



Mining, Minerals and  
Sustainable Development

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# MMSD Draft Report for Comment 4 March 2002

## Part III: Challenges

# Chapter 6 Viability of the Minerals Industry



International  
Institute for  
Environment and  
Development



World Business Council for  
Sustainable Development

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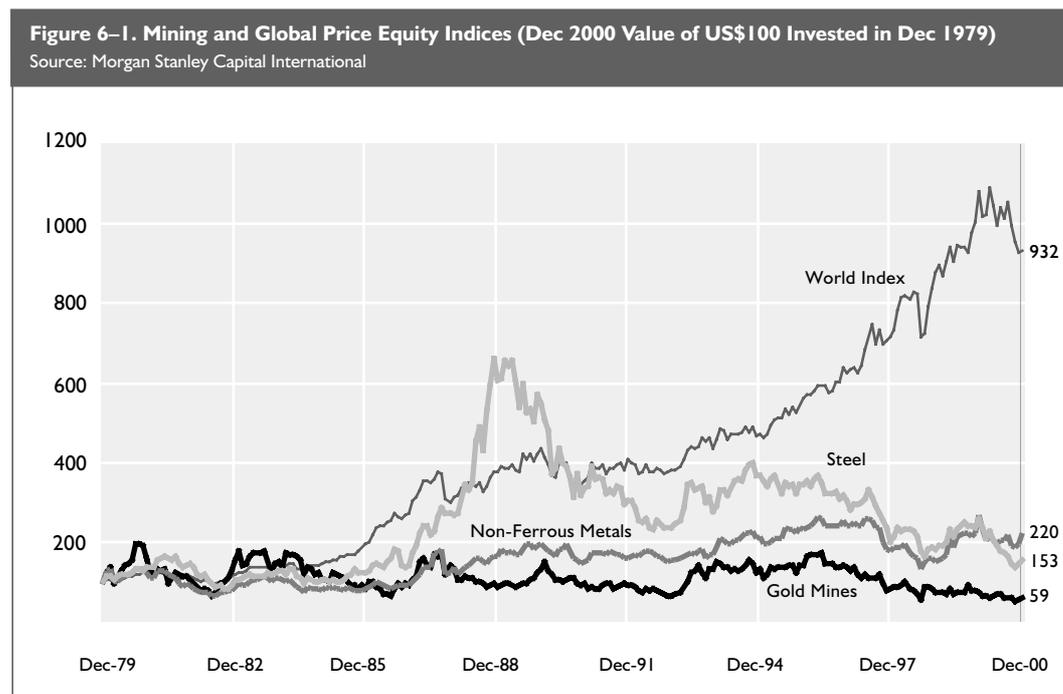
Historically, companies were expected to meet their responsibilities to their employees, their shareholders, and the regulatory authorities where they operated, which they did to a lesser or greater extent. In addressing the challenge of sustainable development, companies will have to understand and meet their responsibilities not only to these groups but to others as well – including the national and local development arms of governments, affected communities, watchdog non-governmental organizations (NGOs), and consumers of their products. This part of [report title] looks at how all these different groups interact with each other and how these interactions can ease or block the path to sustainable development.

Clearly, for the transition to sustainable development to happen, the private sector needs to play an integral part in addressing the priority concerns. It needs to be convinced of the business case for private-sector involvement. But better environmental and social performance will not happen without the active engagement and support of the other key groups, whether they be government officials, union members, or community representatives. The language of the transition to sustainable development underlines that all actors are at different starting-points on an uncertain collaborative journey that will require on-going adaptation and convergence at many levels in many different places. Success will be more likely with clearly defined goals, well-researched alternatives, appropriate indicators to measure progress, diffusion of technological innovation, and effective institutions to encourage appropriate actions.

First, it is useful to examine the minerals companies themselves – their reasons for adopting the sustainable development agenda and how this agenda does or does not tie in with their

core business strategy, the conditions they provide for those who work for them, and their relationship with the financial institutions that support them. The focus in this chapter is largely on the major mineral and metal companies that compete for capital in global markets, operate in many countries, and produce products that are sold into global markets.

Before turning to the business case, it is important to note that mining-industry profitability falls short of most other industries. The real question facing the industry is how it can meet the minimal economic performance to remain viable in the face of mounting demands for improved environmental and social performance. Figure 6–1 demonstrates the poor financial performance of three mining sectors compared with a global index over the last 21 years.<sup>1</sup> While individual companies may – in certain years and overall – do far better than the industry average, the statistics are salutary. However much the poor returns are a function of oversupply, cyclical factors, or plain poor management, the effect in the end is the same. There is little room in this sector to make dramatic gestures from retained earnings or profits. And for as long as this situation persists, many of the costs implicit in this report will be a struggle for individual companies in the sector to meet. The business case and, perhaps more significant, the political case for trying to ‘raise the game’ across the sector must be clear.



## The Business Case for Sustainable Development

The question of how – or indeed whether – successful company strategies can integrate the concepts of sustainable development into core business practice is at the centre of this report. Is it in a company’s financial interest to strive for good environmental, economic, and social performance?

The traditional discussion of a company’s record on environmental and social performance was couched in terms of the problems of externalities. Many of the costs involved in

improving environmental and social conditions are internal, and hence represent an additional cost to the company, but many and perhaps most of the benefits are often external. As many of the traditional benefits do not accrue directly, the company does not have an incentive to incur these extra costs. Proponents of the business case criticize this approach as being too static since it ignores the potential of companies to innovate.<sup>2</sup> In addition, many externalities are increasingly being internalized due to tightening legislation, consumer pressure, and the force of public opinion.

The greatest challenge to embedding sustainable development in minerals companies is this difficulty of linking it to financial success. There is a need for each company to identify more clearly the magnitude and incidence of all the costs and benefits to ensure that its actions are based on rational business interests. The business case for addressing sustainable development concerns includes numerous benefits:

- *Lower labour costs and more innovative solutions* – When corporations demonstrate a visible commitment to corporate social responsibility and corporate and employee values are in alignment, this can translate into better motivation and job satisfaction, higher productivity, more innovation and creativity among the work force, fewer union disputes, lower absenteeism, and lower labour turnover.

For instance, uranium miner Cameco has invested more than a million dollars in northern Saskatchewan in tertiary education, training support, scholarships, school-based athletic programmes, and career information initiatives. All were designed to encourage northern aboriginal children to stay in school, pursue tertiary education, and consider occupations in the mining industry.<sup>3</sup>

- *Lower health costs* – A healthy environment for workers and the surrounding community improves well-being and thus productivity. Investment in social infrastructure, such as schools, hospitals, water supplies, and so on, reduces the traditional health hazards of poverty and underdevelopment. This translates into higher productivity, reduced worker and community compensation and damage suits, lower penalties for non-compliance, and reduced costs to social services and medication.<sup>4</sup>

At Placer Dome's Misima mine in Papua New Guinea (PNG), for example, a tripartite initiative between the mining company, the World Health Organization, and Australia's James Cook University initiated a successful campaign to eradicate the tropical disease of lymphatic filariasis – a significant public health problem – which reduced absenteeism.<sup>5</sup> In South Africa, HIV/AIDS programmes have been initiated by several mining companies. These include BHP Billiton's efforts at Hillside Aluminium operations, located in KwaZulu-Natal, where the prevalence of HIV among employees is 11% compared with more than 30% in surrounding communities. Anglo American at its Namakwa Sands operation in the Western Cape province has a predominantly locally recruited work force with an HIV prevalence of only 2%.<sup>6</sup> Over the past four years, AngloGold has been actively developing a model for integrated HIV prevention and care programme in collaboration with the London School of Hygiene and Tropical Medicine.<sup>7</sup>

- *Cost savings due to cleaner production methods* – Good environmental practices pay for themselves in cost savings and increased production. Reducing raw materials use and increasing recycling and recovery can lower production costs. Innovation and

technology development can introduce new process and product efficiencies, such as the ability to treat lower-grade ore that would otherwise be classified as waste rock and to improve recovery levels of the minerals. Reducing the level of metals in the waste also reduces environmental problems. These opportunities for cost savings may not become apparent until the company is motivated by regulation or concerns about sustainability performance to examine solutions and invest in the necessary research.<sup>8</sup>

The benefits of this kind of practice are illustrated by projects under way at Rio Tinto's Borax operations in the US. These range from simple measures such as installation of energy-efficient lighting, efficiency in packaging, and environmental training programmes to more advanced programmes that involve ISO 14001 certification, management of solid and hazardous wastes, and reduction in carbon dioxide emissions.<sup>9</sup>

Although the 'pollution haven' argument has been leveled at minerals companies engaged in foreign direct investment in developing countries, many of the major multinationals argue that it is more cost-effective to install state-of-the-art clean technology rather than to retrofit older technology as environmental standards become more stringent.

- *Easier access to lenders and insurers and preferential loan and insurance rates* – Lower risks achieved through implementation of a sustainable development strategy may mean lower loan rates or insurance costs. Poor environmental performance reduces a company's access to and increases the cost of debt and equity capital, particularly in countries where legislation follows the 'polluter pays' principle.<sup>10</sup>
- *Lower transaction costs* – Increased transparency and dissemination of information on a project and the plans to avoid, mitigate, and minimize the negative impacts while maximizing the positive impacts will build trust among stakeholders and reduce transaction costs – in terms of management time and the length of the permitting process. The preparation and dissemination of thorough impact assessments and baseline studies, though costly, may be useful evidence in the case of future risk of liability. Anticipating and being sensitive to problems in advance and taking appropriate preventive actions will pay dividends.

For instance, the adoption of several new environmental and community initiatives at BHP Billiton's Cerro Matoso nickel mine in Colombia paved the way for an expansion of the operation to be approved.<sup>11</sup> On the negative side, poor assessment and planning for avoidance and mitigation of environmental and social impacts stopped the proposed Windy Craggy mine project in British Columbia, Canada.<sup>12</sup>

- *Lower closure and post-closure costs* – Development and implementation of a clear long-term and post-closure plan can lower closure costs considerably, if systems are put in place correctly from the beginning. If the plan is comprehensive and integrated, there will be less pressure to keep operating just to avoid dealing with the consequences of closure. Where site reclamation is planned from the outset, the ultimate cost is lower and the results are better. A life-cycle approach to managing the environmental and social impacts – from development through operations to closure – makes commercial sense. Poor planning incurs additional costs in relocating waste materials and dealing with watershed contamination. For example, if the acid drainage problems of the Equity Silver mine in British Columbia had been anticipated when the mine was being proposed, the project would probably never have proceeded.

The greater the time lapse between the occurrence of environmental damage and its remediation, and the greater the neglect of the social issues generated by minerals development, the greater will be the human and financial resources necessary to address the problem.<sup>13</sup> This translates into higher demand for financial resources at the time of closure, when the company is experiencing a reduction in revenues. Preparing for and addressing these concerns from the outset will let the company set aside the necessary funding for terminal liabilities when cash flow is strongest.

- *Higher value for goodwill on the balance sheet* – A commitment to sustainable development may enhance a company’s profile and reputation. This has several advantages. It may be the best way to attract the best people to mining careers, or for an individual company to get better new employees than its competitors. Externally this should lead to an improved social licence to operate: companies attempting to explore for, define, or develop deposits will be more welcome by host nations and local communities if they arrive with a clear vision of themselves as agents of sustainable development. Good relations and acceptance in the local community can reduce the time required to get government approval and lower the possibility of conflict, both of which can be very costly. On the other hand, human rights abuses and worker and community health problems – though they may not incur a penalty directly – will certainly affect the reputation and long-term value of the company.

