MMSD

Artisanal and Small-Scale Mining

Challenges and Opportunities

Thomas Hentschel, Felix Hruschka, and Michael Priester

Projekt-Consult GmbH

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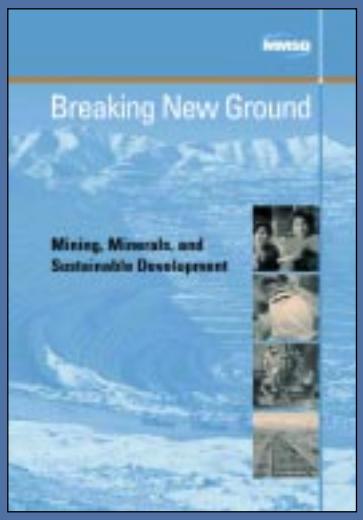
World Business Council for Sustainable Development



Breaking New Ground is the final report of the Mining, Minerals, and Sustainable Development Project (MMSD), an independent two-year process of consultation and research that aimed to understand how to maximise the contribution of the mining and minerals sector to sustainable development at the global, regional, national, and local levels. *Breaking New Ground* contains proposals for global change in the mining and minerals sector.

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Foreword

In many developing countries, artisanal and small-scale mining (ASM) is largely a poverty-driven activity which plays an important economic role. It is estimated that in the order of 13 million people in about 30 countries are directly engaged in small-scale mining, a significant proportion of whom are women and children. A further 80 to 100 million people across the developing world could depend on small-scale mining for some aspects of their livelihoods.

Small-scale mining can be extremely environmentally damaging and often has serious health and safety consequences for workers and surrounding communities. This is generally due to poor practices in mining and processing target minerals. Governments in many countries regard ASM as an illegal activity. The consequent lack of an adequate regulatory and policy framework can prevent formalization of this sector. This, in turn, makes improvements in the livelihoods of miners and their dependent communities difficult to achieve. Absence of formalization also makes improvements in environmental performance much more problematic.

Many of the potential economic benefits of the small-scale mining sector are lost through poor practice in mining, processing and marketing the target minerals. The absence of adequate legal frameworks and secure rights for miners and communities exacerbates this problem. Local governance structures and institutions are typically underdeveloped. Artisanal and small-scale miners are often marginalized and there can be very serious disputes with communities, government agencies and large-scale mining interests. Conflicts over access and land-use can be a particular issue in areas where indigenous or tribal peoples have traditional land rights or land-use patterns. These and other problems commonly associated with ASM (such as child labour, access to health care and education) present a major challenge to the government and

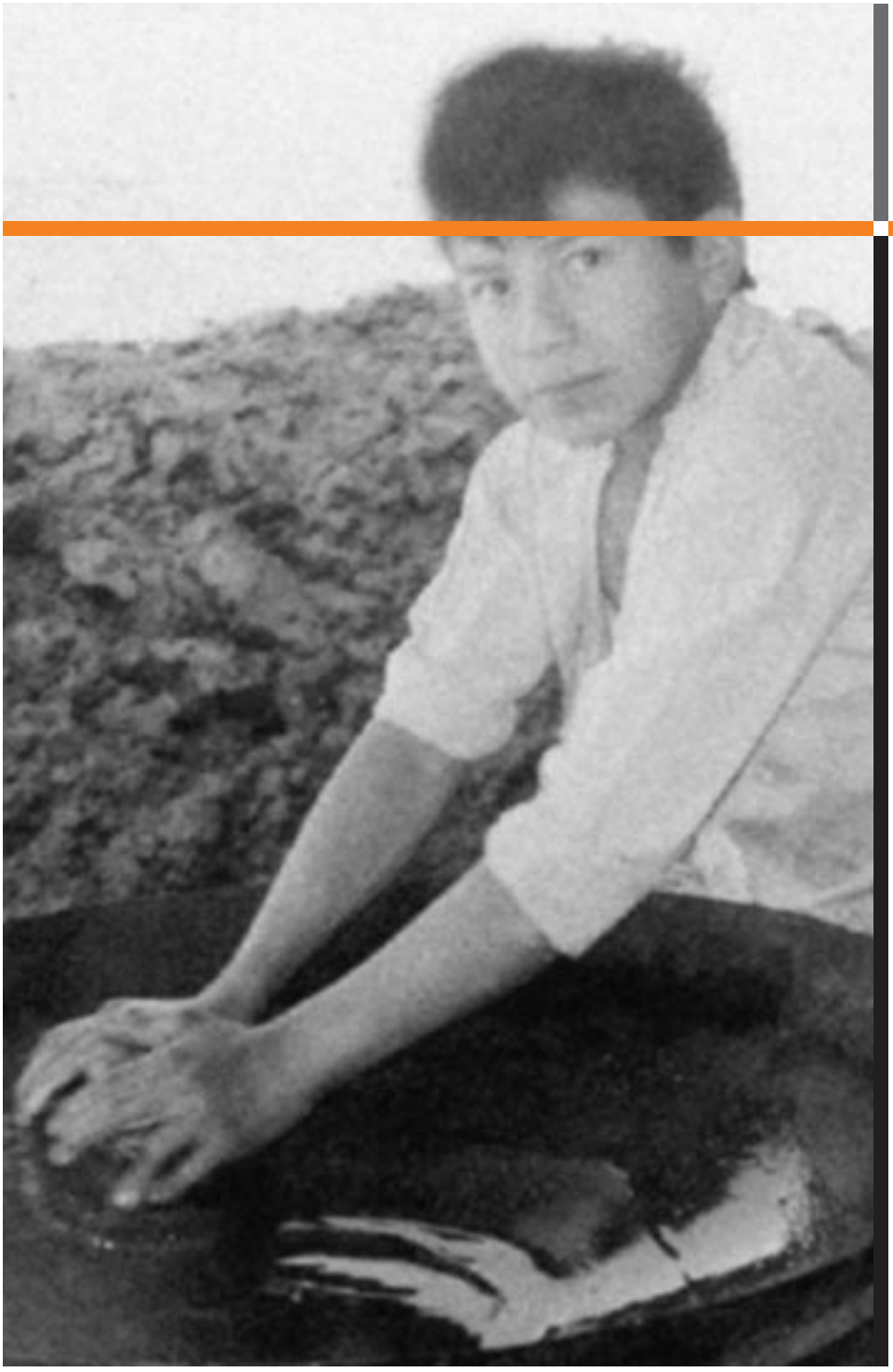
regulatory authorities in countries where these activities take place, as well as to the wider development community.

This paper presents an excellent overview of the issues and challenges facing the ASM stakeholder community across the world.

Andrew J. Bloodworth

British Geological Survey

Note: This working paper is an edited version of research material prepared for IIED´s Mining, Minerals and Sustainable Development (MMSD) project. The full original research papers are available free to read or download at www.iied.org/mmsd, and are included on a CD that comes with the MMSD final report, *Breaking New Ground*.



1 Introduction

In many parts of the world, artisanal or small-scale mining (ASM) activities are at least as important as large-scale mining activities, particularly in terms of the numbers of people employed. ASM can play a crucial role in poverty alleviation and rural development; most of those involved are poor and mining represents the most promising, if not the only, income opportunity available. However, the sector is perhaps better known for its high environmental costs and poor health and safety record. Many continue to view it as dirty, unprofitable and fundamentally unsustainable.

Whether or not the sector is a net contributor to sustainable development, the fact remains that small-scale and artisanal mining activities will continue for at least as long as poverty makes them necessary. It is therefore essential to maximize the benefits brought and enabled by small-scale mining, and to mitigate the costs.

According to a recent survey carried out by the International Labour Organization (ILO) and MMSD, at present around 13 million people work directly in small mines throughout the world, most of them in developing countries. A large percentage of these miners are women and, regretfully, children.

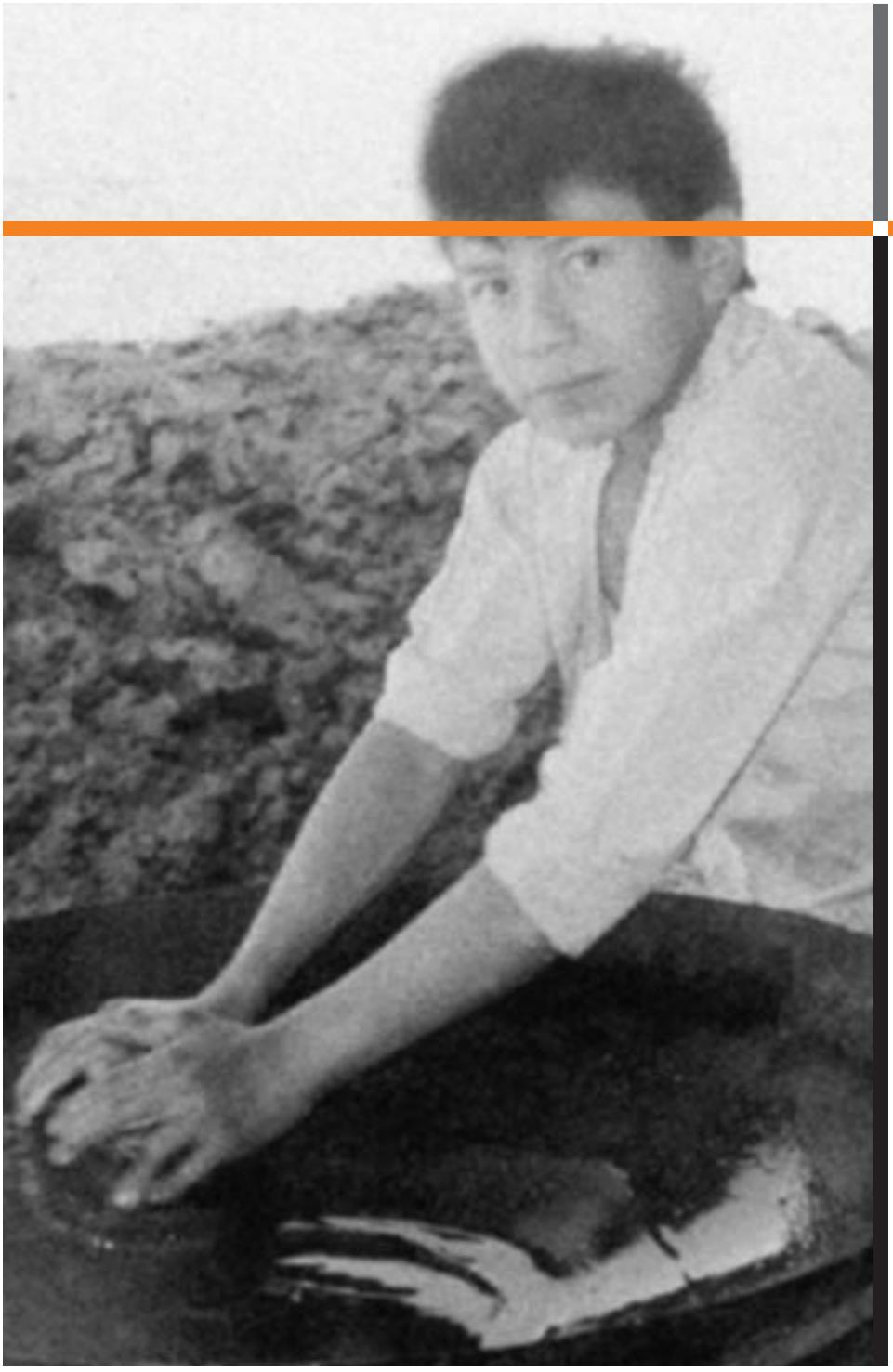
Now, the international development community has turned its attention to the ASM sector. In the last 10 years international donor agencies have recognized the close relationship between ASM and poverty. Accordingly, the sector is gaining more attention. ASM is now on the agendas of many national governments, and of bilateral and multilateral donor organizations, and assistance programmes have been or are being carried out. CASM (Community and Small-Scale Mining – www.casmsite.org) is an initiative of the World Bank and is a valuable instrument for donor coordination, experience and information exchange and for channelling funds. There have also recently been interesting experiences in the relationship between large and small mines.

