IMPROVING SUSTAINABILITY OF SMALL SCALE MINING

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Introduction

Increasing emphasis is being placed on the need for sustainable development of natural resources. In respect of exploitation of mineral resources, this includes a number of principles:

- to use resources wisely, protecting what we do not need now for use by future generations;
- to locate workings so as to minimise damage to the environment;
- to undertake exploration, extraction and processing in ways which minimise impacts on the environment and people ;
- to rehabilitate areas which have been used for extraction to productive uses which are compatible with the surroundings; and
- to transport the extracted materials in such a way as to minimise environmental effects.

Great advances have been made over the past few decades in securing better practices for mineral working. The key principles are, increasingly, being observed by major, and many small, mineral operators throughout the World. However, the best performers are well in advance of the average, and more needs to be done to make mineral working as sustainable as possible.

Whilst substantial, well organised, enterprises are trained and equipped to carry out environmentally acceptable operations, there are, in many parts of the World, small scale mining operations which are conducted with little attention to the environment. In many cases, these are undertaken with little control from any land use planning or other regulatory systems. This is not new. Many developed countries have, over the last 2 or 3 centuries, seen a progression from uncontrolled small scale mining, through consolidation by the more successful miners or through external funding, into large scale, well organised enterprises. Small scale mining in developing countries is the first stage in this progression but the contrast is, perhaps, more stark than in the past because this often takes place alongside major international operations. It is unrealistic to expect small scale mining operations, at their current stage of operations, to come quickly up to internationally recognised environmental standards.

This paper briefly examines the regulation of mineral working in organised situations and points out some major contrasts with the circumstances of small scale mining operations. It examines which issues applying to small scale mining are the most important and how these might be addressed. It offers some suggestions as a basis for discussion but it does not pretend to present solutions. This is a very difficult problem to deal with.

Planning of land use

Most countries have land use planning systems involving two main stages:

a) the preparation of development plan documents , at one or more levels of detail, which set out policies for various activities. These may outline areas within which particular forms of development or conservation provisions are, or are not, appropriate; and

b) the consideration of applications for planning permission in order to determine whether or not development should proceed.

Development plan documents may be general and strategic in character or may be more detailed indicating, for example, specific areas on a map within which extraction may be preferred or opposed. Part of the process of plan preparation is normally some form of environmental appraisal of the plan area in order to ensure that an appropriate balance is achieved between development and social, economic and environmental costs. The resulting plans normally provide the context for assessment of individual planning applications.

Planning applications are normally accompanied by information to substantiate the nature and potential impacts of the proposed development. This includes details of site investigations but, increasingly, also involves fuller environmental impact assessment of major development proposals, such as many mineral workings. Where permission is given for minerals development, this is normally subject to planning conditions to secure restoration and, where appropriate, aftercare of the site. In addition, there may also be regulations under pollution control legislation to be observed according to the "polluter pays" principle. Both the planning conditions and pollution regulations need to be enforced by an appropriate organisation such as local government or an environment agency.

This ideal approach rapidly breaks down in circumstances where public control on parts of a territory is relatively weak, or people who are desperate to make a living from any means available to them are aware that there is money to be secured from readily accessible minerals. It is then unrealistic to expect that formal administrative regulation can help to mitigate the adverse environmental effects of uncontrolled extraction and primary processing of minerals. Alternative approaches have to be identified.

Environmental impacts

Whilst small scale mining operations are, by definition, limited in individual area, they are often numerous where rich mineral deposits are known to be close to the surface of the ground. The individual environmental damage, therefore, is often localised but the cumulative effects can be considerable. Some effects can arise at the prospecting stage, even if no mineral is found, as well as during extraction. For instance vegetation may be cleared, leading to soil erosion and fragmentation of natural communities. Access paths may give longer term routes for migration into undeveloped areas with associated landscape change and effects on biodiversity. In addition, the need for fuel may lead to clearance of vegetation at this stage, and also throughout the period of extraction, both in connection with the mining operation and domestic needs. However, the main effects arise from extraction and primary processing. Minerals extraction, whether in surface pits, or underground, can give rise to many kinds of environmental impacts. For example:

a) noise and vibration from machinery and blasting – Blasting , including poorly supervised use of explosives, can be a problem in small scale mining. Disturbance associated with machinery is less of an issue if labour is primarily manual. Disturbance to nearby wildlife can be severe in some cases;

b) dust and contaminants – Dust may be a particular problem in arid or seasonally dry areas especially if finely particulate or toxic materials might provide a threat to the health of local people, or a source of soil and water contamination. The contamination potential will relate to the potential bioavailability of toxins either directly, or after chemical modifications within the processing regime or the environment. In some cases, primary processing using highly toxic materials can cause major environmental and public health problems. A well known example is the use of mercury in extraction of gold in small scale mining operations in parts of the Amazon basin.

c) Water quality – Contaminants may affect surface water quality in the mining area or downstream. In some cases, over-bank floods may carry contaminants into soils some distance away. Sediment load may be increased to the point where bottom dwelling organisms in lakes and rivers may be excluded and even free-swimming organisms may not be able to persist. This can have effects on the whole natural food chain in the vicinity, with consequent loss of biodiversity. Underground water quality may also be affected and this may become a long term problem. Even if calls on groundwater are limited in a remote region now, the position may be very different if that area becomes more densely inhabited in the future.

d) Effects on the landscape – Whilst vegetation may, in ideal circumstances, cover ground disturbed by small scale mineral extraction fairly quickly, land left derelict often remains unsightly for a very long time, especially in relatively arid areas, unless steps are taken for rehabilitation. There is commonly no incentive, or ability, amongst small scale mining communities to do this. Miners need to expend their energy on creating enough money to live on rather than in tidying up behind them. Where mining is undertaken in a large undeveloped area, there may be little reason to be too concerned about a limited amount of dereliction. However, land left unvegetated may be subject to soil erosion with consequent effects on waterways and, if the catchment which is affected is fairly large there can be effects on microclimate.