Rio Tinto’s Hamersley Iron, operating in Western Australia’s Pilbara region, has invested heavily in the design, construction, and development of three towns, a port, a railway, roads, and associated utilities. At the request of the state, the three ‘company towns’ were transferred to the care of the local government. These towns are associated with a high standard of living that helps to attract and retain world-class employees for the mine.<sup>14</sup>

- *Best-practice influence on regulation* – Companies that follow best practice are much better placed than their competitors to influence how standards are set and the direction of regulatory change. If the industry leaders can adopt a set of standards based on best practice, they will have a competitive advantage when this is taken forward and incorporated in legislation addressing sustainable development issues. Best practice can help establish credibility with regulators and can aid in the move to partnerships to develop realistic, science-based regulations.

In the European Union, the metals industry has an opportunity to contribute further to the effective regulation of its products under the proposed revision of the Chemicals Policy. This can be done by the generation and provision of the best available data for the registration and risk assessment process for substances being placed on the market. The European metals industry also has a key role in ensuring the appropriate and effective development of this policy.

- *Market advantage* – Some mineral companies are finding ways to build deeper relationships with customers and believe that this will allow them to capture more value and move away from strictly being commodity sellers to providing a mix, with some service elements added. Reputation and brand value are increasingly important for companies to establish premium prices for their products.

For example, diamonds from the Ekati mine in arctic Canada are etched with a polar bear to distinguish the product on the basis of origin. The branding has several

advantages – the diamonds are marketed as coming from a source proud of its environmental and social performance, and they can be easily distinguished from conflict diamonds.

- Ethical investors – The rapid expansion of the ethical and socially responsible investment (SRI) movement in North America and Europe poses a new challenge for minerals companies as investors – especially pension fund managers and other large institutional funds – screen out stocks associated with unacceptable social and environmental performance. The growing trend towards ‘best of class’ investment by such funds potentially provides an incentive for mining companies to raise standards and achieve recognition in the investment community. Though some SRI funds operate negative screens that rule out mining companies, a number of best-of-sector SRI funds have invested in the industry leaders.<sup>15</sup>

An example of how social responsible investment is rapidly becoming more mainstream comes from the UK, where changes to the pensions law in 2000 means that trustees of pension funds must declare the extent to which social, environmental, or ethical considerations are taken into account in the selection, retention, and realization of investments.<sup>16</sup> In a survey undertaken by consultants ERM, 21 of the 25 largest UK pension funds now apply social responsibility criteria to at least part of their portfolios.<sup>17</sup>

In order for companies to realize the benefits of having an effective sustainable development capacity integrated thoroughly into its businesses, they need to ensure that company-wide sustainable development risks and opportunities are:

- comprehensively and systematically identified;
- understood in terms of their business significance;
- put on the table and debated, considering the company’s best long-term business interests; and then
- prudently managed.

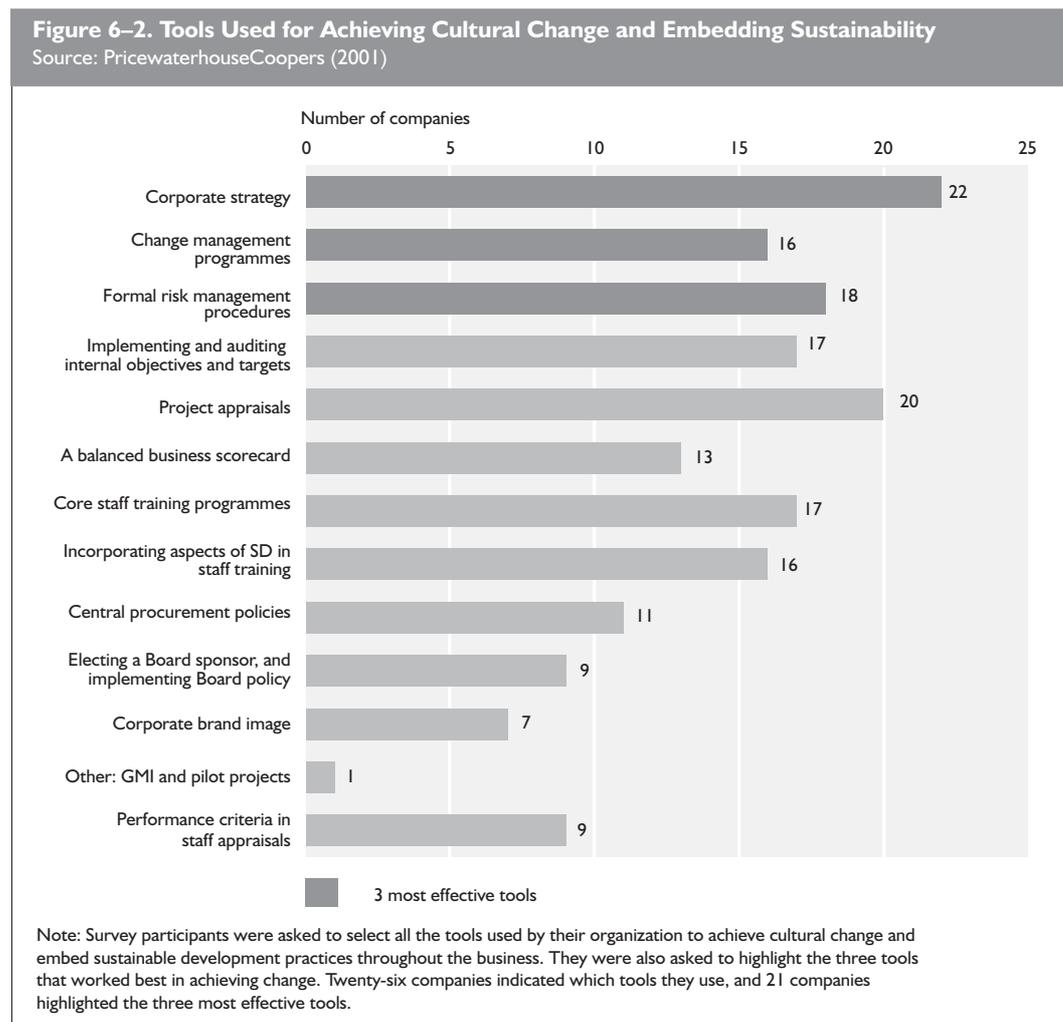
When examining the empirical evidence of the business case, there is a problem of establishing causality, which makes it difficult to draw clear conclusions.<sup>18</sup> Does good environmental performance lead to good financial performance? Or is it that companies in a good financial position can afford to improve their environmental performance?<sup>19</sup> Several mining companies have publicized particular win-win examples of better environmental and social performance going hand in hand with better financial results.<sup>20</sup> In addition, there are many negative examples of substantial costs incurred when environmental and social issues were not given due attention (a cyanide spill at Baia Mare, Romania, for instance, and a tailings dam failure at Los Frailes, Spain). To date, no substantive empirical work on mining company financial performance has been completed that establishes a positive link with actions designed to improve sustainability performance. This should be a priority task for future research to establish evidence for the business case.

As companies begin to accept different and broader definitions of their roles, how are they equipping themselves for the new approach? As part of the MMSD process, consultants PricewaterhouseCoopers surveyed the large mining houses to provide a baseline assessment of how the mining and minerals industry is responding to the issues of sustainable development.<sup>21</sup> Thirty-two organizations, representing nearly US\$100 billion in annual

sales and over 750,000 employees, participated in the survey, with a broad commodity and global geographical distribution.

The survey found that the majority of the participating companies have taken the first critical step towards a better understanding of sustainable development by acknowledging its importance to the industry and its future. They are aware of the importance of their interaction and consultation with local stakeholders, and of socio-economic and environmental impacts on their employees and on the local communities where they operate. Implementation of environmental management is more developed, however, than the management of social issues and wider economic impacts.

Companies are still wrestling with the concrete steps necessary to make the concepts of sustainable development operational. There are some examples of specific measures to integrate concepts into corporate practice, but most companies were far from developing a detailed vision of how to adapt to this new paradigm. Several tools were commonly used to achieve cultural change and embed sustainable development practices into organizations. (See Figure 6–2.) Most companies were still struggling to link these activities with financial success and to demonstrate a clear business case for pursuing sustainable development goals.



A number of leading mining companies are starting to put in place a range of policies and programmes that tackle different aspects of the sustainable development agenda. (See Box 6–1.) Critical questions remain about the implementation of these initiatives and the diffusion of corporate responsibility initiatives beyond the largest corporations. Through the various MMSD consultations, it was clear that most stakeholders appreciate the progress that some companies have made, but there are concerns about the continuation of ‘double standards’ between industrial- and developing-country operations – as well as about the continuing recalcitrance of some companies. One way of reaching beyond this is through collective business action, and the range and number of industry initiatives undertaken both nationally and globally has grown recently. (See Chapter 3.)

#### **Box 6–1. Selected Mining Company Actions for Sustainable Development**

For a growing number of large-scale mining multinationals, sustainable development is an umbrella concept covering health and safety, risk management, emergency preparedness, environmental management, community relations, relations with indigenous peoples, and, in some cases, human rights.

##### **Policy development**

- Developing company-wide operating policies, standards, and performance indicators for critical issues such as human rights, mine closure and rehabilitation, biodiversity, tailings management, water and energy use, and greenhouse gas emissions
- Adopting a policy of best management practices where regulations are absent and standards are not set
- Ensuring policies are long-term and cover all activities – from exploration to provision of support for sustainable community businesses following mine closure
- Developing guidelines for social and environmental impact assessments
- Developing a remuneration policy for accidents
- Extending policy coverage to contractors and suppliers

##### **Policy implementation**

- Appointing senior management representatives and staff to implement policies
- Making compliance and corrective action part of every employee’s responsibility
- Identifying and recording obligations
- Setting site and corporate performance targets for sustainability issues
- Identifying performance indicators for measuring the success of policy implementation, such as the effectiveness of contributions to neighbouring communities
- Establishing methods to evaluate social and environmental risk
- Ensuring full compliance with industry codes of conduct and legal requirements, and exceeding these where possible
- Implementing ISO 14001 or equivalent environmental management systems
- Reporting on performance at the site and corporate levels
- Monitoring, reviewing, and confirming the effectiveness of performance against company standards, targets, applicable legal requirements, technological innovation, scientific discoveries, and stakeholder expectations
- Internal and external performance assessment of current initiatives, for example company sponsorship of an external International Safety Rating System
- Developing mechanisms for public participation and community involvement
- Establishing stakeholder advisory boards
- Financing improvement programmes for sustainability issues, such as community programmes and health and safety audits
- Allocating adequate human resources to ensure that sustainability issues are given high corporate priority

### Box 6–I. Selected Mining Company Actions for Sustainable Development

#### Employee development

- Building environmental and social competencies by providing training on sustainability issues for employees and contractors
- Improving understanding of human rights issues
- Encouraging respect amongst employees for each other, and for local communities and their traditional knowledge and customs

#### Safety at work

- Making a commitment to reduce injuries, incidents, and occupational illnesses
- Including safety accountabilities in job descriptions
- Ensuring businesses and sites have safety management systems and safety improvement plans
- Actively seeking to prevent accidents by disseminating experiences learned
- Ensuring high standards for incident reporting and fitness at work
- Encouraging cooperation between management and the work force on safety issues
- Supporting research and development with regards to safety, health, environmental issues, and technology to minimise impacts
- Developing and testing emergency response plans

#### Links with external stakeholders

- Maintaining good working relationships with local communities, regulatory agencies, businesses, government, academia, NGOs, and other affected and interested parties
- Building active partnerships in the field of human rights, education, and biodiversity management
- Strengthening understanding of communities where companies operate and improving communication and networks with such communities
- Participating in public policy debates on sustainability issues such as climate change and recycling

#### Product stewardship

- Undertaking life-cycle inventories and analyses
- Promoting product stewardship
- Improving understanding and communicating risks posed by company products in the environment
- Ensuring use of company products does not harm people's health

Source: Anglo American (2001); BHP Billiton (2001); Noranda (2000); Placer Dome (2001); Rio Tinto (2000); WMC Resources (2000a); WMC Resources (2000b); and, PricewaterhouseCoopers (2001).