This report is a snapshot that provides an overview of the ASM sector and describes its social, environmental and economic issues. This report is based on:

- Twelve new studies from selected countries commissioned by MMSD (Bolivia, Peru, Ghana, Malawi, Mali, Mozambique, Tanzania, Zambia, China, Indonesia, Papua New Guinea and the Philippines) (see www.iied.org/mmsd)
- Bibliographic research
- Interviews with people active in the field
- MMSD Workshop on Artisanal and Small-Scale Mining, 19–20 November 2001 (see www.iied.org/mmsd)
- The authors' experiences — especially in Latin America and Africa

The report focuses on major issues in ASM and how the sector can best contribute to sustainable development; special focus is given to the different practical experiences and case studies that have been carried out by assistance programmes to the ASM sector during the last ten years.

The second part of the report deals with the different definitions and general problems of the sector. The third part presents a brief historical review of the changes in issues and priorities regarding ASM development policy in the last 30 years. The next section summarizes the country studies and the workshop, and identifies regional differences and common issues. The next section discusses the conditions of livelihoods in ASM communities and the contribution of ASM to sustainable development. A later section addresses traditional issues of ASM like policy, law, organization, the manufacture of value-added products, environment, health and safety, technology and finance. The next section deals with aspects of mineral economics relevant ASM. The penultimate section gives special attention to case studies showing the relationship between large mining operation and ASM. Finally, new trends such as common environmental solutions, networking on the internet, and fair-traded ASM products are highlighted, again with case studies.



2 Definitions and General Problems

Broadly speaking, artisanal and small-scale mining refers to mining by individuals, groups, families or cooperatives with minimal or no mechanization, often in the informal (illegal) sector of the market. Despite many attempts, a common definition of ASM has yet to be established. In some countries a distinction is made between 'artisanal mining' that is purely manual and on a very small scale, and 'small-scale mining' that has some mechanization and is on a larger scale. In some West African countries (for example, Mali), small-scale mining is differentiated from artisanal mining by the presence of permanent, fixed installations that are established once an ore body is confirmed. Throughout this publication, the terms artisanal and small-scale mining are used interchangeably.

Using the legal rubric governing mining activities in different countries, it is possible to group together the criteria used and stratify the mining industry. In particular, ASM activities may be categorized. This does not exclude the simultaneous use of more than one criterion. There are countries that have programmes for small mining, despite the fact that this activity goes unrecognized by the mining law of the country. There are also countries with special laws that apply different treatment to small mining, as in the case of Brazil with its 'Garimpo' or 'Garimpogen' law. The following criteria are most often used:

- production volume
- number of people per productive unit
- intensity (volume) of capital employed
- labour productivity
- size of mine claim

- quantity of reserves
- sales volume
- operational continuity
- operational reliability
- duration of the mining cycle (Chaparro, 2000)

Each of these criteria has its advantages and difficulties depending on the country, the type of mining, the minerals produced, political conditions and the number of miners in each country.

While many attempts have been made to define ASM, a common definition of the term has still not been found. Previous definitions made use of the limited investment volume of the operations, the small workforce or the limited mineral production. The local definitions vary from country to country according to the macroeconomic situation, the geological framework, the mining history and the legal conditions.

Nevertheless, ASM is characterized by a number of conditions:

- Lack of or limited use of mechanization, and a lot of physically demanding work
- Low level of occupational safety and health care
- Poor qualification of personnel at all levels of the operation
- Inefficiency in exploitation and processing of mineral production (low recovery value)
- Exploitation of marginal and/or very small deposits, which are not economically exploitable by mechanized mining
- Low level of productivity
- Low level of salaries and income
- Periodic operation by local peasants by season or according to the market price development
- Lack of social security
- Insufficient consideration of environmental issues
- Chronic lack of working and investment capital

FIGURE 1 **Typical problems of artisanal small-scale mining**

Geology

- lack of appropriate ore bodies
- lack of information about these ore bodies

Law

- discouraging investment climate
- illegality of ASM *
- lack of social security
- lack of political and legal stability
- difficulties of legalizing mines *
- contradictions between different/official acts

Marketing

- access to the market only via intermediaries
- market barriers
- market regulations

Finance

- difficulties in low-cost preparation of feasibility studies
- uneconomical investment decisions *
- lack of bookkeeping and cost-calculation *
- lack of capital
- high tax and royalty burden
- limited access to foreign currency
- limited access to investors and equity capital

Technology

- use of labour-intensive technology
- high losses of values and time *
- lacking transparency of the hardware market

Human resources

- unskilled labour force
- lack of written contracts *
- social dependencies *
- lack of cultural understanding
- bad social image of mining
- subsistence economy *
- lack of knowledge about
  - economic principles *
  - credit and finance aspects
- gambler mentality *
- access to foreign experts limited

Organization

- lack of umbrella organizations
- lack of service offers by GOs
- seasonal activity of SSM *
- coordination or cooperation difficult because of widespread out mine locations

*special problem of informal ASM

- Most working without legal mining titles

The development of the sector shows a strong relationship to the general economic indicators of the country: ASM is poverty related.

2.1 Common and differential issues of artisanal, semi-industrial and industrial small-scale mining

Figure 1 presents the most common issues associated with ASM.

Some small mining operations may have a semi-industrial or fully industrial character. Here the degree of mechanization, internal organization and compliance with international industrial standards is advanced. These operations are most frequently financed and managed by partners from industrialized countries.

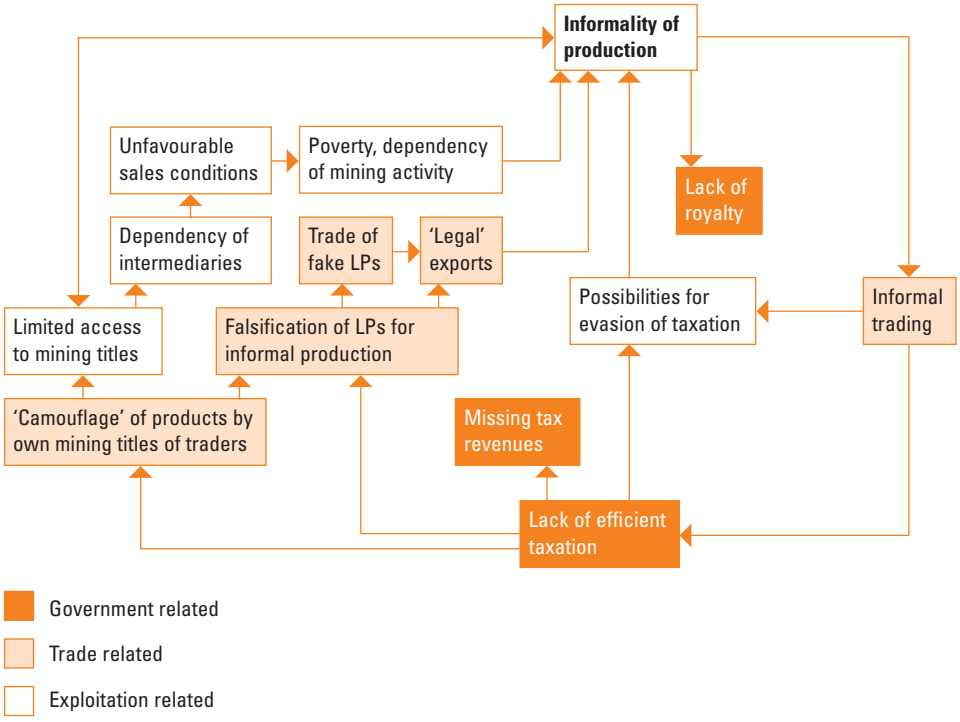
These types of operation often produce niche products, on small and high-grade mineral deposits, which demand complicated exploitation or concentration techniques. These are usually found in countries with a positive investment climate. This kind of operation generates few problems. Moreover, they act as positive examples for the ASM community.

2.2 Formal and informal ASM

In many countries ASM is part of the informal sector. Despite this, the mine operator must often comply with the following legal conditions:

- possession of a mining title (concession, claim or similar) or valid contract with concession holder;
- compliance with environmental legislation;
- possession of an environmental operation licence;
- registration of the company at the mining authority or other fiscal authorities;
- payment of taxes (royalties, company taxes);
- enrolment of staff in the national social security system; and
- legal exportation of the products (export licence or tax).

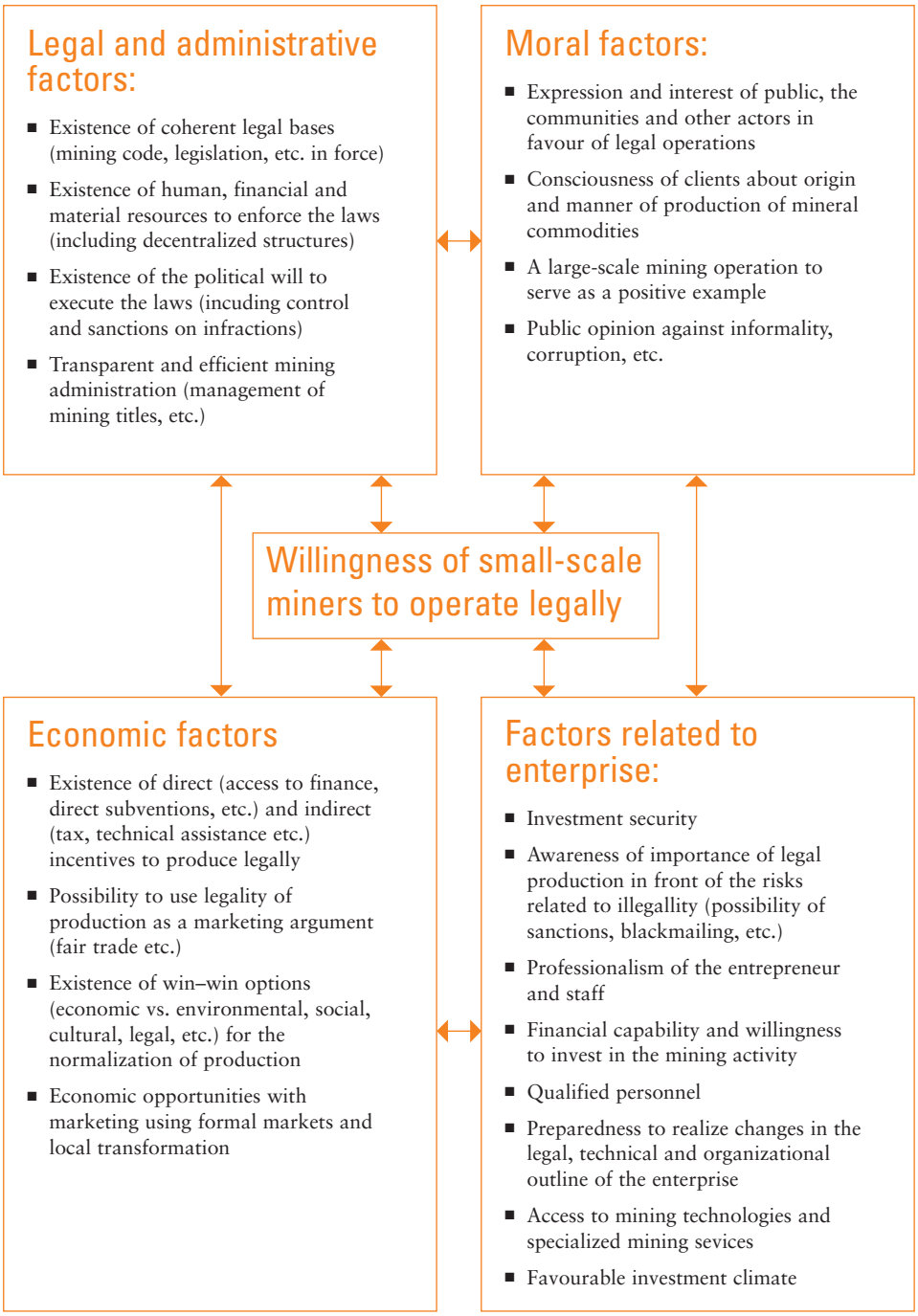
FIGURE 2 **Vicious circle of informality and the effects of inefficient tax administration**



