent and 25 per cent. Neither primary nickel nor tin is recycled as such, but in products like stainless steel and solder.

When due allowance is made for recycling, the rates of net depletion of average annual production over the prospective life of reserves are as shown in the first column of Table 3.

In order to calculate the value of depletion the percentages in the first column should not be applied to total turnover, but to the surplus of revenues over all costs, including a return on capital. In other words, the value of depletion should be related to the mineral industry's economic surplus, or rent. The ore would have no value unless the costs were incurred in extracting its usable content. Due allowance has to be made for all the costs of rehabilitating the mine site, and for other closure costs, when estimating the economic rent.

As shown earlier, the total costs of producing copper, averaged over the business cycle, account for almost four fifths of the turnover of the median mine, leaving the surplus as 20 per cent of turnover. Assuming that similar percentages apply for the other metals, the appropriate net depletion rates, on a global basis, are the percentages of turnover shown in the table's final column. They range from 8 per cent for lead to 20 per cent for nickel and tin. More accurate estimates could be made for each metal, but these figures are merely intended to illustrate the principles involved. These depletion rates have been mainly derived from physical magnitudes rather than from values, even expressed in real terms. This therefore avoids any consideration of the appropriate discount rates to apply to future monetary values to convert them to present values. The choice of the appropriate discount-rate is complex, raising issues outside the scope of this article.

Global averages disguise considerable variations between mineral producing countries. Moreover, the opportunity costs of depletion are incurred by the ore producing countries, whereas the benefits of recycling accrue directly to those countries which process or consume mineral products and metals. Those benefits are not reflected in prices. On the contrary, recycling will tend to result in rather lower prices than if there were no recycling. It is clearly correct to allow for recycling in global estimates of ore depletion and of the minerals industry's sustainability. Estimates of depletion built up from estimates for individual producing coun-

Table 3. Annual rates of net depletion of average annual production

	Net depletion as per cent of average annual production	Net depletion rates as per cent of turnover
Copper	60	12
Lead	40	8
Nickel	100	20
Tin	100	20
Zinc	75	15

tries will overstate global depletion, and in some instances by a substantial amount. As already noted, the overstatement will be greatest for gold.

The World Bank has refined its initial approach, and it now makes some allowance for mine lives. ('Expanding the Measure of Wealth' by John A. Dixon and Kirk Hamilton in Finance & Development December 1996). It now values mineral deposits by "taking the present value of a constant stream of resource-specific rents (to be more precise, economic profits – the gross profit on extraction less depreciation of produced assets and return on capital) over the life of proved and probable reserves." Its underlying assumptions about reserves and extraction costs have been obtained from the US Geological Survey. Its estimates of the industry's economic rent are too broadly drawn, in that they probably do not allow for all the lifetime costs of minerals production, and specifically for closure costs. The World Bank also completely ignores any explicit estimates of the contribution of recycling. This is probably correct when examining the affairs of individual mineral producing countries. The Bank should, however, recognise that its calculations for individual countries should not be aggregated into global totals without any offsetting adjustments.

Depletion and exploration spending

If the value of net annual depletion is a measure of the mining industry's use of the world's non-renewable resources, the replacement of those resources through new discoveries shows how well it is contributing to the supplies of future generations. With society's requirements steadily developing, technology continuously changing, and the pattern of demand for goods and services altering, we never know exactly which minerals will be needed by future generations. Nor can we accurately assess the tonnage needed. That global demand for most, but not all, minerals has risen substantially during this century is no absolute guarantee that it will continue to do so. Previous generations had markedly different patterns of consumption of minerals from our own, and those of the future will also differ very much. Yet it is a reasonable working hypothesis that global demands will expand from today's levels, and it is prudent to replace what we annually consume, net of recycling.

The key here is spending on exploration of all types, from extensions to the ore reserves of operating mines, through the delineation of known deposits, to grass roots discoveries and basic geological mapping. Much exploration is carried out by prospectors and junior companies which have no operating mines, and are never likely to have any. Basic research is usually performed by governments, or by quasi-government agencies, both national and international. Most on-property exploration is in the hands of existing producers. The overall data available are incomplete, the best being the annual surveys of Metals Economics Group of Nova Scotia. Their coverage is biased towards companies based in Australia and North America, and larger companies in Western Europe and South Africa. It underestimates the spending of smaller companies, which may be collectively significant, of governments, and of many European and Asian countries.

Spending on exploration moves both cyclically, in lagged response to the market conditions of individual minerals, and also with fashions and new discoveries. Initial discoveries in virgin areas, or on the basis of new geological models, or with innovative technology, prompt a wave of imitations. Witness the uranium boom of the 1980s in Saskatchewan, diamonds in North West Territories in the 1990s, nickel in Australia in the early 1970s and Labrador in the late 1990s, and epithermal gold around the Pacific. Much exploration spending is unproductive, and represents a complete waste of resources, even taking account of the risks and uncertainties naturally involved. The substantial sums devoted to uranium exploration in the 1970s and early 1980s in Africa, Europe, and the United States were examples of such economic waste. The productivity, and chances of success, of this spending, were very low compared with the money spent in Australia and Canada. This could be said without the benefit of hindsight. Uranium is somewhat atypical, in that the motive for much of the expenditure was not just to find uranium, but to find it in specific areas, for strategic reasons. Unfortunately, as with advertising, it is rarely possible to identify which part of any spending on exploration is wasted. Even where drilling is unproductive, or discoveries prove uneconomic, the results may be taken up successfully by later generations under changed conditions. Many of the copper properties now being brought into production were first discovered many years ago.