e) Stability of the land – Underground mining may give rise to subsidence of the surface for extended periods after extraction has been completed; extraction may give rise to potentially unstable slopes and tips; and areas of accumulated slimes and other backfilled land may give rise to weak ground conditions. These may not be a significant problem if no other development takes place in the area, but unrecorded areas of potentially unstable land can give rise to problems for land use for a very long time. This is certainly the case in many developed countries where poorly controlled or recorded mining was undertaken a century or two ago and now causes significant problems for existing and new roads, buildings and other constructions. Considerable amounts of money are now being spent by central governments and by private landowners and developers on reclamation works.

f) Health and safety of miners – The absence of controls leads to risks to the safety of miners in respect of unstable workings, including poor blasting and excavation practices, and inhalation of dust with consequent risks of respiratory, skin and other ailments. Loss of the ability to work can, of course, affect the dependants of miners as well the miners themselves.

The principal problems

It is completely unrealistic to expect small scale mining to be controlled through the normal regulatory provisions in many parts of the world, but there remains a need to limit the damage which is caused. The key questions seem to be:

- Which of the potential problems matters most?
- How can those problems be addressed?

Important steps are likely to be making progress with guiding small scale mining to appropriate areas, and persuading miners to carry out their operations in a more environmentally sensitive manner but these are only likely to succeed if the miners income, such as it is, is not adversely affected.

a) Identifying locations where extraction would cause the least damage – Whilst it would be difficult to closely regulate small scale mining in many places, it might be possible to define areas within which it might be less damaging so that it can be guided to these. This would require central or local government action to support assessments of mineral resource areas, constraints to development, and the sensitivity and vulnerability of terrains to mining activities. Such multidisciplinary studies would need to be accompanied by some means of enforcing the exclusion of uncontrolled mining from sensitive areas. The resulting assessments could also form part of the basis for longer term development planning to be implemented as the focus of activity shifts, in time, from small scale extraction to larger scale and better organised operations.

b) Mitigating environmental effects of extraction and processing of minerals – Better mitigation of environmental effects of mineral working requires both an understanding of the issues and access to good equipment and facilities. This may be prevented by lack of education and of money to invest in better methods of working. There is a need to address both of these aspects with regard, at least, to the principal impacts described earlier: occupational health, dust, effects on the quality of surface and ground water, and erosion.

c) Rehabilitation of the ground – Since miners are concerned with making a living rather than clearing up the damage they create, one option might be to pay them to carry out simple reclamation work. Whilst modest achievements might be secured in the short term, this sort of initiative might gradually build up expertise in carrying out such work, but would require supervision.

Addressing the problems

The problems may be addressed in a number of ways:

a) Education and guidance – many small scale miners have limited education and knowledge. That they are often remarkably efficient at locating and exploiting mineral deposits shows, however, that they are fully able to

understand the issues if these are presented to them in the right way. There is a need for education concerning better mining practices and environmental and health protection but the principles need to be conveyed in terms which are suited to their ethnic and cultural and linguistic backgrounds, preferably by people of similar origin. Where formal education has been lacking, there needs to be a strong emphasis on visual communication. Suitable approaches have been developed already in, for example, World Health Organisation projects to combat diseases. To be effective, however, education needs to be accompanied by continuing advice and dialogue. This costs money but it may be wiser to spend money and other resources in providing assistance rather than in futile attempts at enforcement.

b) Demonstration – A possible approach which might help to change practices could be the undertaking of demonstration projects within a small mining areas. This could introduce good practices in a realistic and affordable way. Local miners might be given access to see and discuss the operation. If it could be shown that the are better ways of doing things which provide good incomes then it is likely that many miners would not be slow to follow suit.

c) Investment – People on subsistence incomes have no money to invest in improvements and use manual labour or outdated technology. Even if they are successful, the income will often not be large enough to buy equipment or to upgrade facilities. It is possible that groups of people might be able to break out of this situation if they jointly deploy funds, for instance through co-operatives. In many cases, however, it is unlikely that they will be able to adopt better working practices without some external assistance. This could be financial but might be more effective if it consisted of provision of suitable machinery. This is an issue which might be considered by international aid organisations.

Conclusion

Overall there is little hope of securing a positive response if the miners do not appreciate that there is something in it for them. Control without assistance and dialogue can lead only to opposition or confrontation. There is likely to be a better reception if the miners can feel that they have had their say and that their needs are understood. Actions are likely to be accepted only if they can be carried out at similar, or lesser, levels of effort and costs than those undertaken at present.
Possible approaches are:

a) for central or local administrations to define areas within which small scale mining is least damaging and to guide it to those areas;
b) for educational and demonstration initiatives to be undertaken, preferably using local people, to address , at least, the key issues of occupational health, dust, water contamination and erosion;
c) for aid to be provided to improve mining methods and management, perhaps by developing individual operations into more financial viable joint enterprises; and
d) for miners to be encouraged and given financial incentives towards rehabilitating land and well as working it.

Whilst some countries may be able to support such approaches internally others may need to make representations to international aid organisations in respect of proactive assistance in dealing with these problems.
The penalty for not doing this will be a legacy of people with damaged health and destitute dependants, contaminated land, polluted water, unsightly features in the landscape, limitations on future land use and, ultimately, the need for expensive reclamation schemes.

Views expressed in this paper are those of the author, not of the organisation within which he is employed.