Where governments do not have the means to control the compliance of the laws or do not want to recognize ASM activities, many operations remain informal. The most common reasons for this are:

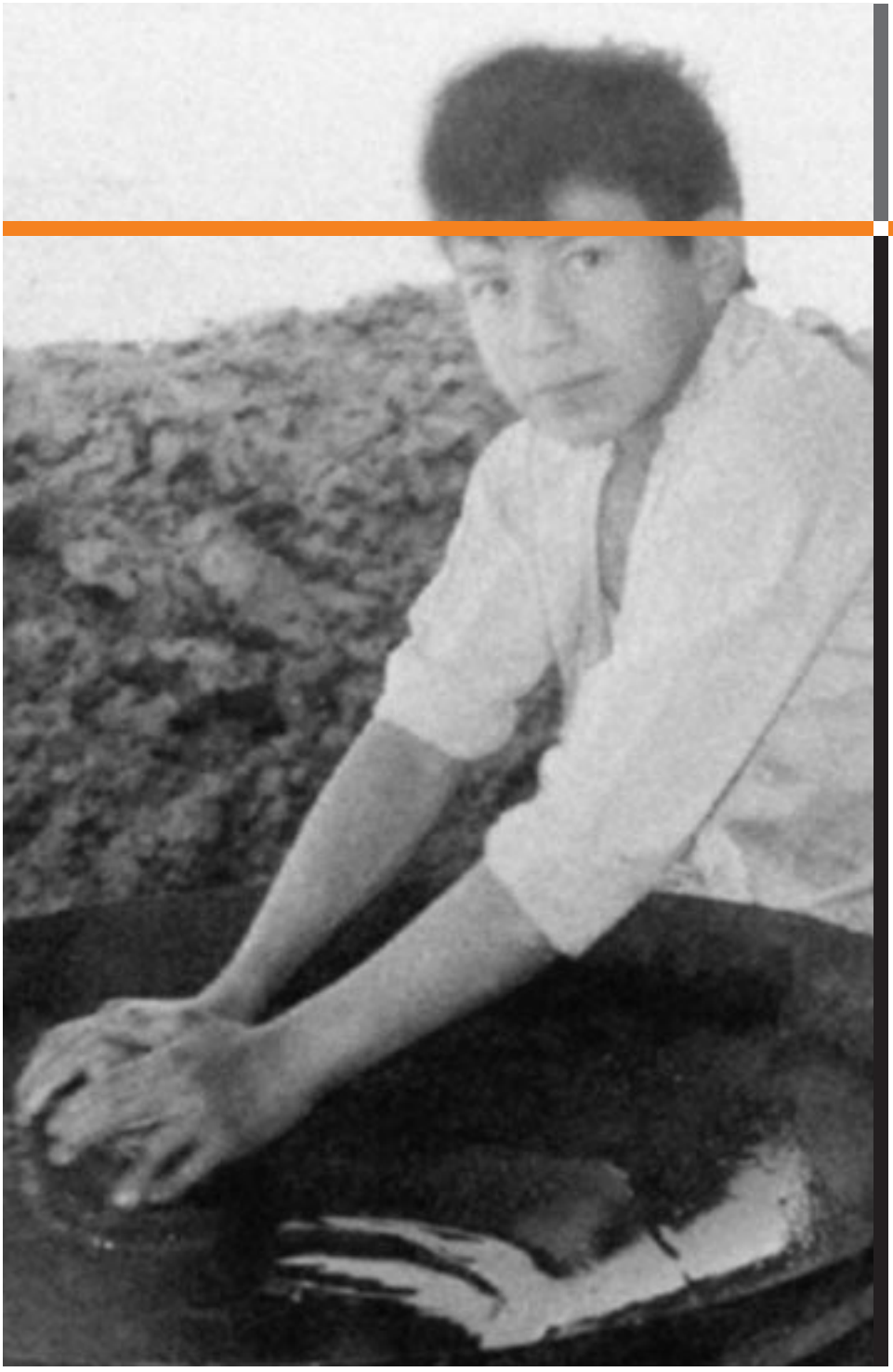
- lack of knowledge about legal requirements;
- local traditional and cultural behaviour;
- little incentives from the government to operate legally;
- high tax burden;
- limited access to mining titles;
- demanding bureaucratic procedures to gain and remain a formal operation; and
- limited danger of sanctions in combination with possibilities to evade the imposition of the law by corruption are the most common.

FIGURE 3 **Factors influencing the willingness of small-scale miners to operate legally**



In some cases, the lack of political will to create an adequate framework for legalizing ASM may be explained by personal interests related to corruption, money laundering and similar illegal activities, enabled by the informal status of the ASM sub-sector.

The informality of ASM may have negative effects on the social, environmental and fiscal regimes of a country or region. Figure 2 illustrates the relationship between informality and weak governance.



3 Historical Review of ASM Issues, Research and Assistance Programmes

National governments are becoming increasingly aware of the sector's importance as both a means of poverty alleviation and a generator of national income. In recent years, a number of governments have formally recognized the sector and attempted to provide facilitating environments. Despite these changes, the implementation of legislation at a local level remains problematic and many miners do not have faith in the ability or commitment of their governments to provide assistance.

The international development community has been concerned with the artisanal and small-scale mining sector for the past 30 years. As understanding of ASM has grown, the support approaches have changed. Table 1 summarizes this evolution.

TABLE 1 Evolution of the development community's approach to ASM

Period	Approaches for dealing with ASM
1970s	Definitional issues
1980s	Technical issues
Early 1990s	Towards integration of technical, environmental, legal, social and economic issues
1990s	Special attention on legalization of ASM sectors
Mid- to late 1990s	Relation between large mining companies and ASM Gender and child labour issues
2000s	Community-related issues and sustainable livelihoods

The sector has traditionally received a low proportion of aid relative to its contribution to livelihoods. In the past 10 years, however, recognition of the sector's close connection to poverty has increased; as a consequence, and in line with a global shift in concern towards poverty alleviation, ASM is gaining more attention. It now appears on many bilateral and multilateral donor agendas and assistance programmes have been, or are currently being, carried out. Examples include the German GTZ and BGR programmes in Ghana, Colombia and Zimbabwe, the UK Department for International Development (DFID) programme looking at the model scheme of assistance to small-scale miners and the Swiss SDC environmental protection programmes in Latin American.

The World Bank funds projects in Bolivia, Burkina Faso, Ecuador, Ghana, Guinea, Madagascar, Mali, Mozambique, Papua New Guinea and Tanzania. UN organizations such as UNDESA, UNDP, ECA, CEPAL, ESCAP, UNCTAD, UNEP, UNIDO and ILO also work in this sector.

The recently formed CASM (Community and Small-Scale Mining – www.casmsite.org) initiative of the World Bank and DFID should prove a valuable instrument for coordinating experience, exchanging information, and channeling funds for these activities. However, there is still little recognition from donor agencies of the sector's potential to contribute to sustainable rural development.

A number of major conferences have been held focusing partially or exclusively on improving different aspects of the sector:

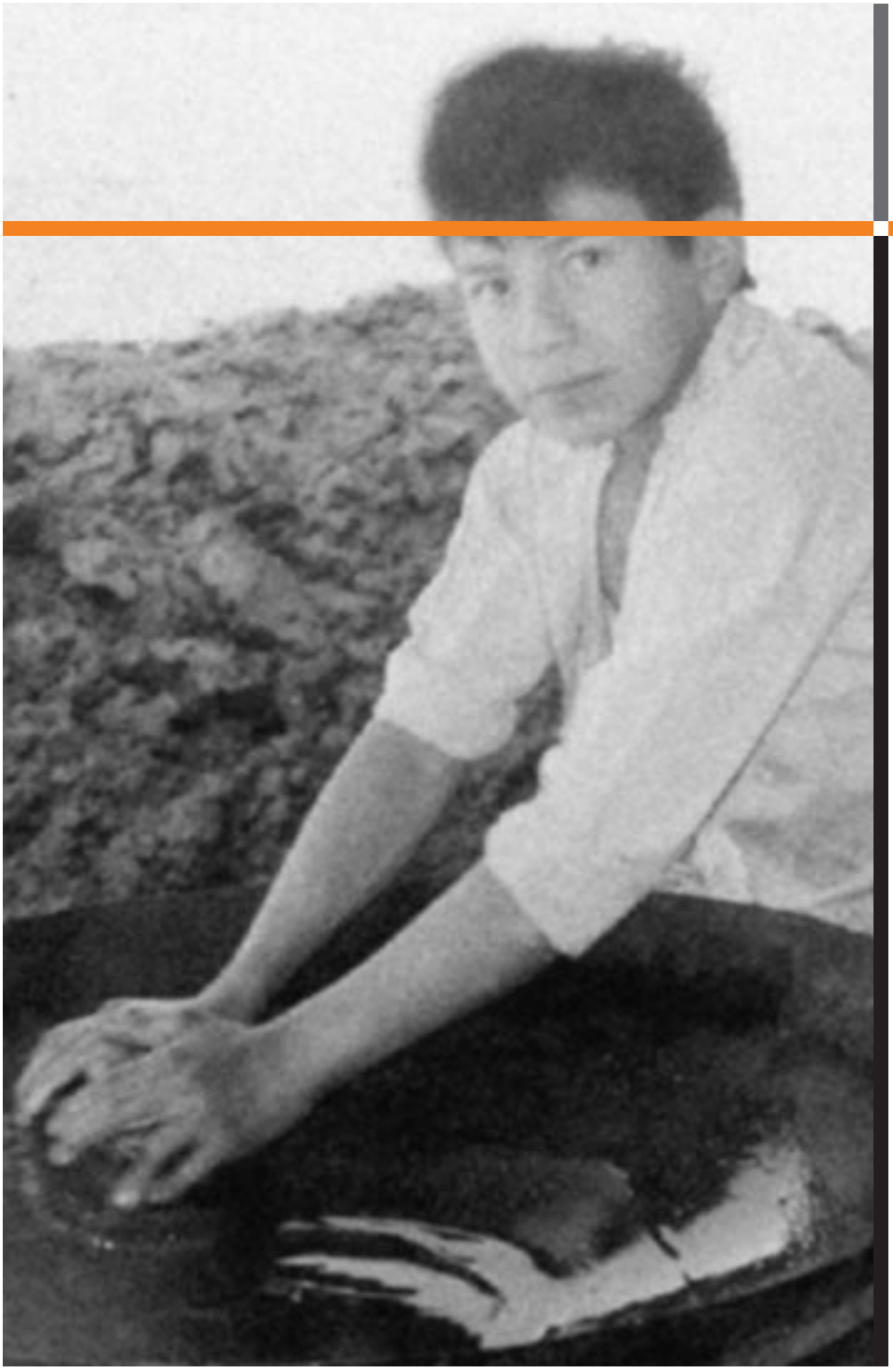
- Calcutta 1991, National Institute for Small Mines
- Harare 1993, United Nations, with important guidelines on small- and medium-scale mining
- Washington 1995, World Bank with a comprehensive strategy towards artisanal mining
- Calcutta 1996, National Institute for Small Mines
- Vienna 1997, UNIDO, Global Mercury Pollution Deriving from Artisanal Gold Mining
- Geneva 1999, Tripartite Meeting on Social and Labour Issues in Small-Scale Mines