## Sustainable Development: Enhancing Shareholder Value?

In the 1980s, global deflation and related commodity surpluses that followed from the second oil crisis led to a dramatic decline in the profitability of the mining industry.<sup>22</sup> With few exceptions, government-owned mining companies suffered serious losses. Far from contributing positively to the rest of the economy, they became a burden. Privatization and deregulation have since been the order of the day. Of specific influence in the mining sector was the tremendous exploration boom in Chile in the 1980s, which ultimately was followed by massive new investment in the industry.

Shortly after the trend towards privatization and deregulation developed, a further change occurred in the business and financial environment affecting mining companies. This was the so-called shareholder value revolution. This significant development in corporate

strategic thinking in mining, as in other global industries, maintains that the principal goal of management is to increase the wealth of owners and that all other obligations are secondary. This change in the business environment gives rise to questions of paramount importance to the debate on sustainable development:

- Does the shareholder value revolution change, for better or worse, the willingness and ability of companies in general (and specifically those engaged in mining and minerals activities) to take account of sustainable development issues in their business decisions?
- What specific impact has the shareholder value revolution had on mining companies so far, and what is the prognosis for the future?

Contrary to initial impressions, the focus on maximizing shareholder value does not imply either a reduction in funding for environmental and social issues or a desire to minimize such costs. In fact, financial markets are becoming more alert to the potential destruction of shareholder value arising from liabilities created by inappropriate corporate behaviour towards the environment, local communities, and governments. Conversely, markets are inclined to reward companies that have established consistently high standards in this field.

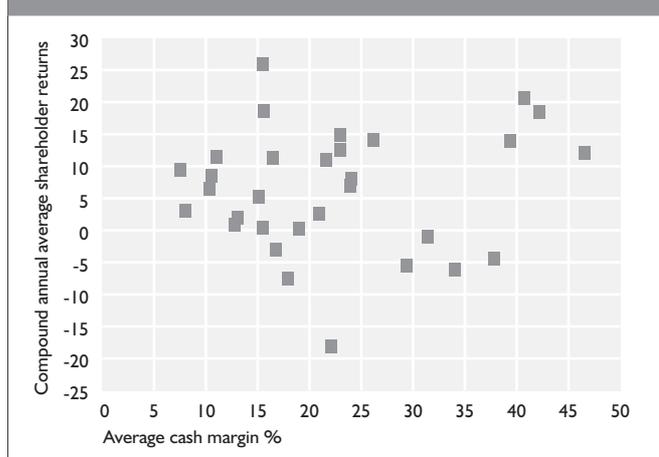
It is generally recognized that a key component of value is the net present value of a company's expected future free cash flow from its existing operations. The mining industry produces standardized homogenous commodities that are traded globally, the prices of which are set by continuous auction in a commodity market. Apart from minor differences reflecting location, all producers sell at essentially the same price, over which they have no control.<sup>23</sup> It follows from this that the only way a company can earn more than its competitors and thus improve its valuation is by reducing costs. This has led to what can only be described as an extremely strong 'cost culture' in the mining industry. This focus has been strongly reinforced by the low prices of recent years for most minerals.

Any demand for increased expenditures on social or broader economic development programmes in the name of sustainable development appears as a direct affront to this culture. Such outlays reduce the net present value of future cash flows and therefore extinguish shareholder value. Worse, the long-term returns come in large part in intangibles (reputation and goodwill), which are hard to value now and even harder in the future. The traditional view, therefore, is that financial commitments to sustainable development – whether they take the form of direct financial payments or involve policies that are not strictly justified on competitive grounds (such as buying locally when offshore suppliers are less expensive) – are just another form of taxation. As with any tax, companies will try, within the limits of legality, to arrange their affairs so as to minimize such costs.

Fortunately this is far from the whole of the story. First and foremost, there is strong reason to doubt that the cost culture just described has served the industry well. Recent research by CRU International has found virtually no correlation between a company's cost competitiveness, as revealed by its gross operating margins, and the rate of growth of shareholder value, calculated by the total return on its common stock.<sup>24</sup> (See Figure 6–3 for this relationship for 50 leading mining companies over the past decade.) This suggests that the change in shareholder value is driven by a number of other factors in addition to the relationship between operating costs and prices.

Figure 6–3. Shareholder Return versus Cash Margins (1990–2000)

Source: CRU International



Among the leading possibilities are:

- *Different company-specific risks* – Estimates of net present value are based on forecasts of the future, which are inherently uncertain. Some uncertainties, like commodity prices, are common to all companies; others, specifically uncertainties relating to a mine’s ability to operate, are company-specific. Faced with this, the market may value different companies on the basis of their perceived riskiness.
- *Terminal liabilities* – In many cases the ultimate liabilities of a mining company may not be clearly presented using current accounting practice and may not even be quantifiable in practice; nevertheless, the market will mark down the value of any company that it fears has potential exposure to such liabilities.
- *Capital productivity* – In many cases a low-operating-cost position is only achieved by investing large sums of capital either in the original mine or when acquiring the operation from someone else. Clearly there is a real risk that a company will invest too much capital for any given competitive position.
- *Real option value* – The ownership of a mine carries with it more than the entitlement to the free cash flow that it generates. It also confers on the owner a right to further develop the mine and exercise other real business options on terms that are not available to competitors. Such options have an independent value that is frequently recognized by the market.

Though these are not the only factors other than production costs that will affect the market’s valuation of a mining company, all of them are intimately linked with sustainable development concerns, so it is useful to look at them in some detail.

First, site-specific risk: aside from commodity market risk, which is common to all, the principal risks associated with cash flow at a specific mine are geological (reserve) risk, national (macroeconomic) risk, and socio-political risk. The first of these could refer to the need to avoid mining in areas of environmental sensitivity or of cultural significance that may constrain access to specific reserves. The second has a link with sustainable development issues to the extent that they affect the national economic environment or vice versa.

The third site-specific risk has a huge potential to destroy shareholder value. A classic example was provided by the Bougainville copper mine in Papua New Guinea. Initially this was a highly successful and low-cost copper and gold producer. But the mine had to be prematurely abandoned in the face of a local rebellion, which began when landowners complained about the social and environmental impact of the mine and which escalated into a full-blown conflict in response to the national government's heavy-handed treatment of these complaints. At a minimum, the alienation of the local community, or for that matter the regional or national government, clearly places a mining venture at risk. Funds spent to avoid or minimize that risk do not necessarily detract from shareholder value, but may in fact serve to protect and enhance it.

Terminal liabilities are a huge issue for mining companies and go right to the heart of the sustainable development debate. Major portions of these liabilities are environmental and relate to the safe closure of a mine at the end of its life. (See Chapter 10.) Current accounting practices are highly questionable in this regard. To quote from one corporate statement:

We record liabilities for environmental expenditures when it is probable that obligations have been incurred and the cost can be reasonably estimated. Our estimates of these costs are based on available facts, existing technology and current laws and regulations.<sup>25</sup>

From this extract it appears that for liabilities to be recognized in a mining company's formal financial statement, a series of assumptions must be made – not one of which is likely to predict the outcome exactly. In particular, the technology available both for the detection of pollution and its remediation is most unlikely to remain constant. It is also very unlikely that the laws and regulations regarding such subjects will remain unchanged over long periods. This is particularly relevant in that for many large mining operations, it may be 20, 30, or even 50 years before these facilities have to be closed. The same financial report contained the following explanation of the company's accounts:

The amounts of our liabilities for remedial activities are very difficult to estimate. This is due to factors such as the unknown extent of the remedial actions that may be required. In the case of sites not owned by us, the extent of our probable liability in proportion to the probable liability of other parties is difficult to estimate. We have other probable environmental liabilities that in our judgment cannot reasonably be estimated. Losses attributable to remediation costs are reasonably possible at other sites. We cannot currently estimate the total additional loss we may incur for these environmental liabilities, *but that loss could be substantial*. [emphasis added]<sup>26</sup>

Terminal risks are not simply environmental. There may be liabilities to employees and to the local community. Moreover, the latter may develop over time and may be influenced by legislation that has not yet been enacted. A parallel situation is the complete inability of the nuclear industry to finance new power stations in most countries. This has arisen primarily because the markets have no idea whatsoever about the size of potential liabilities at the power station when it comes to closing down at the end of its 20–40 years of working life. In most, if not all, cases of power plant closure to date, the costs have far exceeded original estimates and the reserves that were originally destined to cover these expenses.

Another example is the wholesale destruction of shareholder value at publicly quoted steel companies in the United States. In the middle of 2000, the market capitalization of the 14

largest steel companies in the country was less than one-quarter that of a single aluminium company – Alcoa – and approximately 4% the size of Microsoft's.<sup>27</sup> In this industry, terminal liabilities, which are largely environmental and employee-related, have reached the point where no responsible corporation or financial institution can participate in the reorganization and rationalization that appears to be needed out of fear of attracting responsibility for such large and ultimately unquantifiable liabilities.

Faced with the extreme uncertainty that clearly exists in this field, the value that the financial markets place on a mining company's stock is going to be significantly influenced by the reputation and conduct of the company with respect to the effective management of terminal liabilities. Markets will apply significantly higher valuations to companies where they expect the potential for unpleasant surprises in this regard is low, compared with other companies that are perceived to be taking higher risks.

In terms of capital productivity, actions to lower cost were always desirable. Besides being responsive to corporate pressures, they served to improve local employment security. Low-cost mines are less likely to be closed during recessions than high-cost mines. Thus local mine management has tended to favour the substitution of capital (for which they were not usually accountable) for other inputs, including labour (for which they were accountable). As the shareholder value movement takes hold in the mining industry, this paradigm will almost certainly change. When managers are forced to consider the trade-off between capital and other inputs, chances are they will select a different, less-capital-intensive route, assuming such options are available. It is not certain, of course, that this will increase the local economic multiplier, but since the local mining community in developing countries does not generally produce sophisticated capital goods, there is no reason to suppose that it will decrease this multiplier.

Finally, real option value is particularly significant for mining companies. Most ore bodies turn out to be significantly larger than originally estimated. This happens because proving reserves is costly and there is no incentive to establish reserves that are not going to be used for 20 or more years. This means, however, that there is hidden option value present in many mining properties. Thus most mining companies have the real option to expand output at a given site by accessing additional minerals that did not form part of the original plan. Moreover, the cost of such expansions tends to be significantly less than the construction of new greenfield projects.

It is sometimes assumed that the shareholder value movement serves to discourage exploration activities because it focuses too heavily on short-term performance. This is not really the case. If a company, as a result of an exploration programme, proves reserves that either materially extend the life of a mine that is about to become exhausted or that create a new expansion opportunity at an established mine, this will be immediately discounted in the form of increased shareholder value. What the shareholder value approach does is discourage exploration for the sake of exploration or exploration based on an ideological belief that a certain percentage of cash flow should, under normal circumstances, be reinvested in this activity.

Sustainable development issues clearly work to either enhance or detract from the value of real options. If environmental constraints, community opposition, or conflict over land

rights make the potential expansion of a mine problematic, the value of this option to the company significantly decreases. On the other hand, if the discovery of ore extends a mine's life and pushes closure costs further into the future or it makes it easier to fund them, shareholder value will be increased.