As we have already seen, the annual net additions to global reserves over the past half-century have more than offset depletion, since the ratio of reserves to (rising) production has not fallen. Beyond that, it is tempting to argue that the global ratio of exploration spending to turnover should be broadly similar to the ratio of net depletion to the stock of ore, or around 2.5 per cent. In strict logic the case for this is weak in that some spending produces no additional reserves, whereas some can hit the jackpot. Yet there is no satisfactory method of predicting exploration success in advance, notwithstanding the inflated claims of many prospectors. Taking the data of Metal Economics Group the present spending on exploration for copper, at around 750 MUSD, amounts to some 3.4 per cent of annual copper mine turnover (at a copper price of 1 USD per pound). In gold the ratio is in the 4 to 5 per cent range. This may reflect the relative chances of success or the prospects for a bonanza, but it could be argued that too much is spent on exploring for gold. There may be a mis-allocation of resources. For other products, especially where the difficulties involved are smaller, the ratios are much lower. The ratios should strictly be estimated over a period of as long as a decade in order to allow for cyclical fluctuations and the bunching of discoveries. Known global resources seldom change smoothly, but in a lumpy fashion.

Accepting that exploration is not carried out only by producing companies, it is possible to go beyond global aggregates. The comparison of corporate exploration expenditures, both absolutely, and relative to turnover, gives a measure of each company's contribution towards maintaining the global stocks of resources. Similarly, exploration spending can be compared with the values of each company's proven and probable reserves, estimated on a standard basis, and at the average real prices of the past decade. The figures could be calculated for individual products, for countries or regions, and as overall totals. In all instances, exploration expenditures should be totalled on consistent definitions, rather than using the myriad ways in which companies disguise the figures in their annual accounts. After all, the last function of those is to reveal all a company's financial information.

Local environmental and social indicators

One important criterion in any measure of sustainability is that the mining industry should only be held accountable for those things that it can control. This is as relevant at the local level as on a national, regional, or global basis. It is at the local level that environmental and social factors come to the fore. The broader issues that we have discussed so far, of the mining industry's overall sustainability, are naturally of little concern to local communities. Any yardsticks against which mining is judged, even at the local level, should be as universally applicable as possible, even though each mine possesses unique characteristics.

Much contemporary focus is on the impact of mining on indigenous peoples and traditional ways of life in developing countries or remote areas. The projects involved, however, are by no means all those carried out by the global minerals industry. They probably receive media and public attention out of proportion to their contributions to global mining activity and to new mine development. Such attention should not distort, or dominate, the criteria used to assess mining activity. There is a temptation in such cases to load far too much responsibility onto the shoulders of mine operators, especially for social matters. Many people expect them to take over many of the functions of government, whether national or local, and to judge them accordingly, but that is invariably a mistake. Mining companies should never usurp the functions of government, whether consciously or otherwise, by resorting to paternalism as the easy response to short term problems. The prime function of mining companies is to develop mineral deposits competently and efficiently, and to maximise profitability over the long term within the constraints set by society. This is the key to appropriate local indicators. How do mining companies meet those constraints – in both social and environmental spheres?

Mining is visually intrusive, and normally causes strictly localised impacts on land use. The adverse impact is often temporary, over a few generations at most, although the landscape is usually altered permanently. In that latter regard mining is little different from most other forms of economic activity. Mines can be disruptive to local communities, as would any intrusive large scale development, such as a new road, a hydro-electric scheme, or a forestry plantation. Concern over the health and quality of life of the surrounding populace is important, if a mine is to become an accepted and valued part of the local community. This is the backdrop to local indicators. Basically, they reflect and measure the environmental side of sustainable development, and we should never forget that this is only part of the story.

It is much easier to measure the performance of new mines than of long established sites. Many jurisdictions, and certainly modern best practice, require base-line studies of the local environment and community before development starts. The impact of mining on all relevant aspects can, therefore, be measured with reasonable precision. As a general principle, every new mining project, no matter where it is located, should carry out such preliminary base-line assessments, naturally in a cost-effective and flexible a manner as possible. The lack of such studies for existing mines does not change the nature of suitable indicators of performance, but it does complicate their interpretation.

Final comments

The concept of sustainable development means widely different things to different people. This article has touched on both the economic and the environmental aspects. The former are more relevant at the global or national level, and the latter at the local, but both are important. Much recent discussion has concentrated on local measures without examining the broader framework. That impoverishes the debate and hijacks a noble, if woolly, concept for sectional interests. Obviously mining companies will be mainly concerned about local indicators, which they can modify through their own policies and actions, but they should never lose sight of this wider canvas. ■