Moreover, an increasing number of global conferences have specific ASM participation. This includes the incorporation of ASM issues in the agenda of

CAMMA (Mines Ministers of the Americas) and UEMOA (Union Economique Monetaire Ouest-Africaine) meetings.

Large companies also find it productive to adopt more collaborative approaches with small-scale miners. A number of successful relationships have been established, including the Ingwe coal mine in South Africa, the Gold Fields project in Ghana, and Placer Dome's programme in Venezuela.

International NGOs such as the Intermediate Technology Development Group (ITDG), Conservation International, and the International Union Association have ASM-related programmes.



4 Evaluation and Synthesis of the MMSD Country Studies and Workshop on ASM

Artisanal and small-scale mining takes place throughout the world, but is particularly widespread in developing countries in Africa, Asia, Oceania, and Central and South America. MMSD country research studies have been carried out in a number of the most important ASM countries. These are Burkina Faso, Ghana, Malawi, Mali, Mozambique, South Africa, Tanzania, Zambia, Zimbabwe, China, India, Indonesia, Papua New Guinea, Philippines, Bolivia, Brazil, Ecuador and Peru.

Other countries where ASM is carried out include Central African Republic, Congo, Ethiopia, Guinea, Kenya, Madagascar, Namibia, Nigeria, Niger, Sierra Leone, and Uganda in Africa; Laos, Malaysia, Myanmar, Thailand and Viet Nam in Asia; and Chile, Colombia, Dominican Republic, French Guyana, Guyana, Mexico, Nicaragua, Surinam and Venezuela in Latin America and the Caribbean.

Employment 4.1

Recent ILO research estimates that 13 million people are engaged directly in small-scale mining activities throughout the world. This employment is mainly in developing countries, and the livelihoods of a further 80–100 million people are affected by it. There is a lack of clarity over the actual number of people employed in the sector. Many factors make it difficult to ascertain the full extent of employment, including: the informality of the sector, the lack of official statistics, the number of seasonal and occasional workers, and definitional issues. The significance of this is demonstrated by the MMSD Country Study for China, which estimated that anything between three and 15 million people are involved in artisanal and small-scale mining activities in that county.

In spite of these difficulties, there is no doubt that ASM is an important employment-generating sector.

Taking these 13 million people into account, the MMSD country studies cover more than half of the worldwide ASM population.

Bolivia, Burkina Faso, Ghana, Mali, PNG, Tanzania and Zimbabwe are the countries where the ASM sector is socially and economically most important and the largest percentage of the population is involved.

Artisanal and small-scale mining activities provide an important source of livelihood for women. Children also work in mining, particularly where they are very poor or where their families are involved in mining.

TABLE 2 Estimates of the number of people working in the ASM sector in the MMSD research countries

Country	Total number of workers (in 000s)
Bolivia	72
Brazil	10
Burkina Faso	100 to 200
China	3,000 to 15,000
Ecuador	92
Ghana	200
India	500
Indonesia	109
Malawi	40
Mali	200
Mozambique	60
Peru	30
Philippines	185
PNG	50 to 60
South Africa	10
Tanzania	550
Zambia	30
Zimbabwe	350

4.2 Types of minerals

A broad range of minerals is mined within the sector. In many countries, activities centre on the production of gold. For example, in Ghana and Ecuador, gold constitutes two-thirds of production, in the Philippines 90 per cent and in Peru almost 100 per cent. Alluvial gold mining and mercury amalgamation are particularly common activities.

The other minerals mined include bauxite, gemstones, iron ore, marble and limestone and other construction materials. In India, over 40 different minerals are exploited and, in China, more than 20. In China, coal and construction materials

dominate with 46 per cent of miners employed in the former and 44 per cent in the latter. These materials are mainly produced for a local market and sold in villages and along the roads. In certain countries, silver, tin, zinc and other base metals are produced on a significant scale. In Bolivia, the numbers involved in base metal mining exceed those involved in gold mining.

The mining of precious gems, including diamonds, emeralds and garnets, is an important component of the sector. For example, in Ghana 80 per cent of total diamond production comes from the ASM sector. Precious gems are easily sold, via legal and illegal routes, and often end up on the international market.

Levels of production 4.3

The contribution of ASM to overall mineral production is significant: according to the ILO, artisanal and small-scale mines accounted for approximately 15 to 20 per cent of the world's non-fuel mineral production in recent years.

Comparison with the large-scale mining sector provides a useful indication of the scale of production. For example, while a large gold mining operation might process 10,000 tonnes of ore per day, a small-scale operation would typically process no more than a few tonnes per day.

Despite the low production at an individual level, the often large number of units involved means that, on a national scale, total production can be significant, in some cases equalling or exceeding that of large mines. In Indonesia, for example, total production of tin by the small-scale sector is equal to that of large-scale mining operations.

Conclusions 4.4

Several conclusions can be drawn from the MMSD research and workshop on artisanal and small-scale mining. Perhaps the most fundamental is that the ASM sector must be recognized as a significant generator of rural livelihoods. It has the potential to alleviate poverty and be a tool for sustainable development.

The extent to which ASM can contribute to poverty reduction, as well as to the other goals of sustainable development, depends on the nature of the mining. Initiatives aimed at supporting the sector must be seen in the context of the whole community. If exploitation is sudden and short lived, particular effort should be

made to stabilize the local community. In the case of remote, seasonal operations, the main issue is how to integrate the ASM sector into the local community and encourage the investment of profits in other forms of economic activity and services.

Because of the great information gap in the ASM sector in general, more comprehensive baseline socio-economic data on the sector is required to raise awareness of the importance of the sector and to provide better focus for assistance projects.

Regional differences between the continents exist. In Africa AIDS and sustainable community development are the key issues; in the Asia/Pacific region multicultural aspects and cultural rights predominate, whilst in the Latin American/Caribbean region environment, indigenous people and legal aspects are the key issues.

Any assistance to the sector should have the development of the community as the goal (both mining communities and local communities if they are different). The importance of a partnership approach, involving extensive participation of miners and local communities, between the donor(s) and community is imperative if assistance projects are to be culturally relevant and have any real impact. Otherwise, the chances that they will be sustainable at the local level once the project is over are minimal. Projects should be based on an integrated approach that considers organizational, social, economic, legal, technical and environmental issues together.

Donor agencies should view the artisanal and small-scale mining sector as a potential vehicle for poverty alleviation. It should be seen as a key part of rural development programmes and accorded greater priority in spending. ASM assistance projects need to be included in regional and local development programmes. International projects that aim to coordinate assistance to the sector, such as the CASM initiative, should be supported by donors, governments and large mining companies.

Large mining companies should acknowledge the important role that ASM plays in the mining sector and provide support where possible, particularly through fostering partnership approaches.

National governments also have an important role to play. Enabling legislative and regulatory frameworks should be put in place in all countries in which small-scale mining activities occur. Governments need to create objective, consistent, transparent and non-discriminatory regulatory mechanisms which offer easy access

to mining titles and legal production channels. Decentralizing control of the sector was identified as a way to ensure that the design and implementation of legislation and regulation reflect the realities of the sector.

In order to increase the value retained in the local region, the development of small industries based on products from local mines should be encouraged. The focus should be on complementary rather than additional activities. Governments can help by promoting investment and training and providing fiscal incentives for new enterprises.

Most ASM operations have financing problems and difficulty obtaining credit to improve production. As most rotating funds have not worked well, the financing of ASM projects needs to be tailor-made and consider non-traditional forms of financing such as own capital resources, joint ventures, risk capital, equity partnerships and the leasing of equipment.

Transborder dimensions are becoming an increasingly important issue for ASM, in particular pollution, migration and smuggling of gold and precious stones. There is evidence that ASM activities (such as diamond and coltan workings) can finance and prolong conflict in some areas.

The role of women is a vital consideration for community projects and should be considered separately from child labour issues. Assistance projects should ensure that women receive a fair share of benefits for their efforts, and that their key roles in community development are reflected.

Outreach programmes that try to reduce the involvement of children in mining through broader community development strategies should be pursued.

Many environmental and health and safety assistance programmes have demonstrated that interventions should focus on incentives and training rather than on traditional monitoring and enforcement systems. It is important to show how protecting the environment or health can produce more benefits than costs.