The bottom line of this discussion is that the advent of an apparently narrower and more rigorous commitment of shareholder value does not necessarily have negative implications for sustainable development issues. On the contrary, a properly implemented switch from the cost culture to the value culture has the potential to ensure that such issues are factored into business decision-making on a more disciplined and systematic basis. It is the cost culture that is the consistent opponent of sustainable development outlays.

Many of the large international publicly quoted mining and mineral companies state that they are committed to shareholder value. They have formally embraced value-based management techniques that, in theory, encourage the recognition of such things as the risk to value posed by terminal liabilities, the value of real options, and so forth. However, this is merely the theory. In practice, certain issues and problems remain.

First, the value culture may be embraced by the corporate centre, but may not be pushed down the organization or be affecting decisions on the ground. In the bull market of the 1990s, it was easy to embrace shareholder value, as top executives' compensation was paid in highly leveraged stock options. In and of itself, this does not necessarily change behaviour. But how far down the organization have the incentives been pushed, how has the measuring and reporting system been changed, and to what extent are the employees actually using different criteria when making their decisions? If the answers are not far, not much, and not at all, then the management change is just cosmetic.

Second, the change in management culture in the mining industry is far from universal. Large, high-profile, multinational mining companies attract far more scrutiny from governments and NGOs than middle-sized and smaller companies. Moreover, new mine developments attract far more scrutiny than existing operations. When a company like Rio Tinto or BHP Billiton opens a huge new copper mine, there is likely to be a substantial effort to consider the whole range of environmental issues, develop a proper mine closure plan, deal with the local community in a constructive and consensual manner, and so on. This is far from the case when it comes to a small or medium-sized incumbent operator, possibly experiencing diminished financial capability, that is working in an old mine whose original construction and planning were far inferior to modern standards, and operating in a community where a legacy of conflict exists, possibly due to previous owners. Moreover, where a company is not publicly quoted, financial market disciplines are significantly diluted.

Third, although the traditional view is to see social costs incurred by companies in addressing social development issues as just another form of tax, this is not actually the case. Taxes are usually mandatory (though many would argue that they are sometimes negotiable in large foreign direct investment situations).<sup>28</sup> Corporate contributions to sustainable development are clearly negotiable. And they should stay that way. Taking environmental issues as a case in point, the ambient conditions are totally different between the Atacama desert of northern Chile and the rain forest of Indonesia. The management of mine tailings

in one of the driest places on Earth poses completely different engineering challenges and involves different risk considerations than in one of the wettest places. Likewise, where the impact of a mine on an indigenous culture is concerned, it is clear that a 'one shoe fits all' formula is unlikely to be satisfactory.

All these caveats regarding the real-world situation today leave the following problem: rather than recognizing a social cost or obligation and building it into the financial decision-making process, the expense can be negotiated down or away altogether. Making sure that does not happen requires a government structure that:

- is transparent, not corrupt, and committed to consensual decision-making;
- has the technical capability to understand and critically evaluate the options presented by the mining company from an independent perspective; and
- is not so desperately poor that development on any terms is seen as desirable.

Unfortunately, in many cases these conditions are just not present. So what happens will largely be a function of the integrity of the company concerned and the existence of some effective international framework or safeguards applied by lenders and investors, consumers, or the public spotlight.

## **Minerals Companies and their Employees**

Maximizing the industry contribution to sustainable development requires industry to engage with various constituencies and stakeholders at a variety of levels: globally, nationally, and locally. Company employees are one group that has the capacity and the desire to engage with industry at each of these levels to help create the necessary framework for sustainable development, at least for workers in larger and unionized mines. This is an opportunity that should not be missed.

### ***Job Creation***

Job creation is held out as a major benefit of new mining projects and one of the industry's most convincing arguments for its contribution to sustainable development.<sup>29</sup> But this benefit appears to be tempered in a number of ways. Mining operations are becoming more capital-intensive, generating fewer jobs. Local communities also may not benefit from the new jobs. If there are no competitive local contractors, international contractors are brought in. Moreover, even where local people are employed, incentives for contractors to invest in training are limited by the short-term or performance-leveraged nature of their contracts. Reducing employment in current or formerly state-owned enterprises has been a priority for international institutions trying to help with the process of 'reform', especially in East Europe and the former Soviet Union. This and wider market liberalization have in many cases involved large-scale direct and indirect job losses. Bolivia, for example, saw mining industry employment fall from 73,514 in 1990 to 46,402 in 2000.<sup>30</sup> Similarly, in the United Kingdom 180,000 people were employed in mining in 1989 but only 70,000 by 1999.<sup>31</sup>

There is no 'stakeholder' more important to the future of sustainable development in the mining industry than the people who work there. And there is a strong business case for

paying attention to the conditions of the work force in order to attract and retain committed employees. Numerous studies indicate that recruiting and retaining top-quality staff will be a critical source of competitive advantage in the future.<sup>32</sup> The large mining companies are facing a big challenge in attracting high-calibre people for a number of reasons, including fewer young people choosing mining as a career because of the perception of poor future job prospects, a negative industry image, constant moves and disruption of family life, and the poor quality of life in mining towns. In addition, the industry has done a particularly bad job to date of attracting women to work in professional jobs.

Given the great variety of circumstances of individual companies and projects at the operational level, it is hard to go beyond some general observations about companies and their employees:

- *Conditions of Employment* – Good, safe, healthy, and enjoyable working conditions are the best way for companies to attract and retain human capital. Competitive remuneration, reasonable working hours, opportunities for personal career development and training, sensitivity to local culture and traditions, attention to health and safety regulations, and open and participatory management structures are all important in providing a congenial work place and reducing absenteeism and staff turnover.
- *Local Recruitment* – The best way to ensure that miners can be integrated into communities and to minimize the disruption of an influx of outsiders is to recruit workers from the community. Teck Cominco's Red Dog mine in Alaska and Placer Dome's Porgera mine in PNG are just two examples of companies already doing this.
- *Education and Training* – If the company is going to attract employees who understand sustainable development issues, part of the answer will have to be mining education, which helps prepare people for the challenge. Institutions of mining education are trailing in this. They are educating for a high level of technical skills – though they are not in many cases attracting the calibre and number of students they once did. Their curriculum has changed little, and the attraction of a mining education seems to be waning fast in many parts of the world.<sup>33</sup>

The need to improve environmental management has caused many companies to recruit skilled environmental engineers and others capable of helping resolve environmental concerns. The ongoing demands of a transition to sustainable development as a model will require additional new skill-sets on the company staff. Just one example is the need for cultural skills training for company employees posted to new communities. It is also essential for management to encourage environmental and other professionals to take account of the business case for their roles in developing and deploying sound sustainable development policies.

Transferable occupational skills development could leave a valuable legacy for employees when the operation closes. Mentoring schemes for younger members of the community and courses in skills such as welding, foreign languages, and information technology software are examples of this.<sup>34</sup>

Whether the minerals industry is building human capital depends on the rate at which the labour force gains new and useful skills and on the well-being and quality of life of those who work in the industry and their families. The quality of their livelihoods is a critical sustainable development indicator. If compensation, working conditions, and social opportunities for employees are improving, employers will be on the path of sustainable development. These are, for the most part, relatively easy to measure.

### **The Role of Trade Unions**

The history of mine labour has often been one of deep division between labour and management and a high degree of politicization – from the Western Federation of Miners in North America to the Bolivian tin miners’ syndicate, South African gold miners’ unions, and the coal miners of Ukraine, Serbia, West Virginia, or England. The right to form unions for collective bargaining has often been contested, and the industry has seen bitter and bloody labour conflict, recorded in histories (such as Barron Beshoar’s *Out of the Depths*), novels (Emile Zola’s *Germinal*), movies, and songs.

Retrenchment as well as wider work place issues, such as wages and benefits, health and safety, and union recognition, can result in disputes between mining companies and trade unions. Indeed, several large multinationals have been accused of adopting an anti-union stance, in particular resisting collective bargaining and employee consultation over major restructuring programmes. Participation is one of the central concerns of trade unions, and trade union participation is all too often marginalized or denied.

Trade unions – even when they do not represent an entire work force – are more representative of workers than either management or NGOs. This is recognized in International Labour Organization (ILO) Conventions 87 and 98. The UN Global Compact includes adherence to these two key conventions, and yet a number of companies that have committed themselves to the Global Compact continue to deny or actively oppose the trade union rights identified there.<sup>35</sup> Commitment to improved participation will require that companies in future demonstrate that they are meeting at least the minimal standards required under ILO ‘core’ conventions. (See Box 6–2.)

<b>Box 6–2. ILO Core Conventions on Workers’ Rights</b>	
ILO 29	Forced or Compulsory Labour (1930)
ILO 87	Freedom of Association and Protection of the Right to Organize (1948)
ILO 98	The Application of the Principles of the Right to Organize (1949)
ILO 100	Equal Remuneration for Men and Women Workers for Work of Equal Value (1951)
ILO 105	The Abolition of Forced Labour (1957)
ILO 111	Discrimination in Respect of Employment and Occupation (1958)
ILO 138	Minimum Age for Admission to Employment (1973)
ILO 182	The Prohibition and Immediate Action for the Elimination of the Worst Forms of Child Labour (1999)

In addition, mining companies should observe the minimal standards laid down in ILO Convention 176 on mine safety and health and in ILO 169 on indigenous people. Although it is governments, rather than companies, that ratify ILO Conventions, there is nothing to

prevent companies from freely and openly committing themselves to observing the standards laid down in these. Observance of the standards in these two treaties and the eight core ILO conventions could provide a solid rights-based foundation for company interaction with its employees and affected communities. It could, in future, be a key indicator of whether a company is seriously contributing to the social pillar of sustainable development.

### **The Changing Face of the Company**

In the minerals sector, as elsewhere in the economy, people move around and change jobs much more than in the past, so mining communities have to deal with an ever-changing series of company representatives. At the same time, it is becoming clearer that the key to solving many problems is continuity of policy, personnel, and approach.

A high percentage of community complaints are about changing priorities – such as a promise by a company representative that a local road would be surfaced to keep dust from blowing into their houses, but the person is no longer there and the road is not surfaced.

Communities do not relate to the company as an institution nearly so much as they do to company representatives as individuals. Their relationship is a personal one, which does not automatically transfer to the next person in line. People in the corporate world are so used to the people they deal with being rotated in and out of positions that they often fail to appreciate the extent to which the rest of the world does not work this way.

The same principles apply to all kinds of relationships the company has. Sustainable development requires a deeper engagement with other elements of society, which in turn requires a continuity of policy, philosophy, and approach. Unfortunately, with increasing frequency, the people the community see as ‘in charge’ do not work for the mining company but for a consultant or contractor, and they know they will be with the project for only a limited time. (See Table 6–1.) In dealing with the complexity of relationships that occur around mine sites while communicating and negotiating with communities, PNG has a number of initiatives that have been successful and may be usefully deployed more widely, including community relations officers and community affairs sections.<sup>36</sup>

<b>Year (Notional)</b>	<b>Phase</b>	<b>Principal Contact Person</b>
1	Exploration	Junior company exploration foreman
2	Development drilling	Foreman for drilling contractor
3	Feasibility Studies	Transportation, water resources, environmental, social, and various other consultants
4	Permitting	Consulting firm in charge of permitting
5–6	Construction	Foremen of various construction contractors
6–20	Operation	Six different project managers who work for three different companies as the mine changes ownership
21	Closure	Environmental consultants

Four actions can help address the changing face of the company in the local community:

- A Community Sustainable Development Plan, produced through a multistakeholder process, should be implemented consistently over time, independent of any individuals responsible, so that if one person leaves the plan does not fall apart. (The plan is discussed in detail in Chapter 9.)
- The company should recruit people on the ground specifically for the purpose of overseeing the local development plan. This function needs to be part of the core management team, not the public relations effort.
- Local authorities or other appropriate local institutions should ensure that they provide on-going commitment and resources to play a role in designing and implementing the local development plan.
- Local authorities or other appropriate local institutions should play a facilitator role in ensuring that communities are able to play an active role in the plan.

### **Mine Closure**

Although 88% of companies in the PricewaterhouseCoopers survey have environmental mitigation plans post-closure, only 45% have detailed socio-economic plans that are regularly reviewed and given updated costs estimates.<sup>37</sup> Given that the number of livelihoods in the industry has been declining and may continue to decrease, there needs to be an intense focus on what happens to mine workers after they leave the industry. If they are leaving the industry with improved and more marketable job skills and some social safety net to protect them during the transition, this is an indicator of sustainable development. In some places, workers have gained experience and skills that serve them well in other sectors. Government, companies, or unions are providing retraining programmes to equip them for new skills, transition payments to help them move to regions with more employment, and other measures designed to ease the change. In other places, however, unemployment is a heavy burden, opportunities are few, and transitional assistance is scarce or absent.

When the industry lays people off, there is a need to be clear conceptually on the lines of responsibility among companies, the worker, the union, and the state. Certainly part of the burden does belong to the state in the form of unemployment payments or other social assistance. The state receives tax revenues from the industry, which in a sense can be seen as paying for these. Just as certainly, in a sustainable development framework the company has some share of the responsibility to ensure that the human capital it helped develop is sustained. Labour unions also may have a responsibility to help workers understand their options for a transition, and individual workers have a responsibility to keep an eye on a future when the mine may close. Where a reduction of labour force is predictable, part of the solution should be integrated planning to try to ensure that there are opportunities to take advantage of the skills developed.

### **Improving Worker Health and Safety**

Acceptable, safe, and healthy working conditions are one of the first prerequisites of a more sustainable world. The minerals industry, and mining in particular, does not have a good record in this regard. There has been significant progress in recent years, but more needs to

be done to ensure the right of every miner to work without injury or illness, to learn skills that can be transferred once an operation is shut down, and to understand how to contribute to sustainable development.

Mining work has been physically demanding and often dangerous.<sup>38</sup> The history of explosions, rockfall, cave-ins, rock bursts, and other accidents is a long and discouraging catalogue of large and small accidents resulting in a high number of deaths and serious injuries to miners. In addition, miners have faced occupational disease, from the coal miner's Black Lung to the hard rock miner's silicosis or the lung cancer among uranium miners. This has been a feature not only of mining but of the downstream parts of the industry, from lead workers to beryllium workers in refining and fabrication of mineral products. Death and danger aside, miners have often lived in an isolated, often all-male environment, cut off from normal community and family life. Certainly this was the pattern of much of South African mining under apartheid. The image of the hard-drinking miner on a night in town often cloaks a much more bitter reality of isolation, loneliness, and boredom.

Today's industry in most of its operations represents a remarkable advance from these conditions. All but one of the respondents in a recent survey of the top 20 gold mining companies reported that health, safety, and sustainable communities are the most important areas of sustainable development.<sup>39</sup> But there is still further work required to ensure that, without exception, an individual can devote a lifetime to a mining career and emerge healthy and unharmed.

The nature of worker health and safety problems differs depending on where a mine is located (industrial versus developing country), who is involved (large companies or small-scale miners), what products are being mined (gold or uranium versus gypsum or sandstone), and what processes are used (such as underground versus opencast mining).

### *Understanding the Health and Safety Effects of Mining*

According to the International Labour Organization, mining is responsible for 5% of fatal accidents at work but only 1% of the world's work force.<sup>40</sup> The health effects of mining are not only felt in accidents – resulting in injuries and fatalities – but in longer-term health effects such as cancers and respiratory conditions.

Employment in mining also brings positive effects on health, particularly to those who may have been previously unemployed or whose job increases net earnings. Workers may experience psychological as well as health benefits associated with an increase in income and consequent improvement in living standards.

A review of published literature indicates that the main health risks faced in mines are exposure to dust, noise, heat, cold, wind, limited light, and inhalation of poisonous substances; that many accidents arise from the use of large transport or electrical or mechanical equipment; and that there are indirect negative health impacts, such as mental health conditions, stress, and job dissatisfaction. The bulk of the literature focuses on the

continued burden of largely preventable health impacts that mine workers sustain, not just in their working life but also into old age.<sup>41</sup>

The degree and nature of risks are largely determined by the character of the mining operation. Deep underground mines may pose severe risks resulting from high blood pressure, heat exhaustion, myocardial infarction, and nervous system disorders.<sup>42</sup>

The health effects associated with specific minerals are often complex and interrelated and may take years to manifest. Some effects on health are more specific to certain products:

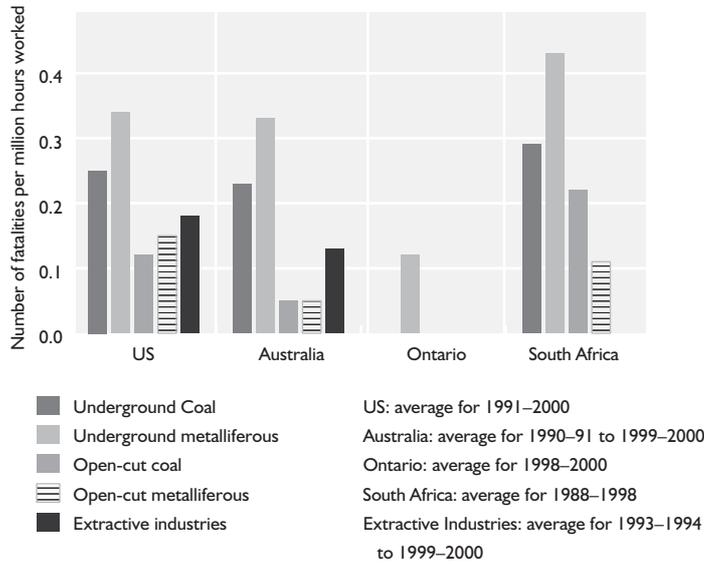
- *Coal* – Chronic diseases due to coal (and other silicates) are largely due to dust inhalation during mineral extraction. Pneumoconiosis and silicosis are the most severe outcomes related to coal dust exposure by mine workers.
- *Asbestos* – Along with coal and other silicate dusts, the dangers of mining asbestos largely relate to damage to the lungs and respiratory functioning. Resultant diseases include pneumoconiosis, asbestosis and lung cancers, the symptoms of which may take many years to develop.
- *Uranium* – The health effects of uranium mining are also long-term, sometimes manifesting themselves more than 20 years after exposure. Most studies find the relative risks of lung cancer to be two to five times higher among uranium workers who have been exposed to higher levels of radon, or to long periods of low exposure.

In other cases, the main health risk for workers may not be the primary product mined but a by-product or some hazardous materials used in processing.

In the last half-century, there has been a significant decrease in the number of accidents, injuries, and work-related illnesses occurring at large mines in most of the world. (See Figure 6–4.) In the US coal and non-coal sector, the average fatalities ratio (AFR) dropped from 0.234 per 100 miners a year between 1941 to 1945 to 0.029 for the period 1991 to 1995.<sup>43</sup> Despite this, performances differ considerably between countries. (See Figures 6–5, 6–6, and 6–7.) In South Africa, for example, despite a reduction in fatalities and injuries, the AFR for 1991–95 was 0.0988.<sup>44</sup> The pattern across countries is that more deaths occur in underground mining than in open-cut – a pattern that appears to be consistent over time and location.<sup>45</sup> While fatalities and injuries in gold mining are considerably more common than in the rest of the industry, even coal mines with relatively low injury rates are prone to methane explosions, which can cause a high number of fatalities.

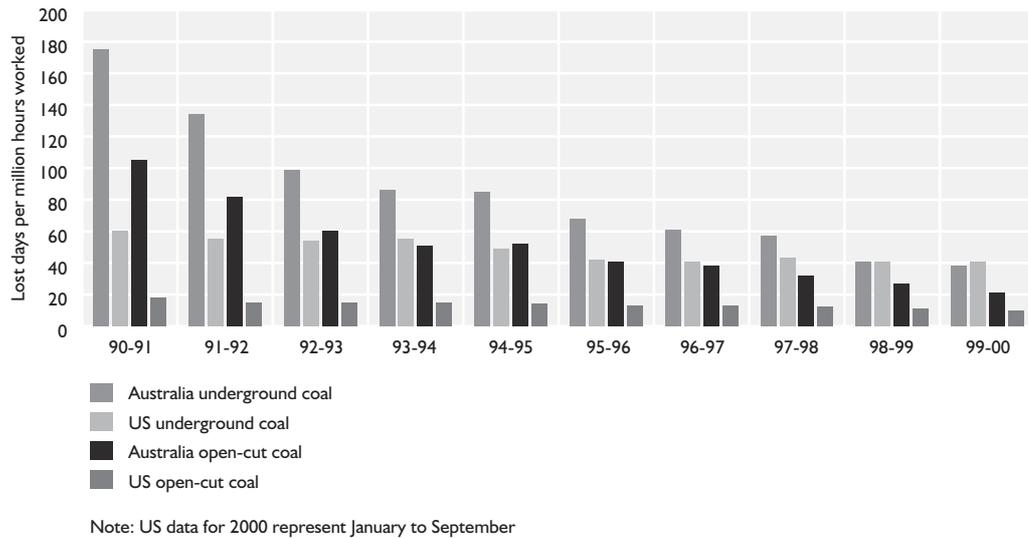
**Figure 6-4. International Mining Industry Fatality Rates, Selected Countries, 1990s**

Source: Minerals Council of Australia (2001)



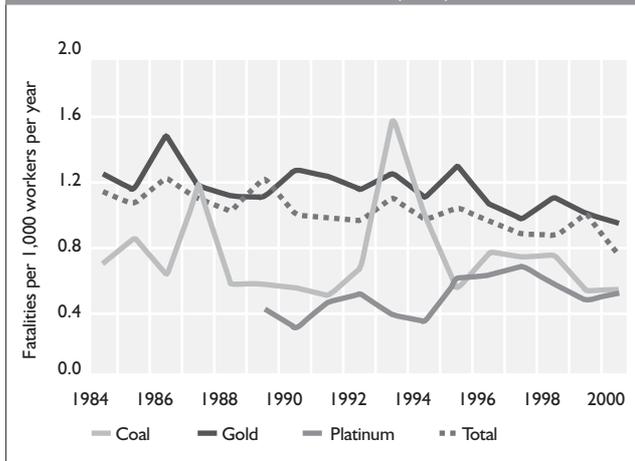
**Figure 6-5. Coal Mining Lost-Time Injury Rates, Australia and United States, 1990–91 and 1999–2000**

Source: Minerals Council of Australia (2001)