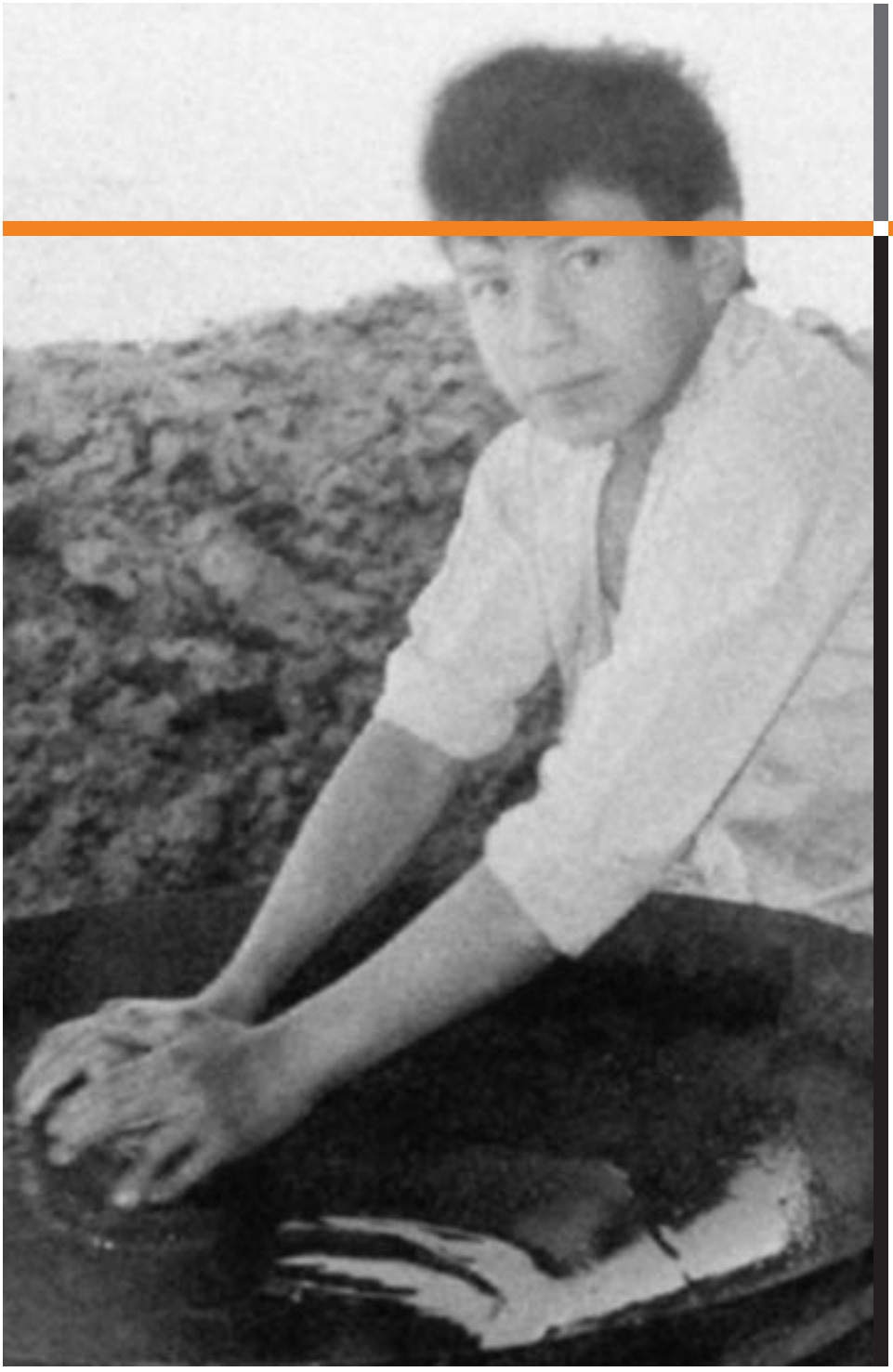
Solutions have a better chance of success if they can be implemented with readily available material that is familiar to the cultural environment of the miners. Adapting and optimizing existing technology is preferable to introducing new and sophisticated equipment. Due to the differences between mining operations and local contexts, a single generic technical solution is normally inappropriate.

Change is most effectively disseminated through pilot operations that are implemented successfully and that serve as models for duplication. Education, training, demonstration and monitoring are the key elements of any programme to

improve occupational safety and health in ASM.

Fair-trade initiatives for giving small-scale producers in developing countries the opportunity to trade their products under better selling terms and conditions should be developed wherever possible.

Encouragement and support for the formation of cooperatives, associations or enterprises to support communication, cooperation and coordination between miners should also be provided as opportunities for networking between miners to share information and coordinate activities are often productive.



5 Livelihoods and Sustainable Development

Livelihoods

From a livelihoods perspective, ASM is often poverty driven and located in rural areas. Miners are generally unskilled and earn little. Individuals may be involved in a number of different types of ASM activity:

- gold- or diamond-rush, which is characterized by unstable communities which are prone to conflict;
- temporary ASM activities fuelled by economic recession. Examples are available from Zimbabwe, Peru, Venezuela and Bolivia (all gold mining). Initially unstable communities with high population fluctuations may disappear after some years or evolve into long-term settlements;
- isolated and remote ASM activities with little or no involvement with nearby communities;
- seasonal ASM activities within an agricultural cycle. This is possibly the most common ASM activity and normally stable communities are involved; and
- traditional year-round ASM activities, which are generally associated with stable communities.

A principal development issue is how to ensure that ASM does not harm the community, but instead creates the basis for poverty reduction and sustainable development. How this can be achieved depends partly on the nature of the mining. For example, if exploitation is sudden (such as in rush activities) and short-lived, particular effort should be made to stabilize the local community. In the case of remote, seasonal operations the main issue is how to integrate the ASM sector into

the local community and encourage the businesses to invest their profits in other forms of economic activity and services such as schools and health centres.

Organizational aspects play a key role in this context. Once there is significant progress in these issues the common tools for supporting the ASM sector can be implemented, including improving:

- organizational and legal support;
- access to prospective land;
- training;
- dissemination of best practice;
- business management;
- availability of micro-credits and other development instruments; and
- use of revenues.

In the past, most activities to support the ASM sector have focused on the ASM operations themselves, mainly to improve their productivity, legal status or environmental performance. These projects have sometimes benefited only a few selected operations or mining entrepreneurs and have not initiated any sustainable development in the whole mining community or the nearby communities. In other words only the ASM sector was involved and the support was not seen in the context of the whole community and the people living in the communities.

There are also a lot of examples, especially from 'gold-rush' areas, where there has been no benefit at all to the livelihoods of the communities during or after the rush activities. In many of those regions, tonnes of gold have been produced, but once the rush is over poverty returns and there are perhaps even more problems because of the cultural damage which may have happened in these areas.

The UN Department for Economic and Social Affairs has developed an interesting sustainable livelihood approach for artisanal mining communities which is currently under pilot implementation in Mali, Ethiopia, Ghana and Guinea. The main policy recommendations for this approach, according to Labonne and Gilman (1999) are:

- Mainstreaming poverty eradication into national policymaking in all sectors including minerals.
- Promoting small-scale mining as a catalyst and anchor for other productive activities to stimulate the development of complementary and alternative productive ventures necessary for sustainable poverty alleviation.

BOX 1 Case study: A negative example of a gold-mining cooperative, Kantuta, Bolivia

The Gold Mining Cooperative Kantuta in La Paz Department in Bolivia was a potentially positive example of a gold mining cooperative, with about 30 members, a very good ore body, and legal registration of their concession. When the cooperative began mining in 1984 they worked completely manually and had no road access. During the following 10 years a road was built and because of the miners' effort and some financial support the operation grew, acquiring specialized technical staff and then mechanizing with a generator, compressors, tracks and a processing plant with ball mills and tables.

In 1994 the MEDMIN programme began to work with the cooperative to improve their environmental performance (mitigation of mercury emission, improved tailing facilities, and environmental licensing). These activities had been implemented without any major issues until one day in 1995 when problems suddenly arose with the nearby communities. About 100 armed members of the community took over the mine and ordered out all the cooperative members. For MEDMIN this came as a big surprise. Today we know that there was no understanding between the miners and the community, but instead envy about gold production on 'community' land. The communities have their own laws and do not accept state laws, such as the Mining Code.

The miners tried different ways to recover their mine (political, legal, negotiated and even violent), but they all failed. The situation worsened, there were violent confrontations and people were injured, a district attorney was kidnapped and, ultimately, the state was unable to enforce the legislation. The mining cooperative lost a lot of money and finally two years later they ceded 50 per cent of their operation to a joint operating agreement with the community. Instead of 30 members, there were now 130 members working in the mine. Organizational problems soon arose and the operation had to stop several times. Problems persisted and the cooperative never recovered. By 2001, most of the former cooperative members had quit and now the mine is run by a few community members who lack technical knowledge and mining experience.

The MEDMIN programme learned their lesson. Now they always carry out a rapid social assessment which covers both the mine and the nearby communities. It is not enough to have the mine legalized, one must also ensure community consultation, participation and involvement – even in the context of a small mine.

- Placing people first through both pro-poor strategies and participatory strategies aimed at strengthening the organizational capability of grassroots communities, thereby favouring a bottom-up approach.
- Reversing the focus from 'hands-on state intervention' (which has rarely been successful) to the creation of private enterprises, particularly micro-enterprises or cooperatives.

Micro-economic effects, local commerce and workforce 5.1

With few exceptions, small-scale mining communities are located in remote rural areas. In these areas, mining frequently constitutes the principal means for development by creating opportunities for micro-, small- and medium-scale enterprises, as well as providing infrastructure for the miners and their families.

Where revenues are re-invested in the region, small-scale mining can have a domino effect on the local economy. Small-scale mining can make a substantial contribution to economic and social development, particularly at the local level. Small-scale mining can generate significant local purchasing power and lead to more demand for locally produced goods and services (food, tools, equipment, housing, infrastructure). Nevertheless, apart from the locally generated demand, appropriate framework conditions are necessary to exploit this potential fully.

Even in the case of illegal artisanal mining and smuggling, income usually returns to the mining region in the form of cash or goods.

On the other hand, effects on local communities may not always be positive. Discoveries of deposits and the arrival of too many new miners can cause major disturbance in rural areas. Examples include conflict between miners (*garimpos*), settlers and local tribes in Brazil. As real or imaginary income opportunities in small-scale mining (especially gold mining) are more attractive than traditional activities like agriculture, the discovery of a nearby deposit may trigger the desertion of farmland. Imbalances may result when the mineral commodity (such as gold) becomes a parallel local currency.

The experience of the Sadiola Gold-mining Project in Mali (see Box 2) demonstrates that the artisanal mining sector needs to be approached in a holistic manner that takes into account all local socio-economic systems. This allows it to become a positive instrument for development in the fight against poverty. The artisanal mining sector can serve as an economic cornerstone for stimulating the development of complementary, sustainable, revenue-generating activities. New money generated by the mining communities can allow the emergence of small businesses which are well integrated into local economic structures and contribute significantly to the sustainable development of the region.

5.1.1 Public health care in mining communities

Sanitation and public health-care in or near small-scale mining communities tend to be extremely deficient. This is generally due to the supposedly 'temporary' status of these communities. In many cases, the discovery of a deposit results in a sudden arrival of miners from other regions in search of new opportunities. Unorganized camps grow virtually overnight. These remotely located camps, because of their temporary status, do not usually qualify for public health-care facilities — especially from the viewpoint of public health officers with chronically low government health-care budgets. Associated problems like crime, prostitution and sexually transmitted diseases quickly follow.

Nevertheless, many of these 'boomtowns' may sooner or later mutate into more

BOX 2 Case study: Diversification of the local economy, the Sadiola Gold-Mining Project, Mali

When large-scale mining operations by the Anglo Gold Mining Company began in the traditional artisanal gold-mining area of Sadiola, a resurgence of artisanal activities accompanied them. However, the Anglo Gold Mining Company resettlement into the villages of Sadiola and Farabakouta led to the loss of artisanal gold-mining sites for the local communities. To lessen the impact of this, the mining company introduced the Sadiola Gold-Mining Project aimed at promoting artisanal mining and diversifying local economic activities through the development of sustainable revenue-generating activities. The project affects a gold-mining population of approximately 500 people in the villages of Sadiola, Farabakouta, Medina and Neteko.

The Sadiola Gold-Mining Project was implemented in several stages. The preparatory stage included a two-pronged approach, one aimed at assisting artisanal mining and one aimed at diversifying the local economy. These included:

- Public consultation with traditional groups to identify, survey and record target groups.
- Identification of revenue-generating activities.
- Working with local NGOs in order to identify potential partners.
- Creation of the Sadiola Mining Cooperative.
- Geological studies (reserves of 1.5 tons with a grade 0.93g/ton and 1.86g/m^3).
- Identification and testing of mining equipment.
- Elaboration and adoption of a programme of operational activities.