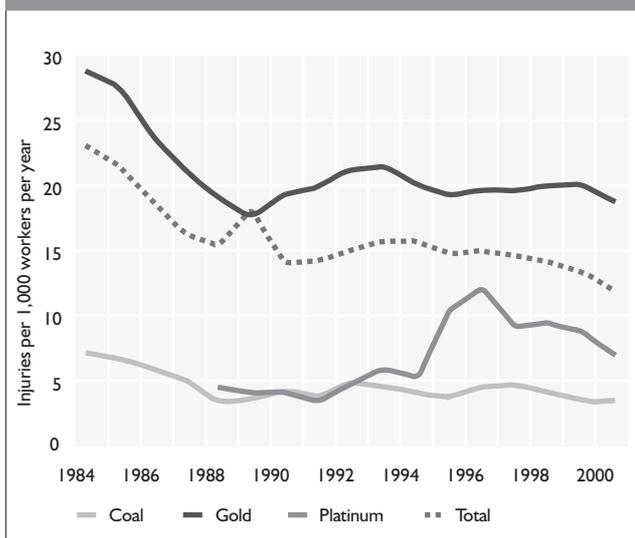
**Figure 6–6. Fatalities in South African Mines by Mineral, 1984–2000**

Source: Chamber of Mines of South Africa (2001)



**Figure 6–7. Injuries in South African Mines by Mineral, 1984–2000**

Source: Chamber of Mines of South Africa (2001)



Despite reductions in the fatality and accident rates, concern over chronic diseases such as those resulting from coal dust inhalation remain: recent studies show that up to 12% of coal miners still develop these fatal diseases.<sup>46</sup> In extreme cases, evidence of the detrimental health impacts of minerals may lead to calls for outright bans on mining them. For example, since 1999 the Collegium Ramazzini has called for a ban on all mining and use of asbestos, supported by international journals of occupational and environmental health.<sup>47</sup>

To date, workers' health has often received less attention than their safety. Moreover, the trend towards longer working hours and shift work, with mineworkers spending more time away from home, has resulted in new health concerns. This trend is illustrated by an ILO survey in Australia, which recorded mining rosters of up to 14 days of 12-hour shifts in a row.<sup>48</sup> In some cases, miners worked 28 days in a row. Increased fatigue, stress, and dissatisfaction among workers were observed. Families also suffered. Increases in the use of contracted labour and reduced job security also have knock-on effects on the mental health

of mine workers and ex-miners. Contract workers are less likely to receive adequate health and safety training.

The impact of HIV/AIDS on the mining industry in some countries, particularly in Southern Africa, is extremely serious. In South Africa alone, 20% of coal miners and 30% of gold miners are HIV-positive, and in the next five years, 5–10% of companies' work forces will start to die.<sup>49</sup> (See also Chapter 9.) As illness forces workers to leave their jobs, valuable skills and experience are lost, often leading to a mismatch between human resources and labour requirements. In June 2001, the ILO adopted a Code of Practice on HIV/AIDS and the World of Work.<sup>50</sup> Its fundamental aim is to help safeguard decent working conditions and protect the rights and dignity of workers living with HIV/AIDS. The code provides practical guidance to governments, employers, and workers' organizations for developing national and work place HIV/AIDS policies and programmes.<sup>51</sup>

### ***Initiatives to Reduce Risk and Maximize Improvements***

Improvements in health and safety can be attributed to a number of factors, including increased understanding of risks and their prevention, laws and regulations, technology, and the health and safety culture of management and workers. An increasing number of initiatives involving different actors – workers, unions, NGOs, government and companies – often working together for common solutions are emerging. For example, union and management activities have triggered changes in law, and governments have supported organized labour in the improvements.

Coal miners have played a unique role in improving worker health and safety, in particular through challenging companies to improve transparency of information and to provide clinics and compensation. Worker successes in this challenge date back to the 1930s and 1940s in the United Kingdom and the United States.<sup>52</sup> Unions have also played a major role in the development of safer conditions in mines and of health information and sponsoring of other services.

Mining companies have also been involved in programmes of worker health and safety. In the past, these mainly involved improvements in working conditions in the mines such as through safety measures to reduce injuries or air conditioning to reduce heat stress. There has been a recent initiative to harmonize safety performance reporting to enable companies to benchmark their performance against that of other companies and to find and implement best practices that lead to superior performance.<sup>53</sup> Other recent initiatives have included educational and training programmes as well as increased consideration of living and social conditions.

### ***Laws and Regulations***

At the international level, a number of ILO instruments – including conventions, codes of conduct, and recommendations – aim to improve worker health and safety in mines. ILO Convention 176, which is relevant to health and safety for the mining sector, has been ratified by 17 mining countries.<sup>54</sup> Governments ratifying this convention undertake to adopt legislation for its implementation, including the provision for inspection services and the

designation of a competent authority to monitor and regulate the various aspects of occupational health and safety in mines. The treaty also sets out procedures for reporting and investigating disasters, accidents, and dangerous occurrences related to mines and for compiling relevant statistics. Both workers' and employers' rights and responsibilities are set out.

It is important to note that the convention provides a floor – the minimum safety requirement against which all changes to mine operations should be measured. The ILO recommendation on this – which is advisory – provides more specific guidance on the different sections of the convention.<sup>55</sup> Some of the ILO codes of practice for mining and for topics relevant to mining are even more specific.<sup>56</sup>

Most countries also have some form of national legislation in place that lays out measures to prevent disease and injury as well as to monitor performance. Prescriptive regulations are being reduced. New regulations highlight the responsibility and liability of mine managers, and require that they manage health and safety and provide a safe place to work. In some countries, regulation has played an important role in reducing fatalities and accidents at mines. In other countries, it has been largely ineffective, often due to a lack of enforcement.

One of the main concerns regarding laws and regulations is that indicators of disease and accidents vary among countries and sometimes among provinces within countries. Similarly, the definition of accidents can vary. In Ontario, Canada, for example, if a worker has a bad back that is considered to be related to mining activities, it is compensable, whereas in Norway, compensation will be provided only if a traumatic symptom is diagnosed as a result of the sore back.<sup>57</sup>

### *Technological Changes on Safety and Health*

Improved mining equipment, methods, and technology have played an important role in reducing the risks faced by mine workers, partly through reducing the risk of human error. In the South African gold mining industry, for instance, the use of hydraulic props accounted for a reduction in accidents from 13.4 per thousand employees in 1976 to 7.7 in 1984.<sup>58</sup> At the Enugu mine in Nigeria, following the introduction of full mechanization, the number of mining accidents decreased by 60% between 1975 and 1980. Changes were also recorded in sickness absence indices, the most significant being the severity index, which dropped from 9.2 in 1975 to 3.0 in 1980.<sup>59</sup>

The effects of new technology have not been uniform, however. Some new technologies have been accompanied by new or intensified hazards – such as dust, noise, vibration, electric current, and ergonomics-related problems.<sup>60</sup>

### *A Health and Safety Culture*

In addition to improvements in technology, companies attribute the reduction in the number of accidents and fatalities to the adoption of management approaches and systems for improving worker safety.

Although the health and safety discourse is widely spread among management teams, there are differing views on the extent to which this actually translates into practice. Unions sometimes report that national and management commitments do not flow down to the work place because, in reality, production pressures take priority for technical or site managers who are responsible for implementing them. Moreover, moves towards an increase in contract workers as well as an increase in shift work are less conducive to improvements. Peter Colley from the Construction, Forestry, Mining and Energy Union in Australia states that ‘companies seeking to achieve good occupational health and safety (OHS) culture need to minimize labour turnover, to have reasonable working hours, and to recognize and seek to mitigate the impact of production targets and bonuses on OHS performance.’<sup>61</sup>

In 1999, the Minerals Council of Australia commissioned a survey into the factors determining safety culture.<sup>62</sup> It found that in some situations management, through encouraging more productive work practices, can inadvertently encourage risk-taking behaviour regarding safety. It also identified a degree of complacency among the mine work force and management, with mining perceived to be an inherently dangerous occupation and risks considered an integral part of the job, as well as an attitude of ‘it will never happen to me’. The survey identified three key requirements to ensure a strong health and safety culture at an operational level: strengthening relationships between management and staff, changing management behaviours and attitudes, and providing the resources necessary to support a safety culture within the industry.

Although there has been a movement away from paying risk premiums for unsafe work in most countries, it is still the case that pay systems based on performance rather than safety bonuses can inadvertently encourage people to work unsafely. In an effort to overcome these concerns, some companies make workers ineligible for performance bonuses if safety requirements are not met. The introduction of a safety bonus is not feasible as it may lead to workers downplaying or covering up injuries.

Some mining companies have developed safety ‘core beliefs’ or internal standards through social dialogue. They form part of the contract of employment and influence behaviour from the top to the bottom of an enterprise. The achievement of a safety culture in mining needs a genuine and visible commitment and leadership from the top, with health and safety being a line management responsibility. It should be accepted that improving health and safety performance is a long-term goal that requires sustained effort, resources, and commitment. Education and training in risk management and risk awareness are essential to improvements in health and safety performance at the operational level. Such training is normally a legal requirement but is often done in ways that are not plain, and the auditing of these assessments is not always transparent.<sup>63</sup>

### ***The Way Forward***

Good progress has been made towards uniformity in accident reporting systems. New regulations on the reporting of accidents and dangerous occurrences were adopted as a resolution of the Minesafe Conference in Perth in September 2000. But there is no uniform reporting system for occupational disease in the mining sector.<sup>64</sup> In an effort to

prevent occupational disease, benchmarking is needed to encourage best practice and to determine occupational exposure limits. The quest for uniformity in reporting is hampered by a series of obstacles. These include differences in national legislation, differences in medical surveillance, lack of standards in collection of corporate data, no standard definitions for disease and injury, and long latency of occupational disease. The International Council on Mining & Metals has put together a health advisory panel to address this issue.

A common set of standards should be developed through a multistakeholder process convened by an international organization such as the ILO. Influencing governments with respect to reporting should not be the goal, although this might follow. Moreover, companies should not wait for governments to develop standards before developing their own.

There is clearly no single accident prevention approach that offers the most effective means of reducing accidents and risks to health. A combination of different measures including legislation, education and training, technology, data collection and analysis, and above all a common vision shared by the different actors is required. Because the types of issues that predispose unsafe behaviour and their relative importance vary from mine to mine, there is no single solution to the promotion of safe behaviour. The main strategies involve compelling, facilitating, rewarding, training, informing, and participating.

Effective safety management on a day-to-day basis requires partnership among management, workers and unions to identify problems, define actions, and monitor and assess performance. Safety cannot be seen as the sole responsibility of designated safety managers but as a shared responsibility of everyone. (The same is true of successful company environmental management programmes, and the same will undoubtedly prove true as companies begin to spread sustainable development policies throughout the work force.)

A better understanding of health in all its dimensions should help counteract an approach that is solely concerned with reducing injury and illness to one that embraces a positive concept of well-being. Moreover, community health and worker health are intimately related – disease can spread quickly from and to the work place. The industry needs to be ahead of the game and to start researching the effects of trends in employment patterns before the effects are felt. To give just one example, further research is needed on the impact of noise and shift work on hearing and eyesight. Research to date has largely been retrospective rather than forward-looking and participatory.

## **The Role of Technology**

Technological change will continue to play a fundamental role in maintaining the profitability that is critical if the minerals industry is to contribute to sustainable development. Despite devoting far less to research and development than other sectors, the industry has thousands of technologies currently under development.<sup>65</sup> These cover the whole minerals cycle. Some of the most significant are those that act as triggers for the exploitation of new types of reserve, such as the high-pressure acid leaching process

(HPAL) for nickel laterites. (See Box 6–3.) For metals, more efficient means of recovery are critical if lower grades are to be mined. The introduction of solvent extraction electro-winning for copper production is one example of this. Biotechnologies can also have a significant impact on metal recovery.

#### **Box 6–3. A Developing Technology for Nickel Production**

Approximately two-thirds of the world's known nickel resources are in the form of laterites – ancient soils in tropical regions that can be up to 15 metres deep. These are relatively low-grade sources of nickel in relation to the alternative source of sulphides ores. The latter are typically found in hard rocks at depths of hundreds of metres. A new process for recovery of nickel (and the associated cobalt) from ores, called high pressure acid leaching, has undergone significant developments in the last few years. This involves lower capital and operating costs, with superior metal recovery. When combined with the relatively low cost of extraction of laterites, HPAL may have a significant effect on the location and nature of nickel mining in the future.

Source: Reimann et al. (1999).

Many technologies are targeted at efficient extraction of minerals from the ground in terms of energy use or ensuring full exploitation of a reserve. The increasing automation that comes through satellite and remote sensing technology is one example. (See Box 6–4.)

There have also been significant advances in the development of technologies to restore parts of ecosystems disturbed or removed as a result of mining and minerals processing.<sup>66</sup> The plant sciences have a significant role in this. They have even allowed the recovery of an economic crop of metals from contaminated land.<sup>67</sup>

#### **Box 6–4. Mining by Computer and Satellite**

One key to improving the efficiency with which a mining operation is carried out is accurate information to characterize a mineral reserve and then to manage the operation to extract it. Computer software has been developed to combine all information on a reserve (physical and engineering) into a single 3D model that can be continuously updated. In many cases this also has significant implications for safety. In South African gold mines, for instance, the rapid detection of faults and other irregularities in the ore body is critical in preventing fatalities due to collapse. Computer and satellite systems lead to the prospect of the complete automation of equipment, which has obvious implications for safety and employment.

Accurate description of a mineral reserve also leads to more efficient exploitation. At the surface, global positioning systems (based on satellites) and associated mine computer systems have a key role in controlling the equipment used so that it is more efficient. For example, such systems can avoid the inadvertent dumping of valuable material that sometimes occurs.

Source: Stewart (2000); Mining Magazine (2000).

New technologies based on scientific knowledge can bring new problems as they solve others – not in terms of extra engineering challenges or even an associated stepping-up of environmental or health and safety standards. Rather, new technologies can bring uncertain 'progress' because of their wider social and economic consequences. For instance, increased automation in the minerals sector has reduced the number of accidents but has led to changes in both the type and number of workers at any one site. Technology not

specifically targeted at the mining industry, such as aviation, has enabled minerals extraction and processing in places where it would previously have been uneconomical.

Technological change is almost impossible to prevent and so it becomes increasingly important for cultural values to frame not only the application of technology in the minerals industry, but also the purpose for which it is developed. For technology to help the industry contribute to sustainable development, two goals must be kept in mind. First, technology should be integrated across the whole production process. This begins with the integration of environmental goals into production plans, which is a key aspect of a plan put forward by members of the National Mining Association in the US.<sup>68</sup> On the other hand, integrated technologies go far beyond reducing specific groups of impacts while maintaining or increasing technologies. Remote sensing of geological structures in the gold mining industry has implications not only for production, but also for the detection of faults, fissures, and other features that pose a danger to workers.<sup>69</sup> Research programmes must be funded and organized in order to achieve integration rather than single, short-term technologies.<sup>70</sup>

Second, technologies must be appropriate in every respect for the context in which they are deployed. This is a particular challenge for international minerals companies that often develop engineering technologies in one part of the world for application elsewhere. Assessments must be made of any technology with regard to impacts on gender, skills, and local capacity to solve problems relevant to the location in which it operates. Clearly, it is not just the way in which knowledge is applied that is critical. The nature of science itself and its separation from ethical considerations has prevented it from contributing optimally to sustainable development.<sup>71</sup>

Technology will have a key role in ensuring that current and future social and environmental costs of mining activity are internalized.<sup>72</sup> If better mining methods evolve, better ways to separate wastes and recycling emerge, or better ways to reduce the environmental impacts are developed, then engineering technology – developed in an integrated and appropriate manner – can make a fundamental contribution to sustainable development.

## **The Financial Sector**

One of the arguments in making the business case for sustainable development is that improved sustainability performance will result in lower risks for the financial institutions that provide debt and equity funding as well as insurance to the industry. If these institutions were able to recognize good environmental and social performance, they would be able to reward companies with lower costs of capital and insurance premiums. Thus the financial institutions are potentially an important leverage point to improve sustainability performance. As early as 1995, a United Nations Environment Programme (UNEP) study found that more than 90 international banks were undertaking environmental financial risk assessment of borrowers and 50 of these incorporated environmental liability into loan terms.<sup>73</sup>

On the other hand, there is a strongly held view that financial institutions have reinforced the failings of mining companies in their lending practices by focusing solely on a project's relative cash operating costs.<sup>74</sup> This allows marginal or unprofitable projects to be funded and encourages operators to pursue technical economies of scale in order to spread fixed costs over a larger output level. This in turn can lead to greater environmental and social impacts as the project is scaled up. On the equity side, the market's focus on short-term performance measures (such as quarterly reports) also prevents a true assessment of the long-term profitable and sustainable mining companies.

Public financial institutions such as the International Finance Corporation (IFC) can have significant influence over how mining projects are developed because of the leverage they can bring to a project. Considering volume of equity and debt financing, the IFC is a relatively small player from a global perspective. From 1993 to 2001, the IFC financed a total of 33 mining projects through about 56 transactions activities, providing US\$681 million of equity and debt financing – about 18% of the total cost of these projects.<sup>75</sup> (On an annual basis, the mining industry invests about US\$30 billion world-wide, of which less than 2% is from IFC.) However, the IFC still has quite a significant influence over how many mining projects are developed, because its environmental and social guidelines are widely accepted by many of the more responsible companies as industry standards, and because it can invest in countries that others might consider too risky. All mining projects financed by IFC must meet IFC environmental and social guidelines. Many newer IFC-financed mining projects also have local economic development components.

Another group of public financial institutions, the national export credit agencies (ECAs), are believed to be the 'quiet giants' of mining finance, though their activities have largely remained outside the public debate and they are generally unaccountable for the environmental and social consequences of their financing. Unlike most other financial institutions, many of them have failed to date to develop environmental and social guidelines and procedures to guide decision-making. Notable exceptions are recent guidelines developed by the US, Canadian, UK, and Australian agencies.<sup>76</sup> Statistics are not available on their lending to the mining sector, but it is understood to be considerably higher than all the commercial banks and multilateral institutions put together. One high-profile example is the largest mining project ever – the US\$2.3-billion Antamina copper and zinc mine in Peru: ECAs provided 51% of the debt finance, guaranteed a further 8%, and were part of a consortium guaranteeing a further 25%.<sup>77</sup>

Mining represents a very small fraction of bank lending portfolios world-wide, and probably not much more than 1% of equity investment. Equity or debt financiers may not always find the minerals sector attractive, however. As indicated at the beginning of this chapter, the rate of return on equity invested in mining, for example, has been generally low over recent years.

Over this period, market liberalization and privatization have been accompanied by a rapid opening of new areas to exploration and development, such as the former Soviet Union and Eastern Europe. Areas where foreign investment was quite limited because of broad political disapproval of government systems (South Africa and Chile, for instance) have changed governments and become attractive to investors. Legal protection and guarantees for investors, liberalized trade and investment regimes, 'reformed' mining codes, and

political change have created many new opportunities for people who are looking for minerals. These trends have been helped by dramatic gains in exploration technology, which have made it much easier to locate and ‘take a look’ at promising geologic structures in areas that were previously thought too distant from markets, transportation, or other infrastructure.

The bitter struggles with some developing-country governments, based on the perception that there was a fixed pie to be divided in some sort of ‘zero sum’ struggle, have pretty much subsided, at least for the moment. Although confrontational negotiations with private companies over rent capture or nationalization of mining companies have receded in recent years, host-country governments do have a stake in the outcome and will assert that vigorously through one means or another. They will take appropriate action to protect the national interest and respond to public concern if mining companies fail to meet the national expectations of economic, environmental, and social responsibilities.

Just 25 years ago there was relatively little chance that western multinationals would be exploring or mining in Uzbekistan, Vietnam, South Africa, Argentina, Romania, Nicaragua, Chile, or a host of other countries. If, from the companies’ point of view, this opening up of new areas was positive, it has had some other effects as well. One is that as it has opened up competition and helped to create the current conditions of abundant supply and sinking prices. Another is that it has encouraged companies to develop projects in areas that have relatively pristine environments but weak environmental management, indigenous groups with territorial claims that have never been effectively resolved, and local populations with immense development needs but no functioning local government. In this milieu, there have been numerous explosive conflicts over mining or exploration proposals, which have created new levels and kinds of risks for institutions that provide capital to the minerals sector. There have been some major losses for equity investors, lenders, and insurers alike.

Opponents of mining projects in some countries simply do not have other remedies. They do not have access to clear legal rights for communities, developed environmental law, administrative law capable of holding agencies to account, or functioning and reliable court systems. They have few alternatives to press their complaints. The financial institutions that support the project therefore have become a favoured venue in which complaints about social, environmental, economic, land tenure, and other issues related to projects can be heard. Not all financial institutions want or are comfortable with this role or with putting their own reputations on the line over how these issues get resolved.

NGOs and affected community groups have increasingly used both the multilateral and private commercial banks as a leverage point for changing mining practices. Friends of the Earth International and others, for example, successfully campaigned for the World Bank Group to assess its activities in the extractive industries, which has resulted in the launch of the Extractive Industries Review.<sup>78</sup> The annual general meetings of major banks have been disrupted by protests over the banks’ involvement in mining finance. In 1999, ABN AMRO agreed to take up some of NGO concerns with the mining companies to which it provided financing, particularly Freeport McMoRan in Indonesia, and to meet regularly with an NGO to discuss progress.<sup>79</sup> In Australia, Westpac Bank has come under pressure from several NGOs for its involvement in the controversial Jabiluka uranium mine.<sup>80</sup> After the cyanide spill at Baia Mare in January 2000, Dresdner Bank, which had invested US\$8.5

million, became the target of an NGO campaign.<sup>81</sup> In July 2000, Barclays Capital was included in an NGO petition to urge strict enforcement of environmental regulations for Tiomin Resources project in Kenya.<sup>82</sup>

The realities from the point of view of financial institutions therefore must include:

- high transaction costs in evaluating minerals projects and associated risks;
- a growing probability that they will become the court of last resort for those dissatisfied with the project, and that their own reputation will therefore be at risk;<sup>83</sup>
- new and unpredictable kinds of risks, which have shown in some cases to be very real threats to project viability; and
- a quite limited flow of capital to a relatively small sector of the economy with an overall recent history of poor returns.

This has led a number of financial institutions to leave the mining sector. Although no statistics are available, it is believed that the number of institutions capable of leading a syndication for a major mining project has fallen from around 10–15 banks 10 years ago to about 6–8 today.<sup>84</sup>

As a result of consolidation, the largest mining companies are now moving into an era where they will not be depending so much on project finance as on corporate finance. In other words, they will seek loans directly to the company on the strength of its balance sheet rather than on specific projects. This trend is reinforced by the low metal price environment, which reduces the number of new project developments. This has a number of potential consequences. First, it may mean a lower level of outside scrutiny on whether to embark on specific projects. As it is now, a bank (or other investor) must be convinced of the merits and viability of the project. This is not possible if funds provided are not earmarked for a particular project. Second, it could take the loan decision out of the political realm: since the loan will not be (at least overtly) linked to a specific project, it will be much harder to build NGO campaigns against the loan. This again means less outside scrutiny of project decisions. And it also means that there may be additional pressure on NGOs that are concerned about projects to develop new ways and means to express those concerns. Third, if this model of borrowing becomes more attractive than project finance, there will be a growing distance between the companies big enough to avail themselves of the corporate finance alternative and those that are not. This could accelerate the trend to concentration in the industry. Nevertheless, project finance will continue to be used by medium-sized players and by the large companies to manage country/political risk.