The operational stage of the project comprised technical assistance to the gold-miners. Economic diversification was mainly achieved through socio-economic group capacity building. This included:

- Assistance in the creation and organization of a communal development fund with a monthly budget of approximately US$60,000.
- Reinvestment of profits.
- Establishment of women's activities such as market gardening, and the making of dyes and soaps.
- Improvement of mined sites through fruit tree planting and conversion into ponds for fish breeding.
- Organization and management of grain banks and communal stores.
- Financial support for small projects such as bakeries, restaurants, woodwork shops, jewellers and metalwork shops.
- Support for the construction and organization of a communal market.
- Construction and organization of a rural school and adult learning centre.
- Support for construction and running of a communal health centre.

In terms of artisanal mining activity, positive changes generated by the project include organizational and management capacity building for efficient resource extraction. In terms of community development: revenue-generating activities that complement artisanal mining were developed, local entrepreneurship was stimulated, purchasing power in local communities was improved and a decrease in subsistence-related activities was noted.

permanent communities. Unfortunately, it may take decades before these communities are recognized as villages and qualify for public-health facilities or sanitation programmes, with obvious health consequences. Malaria, cholera, tuberculosis, bilharzia and enteric infections are common.

The absence of urban planning also provokes the chaotic intergrowth of working and living areas. Houses are frequently built on top of the mine entrance, in order to 'protect' the property. Grocery stores sell mining chemicals and restaurants offer 'complementary services' like burning and buying amalgam. This may lead to unexpected phenomena, like in some Peruvian mining villages, where mercury poisoning among women and children is higher than among miners, as the miners spend eight hours daily in the only 'non-contaminated' environment, which is the mine.

Special attention should be given to the AIDS pandemic, especially in Southern African ASM communities.

5.1.2 Gender

In contrast to large-scale mining, the involvement of women in small-scale mining activities is generally high (see Table 3). In Guinea, women comprise 75 per cent of those involved in the sector while in Madagascar, Mali and Zimbabwe the figure is 50 per cent, and in Bolivia 40 per cent. In the Gaoua region of Burkina Faso the exploitation and selling of gold has traditionally been a female-only activity.

Generally, the handling of mechanized equipment and machines is reserved for men. Women's participation in ASM involves not only the mining itself, but also the supply of food, drink, tools and equipment, as well as sexual services. Women also trade minerals such as gold and gemstones.

The participation of women can bring direct benefits through better control of family revenues and spending. Where women participate in ASM in the family context, however, it is often the male head of household who controls the mining income and women do not necessarily receive a fair share. A gender-sensitive approach seeking to empower women and increase their participation at all levels of the ASM industry is necessary. This is particularly true in so far as increasingly women are entering this sector as an alternative to subsistence agriculture, and it has been found that women are more likely to spend their incomes on family maintenance compared to men, who tend to spend more income on prostitution, gambling and alcohol. Empowering women in these communities could lead to substantial alleviation of poverty. There are some stages of the mining process, however, where women should not participate, particularly where contact with chemical substances might present a health risk to unborn or breastfed babies.

TABLE 3 Estimates of the number of women (and children) involved in the sector according to the MMSD-commissioned country studies

Country	No. of women involved	% of total
Bolivia	25,500	
Brazil		
Burkina Faso	45,000–85,000	
China		
Ecuador		
Ghana	87,000	44
Indonesia	10,900	10
Malawi	4,000	10
Mali	>100,000	50
Mozambique	18,000	30
Peru		
Philippines		
PNG	12,000	20
South Africa	500	5
Tanzania	137,500	25
Zambia	9,000	30
Zimbabwe	153,000 (women and children)	

More women are participating in artisanal mining activities for a number of reasons. The ILO describe how 'the impact of structural adjustment programmes, low commodity prices or drought on private and public sector employment, trading, farming and inflation has led many people, especially women who relied on subsistence agriculture, to seek new, alternative or additional paid employment for a better quality of life, or more usually, just to survive' (ILO, 1999).

In some countries, particularly in Africa, women own mines and processing plants. Frequently these enterprises are better organized than those run by men, although

women are not given equal opportunities regarding access to financial, technical or legal support. For example, a UNIFEM study found that only 6 per cent of women miners had been able to obtain a loan to invest in their mining operations. This was attributed to women's lack of collateral for loans and the negative attitudes of (mostly male) bankers towards women engaging in business. The fact that many women lack formal education may further stifle their ability to deal with formal lending institutions.

A number of women's mining associations have been developed which attempt to overcome the barriers to women's advancement within the industry. For example, in Southern Africa, the SADC Women in Mining Trust addresses the needs of women miners and has members in Angola, Botswana, Namibia, Congo DR, Mozambique, Swaziland, Tanzania, Zambia and Zimbabwe. The main objectives of the trust include: lobbying for support of women in mining both regionally and internationally; identifying the training and technical needs of women miners and conducting training programmes to meet those needs; training women in environmentally sound mining methods; funding revolving loans to increase women miners' access to capital; and networking and facilitating the marketing of members' products.

The mission of the Tanzanian Women Miners Association (TAWOMA) is: 'To facilitate women miners to organize and access required financial, technical and marketing services so that they can carry out mining activities that are both economically and commercially viable and environmentally sustainable and thereby raise the standard of living for women miners and their families'. As a long-term goal, TAWOMA is working towards establishing a centre for the rental of mining equipment and tools; a lapidary and jewellery production unit; and a skills training centre focusing on environmentally sustainable mining and processing methods, health and safety issues and the rehabilitation of ecologically sensitive mining areas.

5.2 Child labour

The discussion about child labour in small-scale mining started some years ago, following international press reports about the phenomenon in Colombian coalmines, which sensitized the developed world. This led to a ban on Colombian coal, especially by Germany, which also made use of this situation to protect their own highly subsidized coal-mining industry.

Since then child labour in ASM is becoming a high-priority issue. With its new convention 182 (to eliminate the worse forms of child labour — including in mining) the ILO's International Programme on the Elimination of Child Labour (IPEC) is focusing on this issue. There have been different surveys and considerable

data are available from countries like Guinea, Madagascar, Burkina Faso, Niger, Tanzania, Bolivia, Colombia, Ecuador, Peru and The Philippines. IPEC is also trying to implement its programme to prevent and progressively eliminate child labour in small-scale traditional mining in South America.

Children start washing gold from the age of three; from six they can be seen breaking rocks with hammers or washing ore. Some children as young as nine work underground, and by 12 boys are working underground in many countries and do the same work as adults. In the Cerro Rico in Potosi, Bolivia, half of the 8,000 miners are children and adolescents.

There are many consequences, including:

- The children attend school irregularly or not at all.
- Child workers have physical and psychological development problems.
- The children have health problems, for example mercury poisoning or injuries from carrying heavy loads.
- They are the victims of accidents.

The main reasons children work in mining are poverty-related and include:

- Family incomes are low in many ASM regions. Families do not have enough money for school materials, clothing and food.
- There is a lack of education infrastructure.
- Parents are not interested enough in the education of their children.
- Parents do not know about the risks to children from working in mining.
- Parents do not plan their children's future.
- Children have traditionally worked in mines.
- There is not enough legislation, enforcement or labour inspection.

IPEC's general strategies to combat child labour in small-scale mining include:

- Prevent children from working in small-scale mines.
- Remove children from working in small-scale mines.
- Improve children's working conditions as a first stage towards eliminating child labour.
- Increase knowledge about the living and working conditions of the children.

BOX 3 Case study: Experiences from Santa Filomena, Peru

Santa Filomena is an artisanal gold-mining community on the southern Peruvian coast. Five hundred families (about 1,500 people) make their living from artisanal gold mining under very poor conditions. This includes 42 per cent of the population who are children or adolescents; many of them work in mining activities.

IPEC has been funding the Peruvian NGO Cooperacción to run a programme to eliminate child labour in artisanal mining in Santa Filomena since 1998. The intervention had three different phases, 1998–9, 1999–2000 and 2000–2002, and the following strategies:

- Analyse the situation and plan participatively.
- Raise awareness, and sensitize and change cultural habits.
- Develop the technical and productive elements of the mining activities.
- Generate family income.
- Promote local public services in education and health.
- Support a process of integrated development within the local population.

The results of the first two phases have been:

- Local people have identified alternatives to child labour in mining.
- The children are no longer carrying mineral loads.
- The community has a future vision and is considering their economic and social development.

So far the main impacts of the different strategies are:

- Population analysed and focus groups created
- Occupational health situation analysed; workshop discussions held; videos and publicaitons disseminated
- A winch has been installed to transport minerals from the mine, and feasibility studies for mining and processing improvements have been carried out.
- A bakery was set up for the mothers' club, and special support programmes have been developed for economic initiatives aimed at women.
- Teaching materials have been donated to the school, and support provided for the construction of school rooms and a medical post.
- A workshop was held on strategic planning for local development and leaders chosen.

The following results were expected during the final phase:

- All children will be withdrawn from working in mines.
- Self-regulation and different forms of social control will ensure that children do not work in mines.

This is one of the most successful IPEC programmes, and one of the key success factors is that the programme approaches the whole mining community in an integrated way.

Source: Cooperacción, 2000

- Make children, parents, employers, private and public institutions, and the public more aware of the dangers.
- Improve legislation and enforcement.

There have been successful interventions, as the intervention in Santa Filomena, Peru, makes clear (see Box 3).

Contribution of ASM to sustainable development 5.2.1

While it is difficult to define sustainability for an operation that exploits a non-renewable resource, Agenda 2000 and experiences from past and ongoing small-scale mining projects can help to define the desirable conditions of a sustainable small-scale mining sector. They should include:

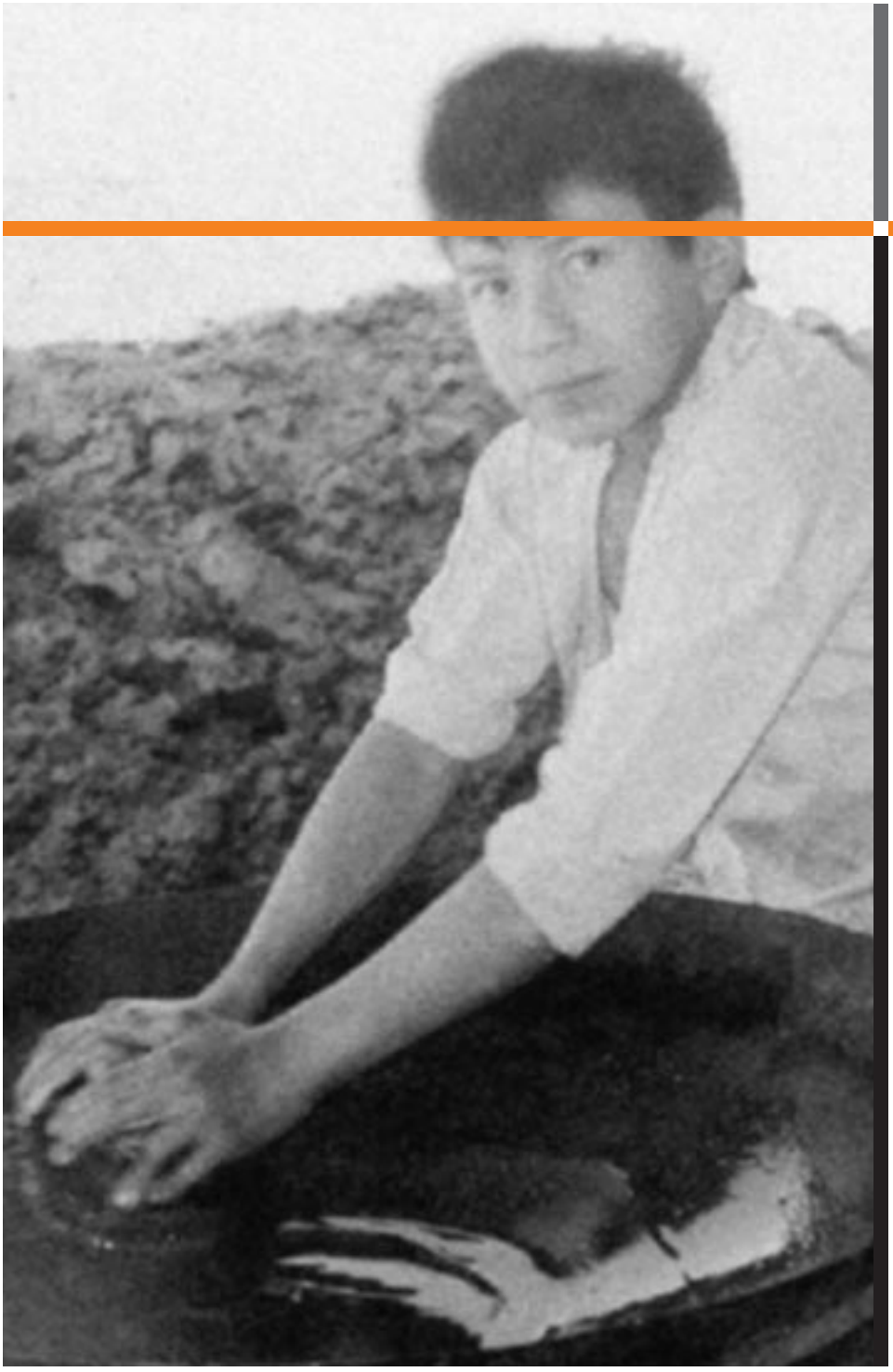
- ASM activities should make a positive contribution to rural and regional development.
- Activities should operate legally in harmony with national mining sector development policies and existing legal frameworks.
- Operations should comply with international social standards, such as social security, occupational health and safety, labour regulations (including ILO conventions about child labour), access to social infrastructure (schooling, medical, etc.) and an acceptable level of income.
- Operations should be environmentally sound.
- There should be no conflict between small miners and local communities and no degradation of traditional values.
- There should be harmony between small and large mining operations.
- Exploitation should concentrate on products with high recovery values and systematically develop these deposits.
- There should be continuous operation over a longer period of time.

Given the great importance of the workforce of ASM in the rural context, the potential for a beneficial contribution of ASM to sustainable development is very high.

TABLE 4 Main factors needed at different levels for ASM to contribute to sustainable development

Level	Economic aspects	Social aspects
Macro-level (state)	State receives a realistic amount of taxes and royalties	Fair distribution of the micro- and macro-economic mining benefits
Meso-level, community	Existing supply of services important for enterprises	Participation of the population in mining activities and consideration of local interests during the planning phase
Micro-level, enterprise	Entrepreneurial competence and management knowledge Knowledge of the situation of the reserves, which serves as a sound planning basis Capitalization of the enterprise Economic operation without free financial support or subsidies through third parties Long-term and continuous mining activities	Qualified and motivated manpower Existence of an in-company programme for training and upgrading High degree of occupational safety Social protection for the miners Inclusion of mining in the effective national judicial system

	Factors important for environment	Political aspects
	Minimize or eliminate potential conflict in competition for the exploitation of respective resources (water, surface of the ground, ground, air, minerals, etc.)	Existence and realization of a liberal mining and economic policy Existence of a transparent, consistent and fair judicial system (commercial law, tax law, mining law, environmental law) Existence of a positive investment climate (stability, orientation towards a free enterprise system, legal security, free access to the market for products, capital investment goods, capital, etc.) Participation of the mining sector in the planning of rural development
	Existing supply of services important for environment	Fluent dialogue between the enterprise and government Existence of instruments and institutions to realize the political guidelines
	Reasonable and careful use of non-renewable mineral resources (if possible, total exploitation of the deposit with a high degree of recovery; extraction of secondary products; avoidance of uncontrolled exploitation, etc.) Extraction and processing with minimal environmental cost	Existence of a sound planning basis for the use of the mineral, financial, material and human resources Existence of mine closure plans



6 Key Issues

Policy 6.1

In order to create straightforward, steady and sustainable development in the small-scale mining sector in a way that contributes to rural development and is integrated into the formal economy, governments need to develop a consistent policy for the sector.

This policy should be based on four strategic pillars: poverty alleviation, a good business climate for the small-scale mining sector, sustainability, and stabilization of government revenues from the sector.

The following tools will help governments to meet these objectives:

- Demand-oriented extension services (legal, organizational, economic and technical) for the sector.
- An incentive scheme for legal ASM operations (including tax aids for young businesses, exemptions from import duties, access to finance, free markets, and improved export facilities).
- The integration of all relevant government institutions into the sector policy implementation (finance ministry, mining ministry, social issue authorities, provincial and local administration).
- A transparent and appropriate legal framework.
- Strict control of compliance with the legal framework and sanctions against infractions.
- Support for the private sector.

FIGURE 4 **The four main strategic pillars of good governmental policy.**

Figure 4 summarizes the most important policy issues for promoting legal ASM activities.

6.2 Legal and administrative issues

Legalization should help ensure that the negative social and environmental effects of the sector are better managed and will enable governments to capture more revenue from the sector. In Tanzania, for example, the implementation of a mineral trade liberalization policy in the late 1980s created a more formalized ASM sector. This increased legally traded gold production from US$0.55m in 1985 to US$38.78m in 1992.

There are a number of reasons why artisanal and small-scale miners continue to operate within the informal sector. They may not know about the legal requirements, and this may be made worse by the demanding bureaucratic procedures often required to become and remain a formal operation. Where communities have traditionally operated outside the formal sector, they may also be reluctant to be legalized, particularly where there are no obvious incentives to do so and where legalization involves paying taxes that they would otherwise not pay. A lack of capacity on the part of governments to either enforce penalties or provide the benefits that should be associated with legalization are further disincentives to miners.

Governments often lack the political will to legalize the sector, especially where rights to land are not recognized. In countries with value-added tax (VAT), it may actually suit the government to maintain the informal status of miners since they pay VAT on purchases but do not benefit from VAT credits. If smuggling is not an issue and the product ends up in the official domestic market, the final product is again liable for VAT. The double payment of VAT at both the producer and the consumer ends generates double the income for the government.

In certain cases, the lack of political will to create an adequate enabling framework for legalization can be explained by personal interests related to corruption, money-laundering, and similar illegal practices. The government may also try to attract international mining companies to invest in the country and a strong ASM sector may be seen as a disincentive.

Once the sector is acknowledged, governments need to develop a consistent and holistic sector policy. In most countries where artisanal and small-scale mining takes place, there is no policy addressing the needs of the sector. There are some

BOX 4 Case study: Shutting down coal mines in China

In June 2001 the central government issued a state council order to shut down all small coal mines in China with immediate effect. At least one and a half million (but probably closer to two and a half or three million) coal miners are employed in these mines.

Official statistics on small coal mines estimate that there are more than 6,000 deaths in coal mines every year. Unofficially, there are probably hundreds if not thousands more unreported deaths. Although environmental impact and the poor health and safety record of the coal mines are the official reason for the state order to close the mines, the government has a vested interest in stopping the oversupply of coal from artisanal coal mines as this undercut the profitability of the larger state coal mines.

Putting this many miners out of work will have massive socio-economic ramifications in areas dependent on coal mining. Many remote areas of China have thousands of previously legitimate coal-mining enterprises which became illegal almost overnight. There have been numerous government attempts to shut down small coal mines in the central Chinese Hunan province. It has been reported that some mines have been closed down as many as 20 times.

exceptions to this, for example in Peru, Colombia, Tanzania, and South Africa, where recent reforms in national policy have led to the recognition of the sector and to attempts to provide an enabling framework.

The main tasks for governments in the ASM sector are to:

- manage the exploitation of the national mineral resources in a socially acceptable, environmentally sound and sustainable manner;
- promote investment in the sector;
- license mining titles; and
- promote legalization and normalization of the ASM operations.

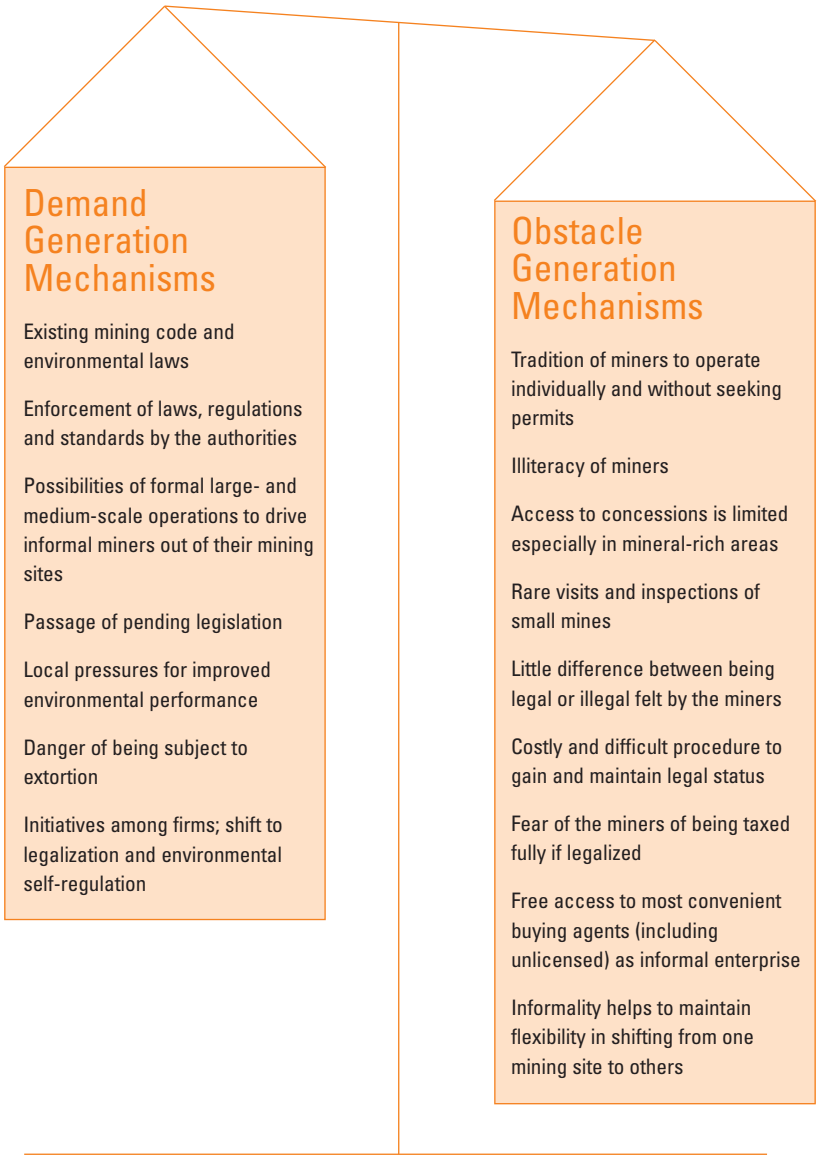
The main tools that governments can use in this regard are mining laws, the concession system, and the supervision of the compliance with the laws, together with national or international technical standards and procedures.