There is, what appears to be, an irresistible pressure for differentiation within the minerals industry. The industry can begin to divide along lines of quality, based on effectively enforced common understandings about sustainable development. The industry can also begin to divide along lines simply of size: the big survive and the small starve. There is likely to be some of both, but if the division is principally based on performance, then the industry will look very different in 10 years than if the split is basically just about size.

In partnership with UNEP and the World Bank, MMSD held two major workshops on mining finance. The first, in Washington in April 2001, had some 125 participants from the finance sector, the minerals industry, government, academic institutions, labour

organizations, and environmental and human rights groups. The second, in Paris in January 2002, had 30 attendees from finance and insurance, the mining industry, and NGOs. It reviewed research in three key areas – indicators for public reporting, the business case for sustainably orientated management practices, and the need for clearer governance systems around the financing of mining projects. The two workshops and MMSD commissioned research came up with several conclusions and recommendations:

- Lending institutions need to focus on the value of the companies they finance and the sources of risk to that value, and to encourage these companies to adhere to the legal requirements and best practice.
- The consolidation among financial institutions in recent years means that there are a limited number of key institutions, which will make it easier to bring them together on a common platform.
- The best hope for creating effective, meaningful guidelines or standards for better performance in the minerals industry is to create a common set of sustainable development standards and criteria for finance decisions – developed in an open process and accepted and applied by the World Bank Group, export credit agencies, regional development banks, commercial lenders, insurers, equity investors, and other financial institutions. These need to be a set of global principles that can be interpreted at a national and local level. The World Bank Group should convene a meeting of relevant institutions to discuss how a joint approach might be prepared and implemented.
- There is a danger that this process of coming together on a common set of standards could exclude some important actors or fail to provide a balanced outcome. It could, for example, wind up focusing on a ‘green’ agenda to the exclusion of development concerns, or the reverse.
- The various World Bank policies and guidelines have in fact become the common standard for the financial community. They are widely used. No other broadly applicable set of norms has near this level of acceptance. Any successful strategy must therefore start by recognizing and building on these, rather than starting from scratch.
- Once the World Bank Group has established its own role in the minerals sector, through the current Extractive Industries Review, it should proceed without delay to work with other banks, insurers, investors, and others to see whether common approaches can be developed.
- All should recognize that the existing safeguard policies are generic: they apply to all Bank projects. They therefore need to be supplemented with some detailed guidance on issues of importance to the sector, such as social and environmental planning for closure and financial assurance for closure costs.
- A joint process, open not just to World Bank entities but also to regional development banks, ECAs, investment guarantee agencies, commercial banks, insurers, and other financial institutions, should be established. With the full participation of other stakeholders, this body should take the lead in establishing this mining-specific supplement to the Bank’s safeguard policies.
- The World Bank standards are used by default as the benchmarks for other private and public lenders in the mineral sector even when no Bank entities are participating. But there is no Inspection Panel or CAO to deal with complaints when the Bank is not

involved. A clear and consistent complaints system for people or organizations that claim to have been injured by failure to observe the World Bank's safeguard policies or any sector-specific supplement needs to be established, even when the IFC or other parts of the Bank are not involved in the loan. The industry itself could establish such a system. In not, financial institutions will need to take the lead to get this done.

- There is a need for cross-sectoral learning of financing best practice from other capital-intensive sectors, such as oil and gas or pulp and paper.

## **The Industry as Part of the Minerals Sector**

A holistic approach is required to address sustainable development. This kind of integration is difficult to achieve – more difficult than improving a particular process or method. But it holds out the promise that companies that can achieve this kind of integration will be able to create durable, sustainable competitive advantages.

To meet the sustainable development imperative, companies need to go beyond their traditional responsibilities to employees, shareholders, and regulators. The transition towards sustainable development involves meaningful partnerships with local communities and government, enhanced stakeholder participation, integrated life-cycle planning, transparency, forward-looking preventive action, timely remedial action, regulatory compliance, a respect for declared 'no go' areas, and investment in the future to provide for well-being in a post-mining world.<sup>85</sup> These are some of the subjects of the next eight chapters.

## Endnotes

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- <sup>1</sup> The figure is reprinted from Camus (2002). The data from Morgan Stanley Capital International relate to monthly price equity indices and are consistent across 23 developed markets, 28 emerging markets and almost 6,000 companies.
- <sup>2</sup> See, for example, Porter and van der Linde (1995).
- <sup>3</sup> Wayne Dunn and Associates (2001).
- <sup>4</sup> Noronha (2001).
- <sup>5</sup> Placer Dome (2001).
- <sup>6</sup> MMSD Southern Africa (2001).
- <sup>7</sup> Elias and Taylor (2001).
- <sup>8</sup> Grieg-Gran (2002).
- <sup>9</sup> Borax (2001).
- <sup>10</sup> SustainAbility (2001).
- <sup>11</sup> BHP Billiton (2001).
- <sup>12</sup> Young (1996).
- <sup>13</sup> Warhurst and Noronha (2000).
- <sup>14</sup> Case study prepared for MMSD by Rio Tinto, July 2001, 'The Contribution of Hamersley Iron to the Development of Western Australia's Pilbara Region'.
- <sup>15</sup> Westpac in Australia has a sustainable development fund that has holdings in BHP Billiton, Alcan and Placer Dome. YMG in Canada has invested in Noranda and Falconbridge. See Grieg-Gran (2002).
- <sup>16</sup> The Guardian, London, June 30, 2000.
- <sup>17</sup> ERM (2000).
- <sup>18</sup> Grieg-Gran (2002).
- <sup>19</sup> Hart and Ahuja (1996).
- <sup>20</sup> [[Company examples – reference to come]]
- <sup>21</sup> PricewaterhouseCoopers (2001).
- <sup>22</sup> This discussion relies heavily on personal communication with Robin G. Adams of Resource Strategies, a strategy consultancy specialising in the mining, metals and energy industries, November 2001.
- <sup>23</sup> This applies both to upstream products like concentrates and downstream products like sheet metal; both are typically priced either on formulae that reference commodity prices or on negotiated spreads over commodity prices; the companies in question remain heavily exposed to the basic commodity market risk regardless of their degree of vertical integration.
- <sup>24</sup> CRU International (2001).
- <sup>25</sup> Phelps Dodge (1999).
- <sup>26</sup> Ibid.
- <sup>27</sup> Personal communication, Robin G Adams, Resource Strategies, November 2001.
- <sup>28</sup> OECD (2001d).
- <sup>29</sup> The other argument must be the essentiality of mineral products in any scenario of a more sustainable future.
- <sup>30</sup> Bolivian Vice-Ministry of Mining and Metallurgy, cited in Enriquez (2001).
- <sup>31</sup> By virtue of their location often in areas remote from urban centres with few other sources of livelihood, the focus here is on mining operations. However, the reality of declining employment has occurred through the product chain (see Table [2–2] in the Portrait chapter on the decline of employment in the steel industry from 1974 to 2000).
- <sup>32</sup> SustainAbility (2001).
- <sup>33</sup> McDevitt (2001).
- <sup>34</sup> See, for example, Borax (2001).
- <sup>35</sup> Personal communication, Reg Green, ICEM, 17 December 2001.
- <sup>36</sup> Banks (2001).
- <sup>37</sup> PricewaterhouseCoopers (2001).
- <sup>38</sup> This section draws predominantly on the Workshop co-hosted by MMSD and the London School of Hygiene and Tropical Medicine on Worker and Community Health and Safety, September 2001, and Stephens and Ahern (2001). The latter was a review based on literature available through an international database of peer-reviewed scientific journals related to health, occupation and

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- environment, PUBMED. 996 peer-reviewed scientific articles published between 1965 and 2001 were downloaded.
- <sup>39</sup> Hilson (2001).
- <sup>40</sup> ILO (2001c).
- <sup>41</sup> Findings are based on Stephens and Ahern (2001).
- <sup>42</sup> Stephens and Ahern (2001).
- <sup>43</sup> Adams and Kolhos (1941); Adams and Wrenn (1941); Reese et al. (1955); MSHA (1999).
- <sup>44</sup> Minerals Council of Australia (2001).
- <sup>45</sup> Ibid.
- <sup>46</sup> Stephens and Ahern (2001).
- <sup>47</sup> Ibid.
- <sup>48</sup> Heiler et al. (2000).
- <sup>49</sup> World Bank-International Finance Corporation (2001).
- <sup>50</sup> ILO (2001).
- <sup>51</sup> Jennings (2001).
- <sup>52</sup> Mulcahy (1999); Derickson (1989); Derickson (1991).
- <sup>53</sup> Adopted as a resolution at The Minesafe International Conference, held in Perth, September 2000; See website, <http://www.hsebenchmarking.com>
- <sup>54</sup> ILO (1995).
- <sup>55</sup> The Recommendation is at: <http://ilolex.ilo.ch:1567/scripts/convde.pl?query=R183&query1=183>
- <sup>56</sup> ILO (1991).
- <sup>57</sup> [[Compensation for bad backs in Norway – reference to come]]
- <sup>58</sup> Scott-Russel (1993).
- <sup>59</sup> Asogwa (1988), as cited in Stephens and Ahern (2001).
- <sup>60</sup> Jennings (2001).
- <sup>61</sup> Personal communication with Peter Colley, CFMEU, August 2001.
- <sup>62</sup> Minerals Council of Australia (1999).
- <sup>63</sup> Extract from presentation by Norman Jennings at the Workshop co-hosted by MMSD and the London School of Hygiene and Tropical Medicine on Worker and Community Health and Safety, September 2001.
- <sup>64</sup> Based on a presentation made by David Barnes at the Workshop co-hosted by MMSD and the London School of Hygiene and Tropical Medicine on Worker and Community Health and Safety, September 2001.
- <sup>65</sup> National Research Council (forthcoming).
- <sup>66</sup> Bell (2001).
- <sup>67</sup> Brooks et al. (1998).
- <sup>68</sup> US DOE (2000).
- <sup>69</sup> Stewart (2000).
- <sup>70</sup> Ibid.
- <sup>71</sup> Carley and Christie (2000); National Research Council (1999).
- <sup>72</sup> Humphreys (2001b).
- <sup>73</sup> Vaughan (1995).
- <sup>74</sup> See for example, Crowson (2002).
- <sup>75</sup> Personal communication, Monika Weber-Fahr, Mining Dept, IFC, February 2002.
- <sup>76</sup> See Export Development Canada (EDC) at [http://www.edc.ca/corpinfo/csr/disclosure/enhanced\\_e.htm#3](http://www.edc.ca/corpinfo/csr/disclosure/enhanced_e.htm#3) the UK Export Credits Guarantee Department (ECDG) at <http://www.ecgd.gov.uk> the Australian Export Finance and Insurance Corporation (EFIC) at <http://www.efic.gov.au/environment/environstd.asp> and the US Overseas Private Investment Corporation (OPIC) at <http://www.opic.gov/>
- <sup>77</sup> UNEP (2002).
- <sup>78</sup> Beattie (2000).
- <sup>79</sup> UNEP (1999); see also World Rainforest Movement (2000).
- <sup>80</sup> See, for example Wilderness Society (2000).
- <sup>81</sup> CEE Bankwatch Network (2000).
- <sup>82</sup> See, for example, Global Response (2001).

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<sup>83</sup> One source states that rather than be associated with an environmental disaster, two financing banks of the Baia Mare project wrote off US\$4 million each following the cyanide spill in January 2000.

<sup>84</sup> Personal communication, Gerard Holden, Head of Mining Finance, Barclays Capital, February 2002.

<sup>85</sup> Noronha (2001).