Regarding legal and administrative issues, governments are advised to create objective, consistent, transparent and non-discriminatory regulatory mechanisms which offer easy access to mining titles and legal production. This includes good governance by an administrative procedure that has transparent, clear and fixed rules. The government's role in the ASM sector should be limited to normative and control issues.

Operative activities should be outsourced to the private or NGO sector.

In order to strengthen the development of the sector governments should introduce and expand competition at all levels (service delivery, commercialization, etc.)

FIGURE 5 The legal balance



The decentralization of the mining sector administration as a tool to guarantee proximity services is highly recommended. In order to integrate ASM sector development further into rural development and avoid conflicts of interests, the mining authorities are advised to coordinate activities with the local administrations and communities.

A very important additional issue is the development of instruments and administrative responses to rush developments in the ASM sector. Examples like Serra Pelada (gold) in Brazil, Mt Kare (gold) in Papua New Guinea, Ilakaka (sapphires) in Madagascar or Nambija (gold) in Ecuador, where in a couple of weeks hundreds or even thousands of people migrated there is search of recent new mineral finds, underline the need for appropriate intervention from government.

Currently most governments lack these tools and so experiment, with varied success. The instruments that have been tried include: creation of small-scale miner reserves; creation of special economic zones; containment of the entire area; and creation of central commercialization facilities supervised by the mining authority.

6.3 Organizational

On the government side there is a differentiated organizational structure comprising ministries, national mining authorities and regional directions. In the private sector, ASM normally lacks a structured organization. Governments therefore do not have an adequate counterpart to work with.

A chamber of commerce and industry or chamber of mines should be encouraged and nurtured to ensure that the ASM sector is adequately represented.

The primary tasks of such a chamber should be to:

- Serve as a source of information and aid on all important issues related to: legal, fiscal, institutional and administrative framework of the sector; access to foreign markets; and activities within the sector (comprising not only extraction but also transforming, marketing and exporting the products).
- Serve as an agent to provide access to training and further qualifications for members (in the long term training centres could be established).
- Lobby government for the needs of the sector and defend the interests of the members, i.e. propose changes to the legal framework in order to deregulate the markets, facilitate exports, etc.

BOX 5 Case study: Shamva Mining Centre

The Shamva Mining Centre (SMC) was established in 1989 as an initiative of the Ministry of Mines, the NGO ITDG, the Small-Scale Miners Association of Zimbabwe (SSMAZ), and other donors. The objectives of the project were to:

- Provide a commercially viable and sustainable custom-milling facility for small-scale gold miners in the Shamva area to improve incomes of miners.
- Create jobs.
- Train miners in health, safety and sustainable mining methods.
- Share and disseminate lessons and experiences on the project locally and internationally.

At its inception, the centre was expected to serve about 43 miners within a 50km radius of the centre. By 1995, however, the services provided at the centre had proved so effective and popular that more than 150 miners were using it. The cetnre's catchment area extended to a radius of 200km.

Training was provided (and continues to be provided) to small-scale miners to improve their skills in mining methods, geology, mine pegging, environmental management, health and safety, business planning and management.

The SMC project was successful because it addressed a real need of small-scale miners by improving access to processing technology. Custom-milling services provided at the centre made a difference to the livelihoods of small-scale miners by increasing their incomes. In some cases, miner's incomes increased by as much as 30 per cent.

There is a ready market for gold, the mineral processed at the centre. The fees paid by miners to have their ore processed are directly related to the final price at which their gold is bought by the reserve bank. Fees are therefore set at a rate that is affordable to miners while at the same time competitive enough to allow the centre a profit. The project was a collaborative initiative from all key stakeholders — small-scale miners, government, ITDG, and donors. The government gave its full support to the project because it offered a real solution to the needs of small-scale miners and increased gold deliveries to the reserve bank.

The problems encountered by SMC reveal the difficulties involved in balancing commercial and development objectives. By the early 1990s, it became evident that the capacity of the ball mill installed at the centre was inadequate to meet the growing needs of miners. The mill had a processing capacity of only one tonne of ore per hour, so miners had to wait between three and six weeks to have their ore processed.

In an attempt to address this problem, the SSMAZ executive committee decided that a miner would have to bring in at least ten tonnes before the ore could be processed. Those bringing less would have their ore milled during slack periods. This arrangement then effectively excluded the very small-scale miners from benefiting from the facility.

Some of the centre's biggest problems were a result of poor business decisions made by the SSMAZ executive committee concerning the operations of the centre. In January 1999, the committee decided that it had built sufficient capacity to run the centre without external assistance. No experienced and competent manager was appointed to take over from the ITDG manager. By June 1999, the centre had run into serious cash flow problems. In January 2001 the committee decided to lease the centre to a local miner in Shamva. The centre is operating well below capacity and milling services provided are far less efficient than was the case prior to the takeover of the centre by SSMAZ. .../

BOX 5 Case study: Shamva Mining Centre (continued)

Lessons learnt:

- Development agencies need to rethink whether it is always necessary to hand over commercial projects to producers' associations. Clearly, SMC's performance has suffered since the take over by the SSMAZ. Producers may well be better off leaving the management of commercial projects to qualified managers while they enjoy an efficient and competitively priced service. Great care has to be taken in working with associations to ensure that a few powerful people in the association do not monopolize the benefits for their own gain.
- Technology unlocks the potential of small-scale miners to run viable mines. Access to processing facilities at SMC enabled miners to increase productivity and improve the viability of their mines until management problems emerged in January 1999.
- Small-scale miners, like any other entrepreneurs, require a complete package of business development services to thrive and grow. In addition to technology, they require skills in business planning and management, mining methods, sustainable environmental management, access to credit, and profitable markets.

Source: Drechsler, 2001

- Help informal groups of miners to become formalized and help the formal businesses to compete with the informal and to control more effectively informal activities in the sector.
- Act as a promotional agent for the sector to improve or build a good image.

For an investor, client or other representative of the private sector, the chamber should serve as a first port of call for all sector-related members and activities.

For the government, such a chamber should act as a link to the private sector, channelling access to the diverse enterprises. The chamber should also be a competent partner for the government in sector-related issues.

At the level of mining exploitation, the support to the formation of groups of miners, whether in cooperatives, associations or enterprises should be a major focus of the mining policy. These groups will, at a later stage, serve as an important channel of communication to individual miners.

While international experience shows that major socio-cultural factors inhibit the development of efficient cooperatives for mining, in the fields of financing, marketing, pooling equipment or collection of by-products, there are many encouraging examples of cooperatives and associations from the small-scale mining sector.

TABLE 4 Examples of adding value to ASM products

ASM product	Possible transformation in country
Gold	Jewellery, coins, medals
Gemstones	Cutting and polishing, jewellery
Coal	Coke
Dimensional stones	Tiles and slab production
Non-metallic minerals	Ceramics, paint, concrete blocks, etc.

Finally, local administrations should be encouraged to establish both formal and informal structures to support communication, cooperation and coordination aiming at a more effective and efficient, harmonized management of local resources.

Manufacture of added-value products 6.4

The local and regional market for ASM minerals can be created and/or strengthened by encouraging the manufacture of added value products (see Table 5).

In many countries, the mining laws or other legal instruments do not support the development of small industries based on local mining products. This is especially true of the products from informal ASM, which are often difficult to integrate into the formal economy.

BOX 6 Case study: Bolivian gold mining and jewellery manufacture

In Bolivia there are many informal and semi-formal miners exploiting gold ores. While most of the miners operate on legally granted concessions, most of the production is neither declared nor paid for (royalties and taxes, including VAT). The country has also long had a notable jewellery industry. Because of the difficulties of getting a reliable supply of raw materials from the informal producers, most of the jewellers had to import their gold. But the time-consuming and expensive procedures involved in import and tax reimbursement (VAT) also forced many jewellers into the informal sector or to close down their operations. With the objective of restrengthening the competitiveness of the Bolivian jewellery industry on the export market the Bolivian government has put in place a system of 'self-declaration' for gold bought from the informal market. Currently the jeweller is taxed normally and, as the exported jewellery is exempted from VAT, the government simply accepts the local market value (which is equivalent to the international market value) of the gold from the informal market as a deductible cost. This way the government strengthened both the creation of added value in the country and the competitiveness of the Bolivian industry on the international market, as well as helped to formalize at least a part of the production chain.

This activity should focus on the creation of complementary activities by 'matchmaking' with other groups, and not, as frequently proposed, as an additional activity of the miners themselves. Experience shows that most experiments which set out to teach miners to manufacture jewellery have failed.

By developing strategies for including informal ASM products into the formal market, governments may help reduce the 'black market' for ASM products. A case study from the Bolivian jewellery industry may serve as a model for this (see Box 6). Similar approaches may be applicable in other developing countries.

Governments can also stimulate this transformation directly by investing in promotion, personnel training, and improving taxation and fiscal incentives for new enterprises. This will help to secure a growing added value which is generated in the country.

6.5 Environment

The environmental costs of ASM are in general higher than those of other types of mining. This means that ASM is dirtier per unit of output than medium-sized or large and modern mining operations. Another problem of ASM is the great individual number of polluters, normally concentrated in a specific area, which causes significant local impacts. It is very difficult to control or monitor environmental violations or enforce regulations because of the lack of resources and the inaccessible nature of most operations.

ASM harms the physical and social environment during the different stages of mining (exploration, exploitation, processing and closure). The most important environmental problems are:

- mercury pollution;
- cyanide pollution;
- direct dumping of tailings and effluents into rivers;
- improperly constructed tailings dams;
- acid rock drainage;
- improper closure;
- river damage in alluvial areas;
- river siltation;

- erosion damage and deforestation;
- landscape destruction;
- garbage and solid waste;
- tropical diseases (malaria);
- induction of subsequent colonization;
- cultural damage due to invasion of sensitive tribal land; and
- uncontrolled ASM activities in protected areas.

There are many causes for the severe environmental impacts that result from ASM, the most relevant being:

- lack of knowledge, education and training (technical and environmental);
- inefficient technology and limited techniques;
- inefficient administrative management;
- errors in human control;
- economic limitations;
- lack of access to better techniques;
- lack of information about good practice;
- lack of control and enforcement; and
- inadequate environmental legislation.

Given the many reasons, it seems clear that only win–win solutions or at least 'win–do not lose' are likely to succeed. As ASM is very heterogeneous, there are many ways to intervene effectively. These should focus on incentives and training, rather than on traditional monitoring and enforcement systems. Benefits need to be demonstrated and standards must not be unrealistic. If possible, activities should be undertaken with larger mines (such as the use of tailings processing facilities).

Environmental problems cannot be solved by technically oriented approaches alone. The implementation of effective technical 'solutions' also requires detailed knowledge of the cultural, social, economic and organizational context of the miners. Environmental problems require technical solutions that are culturally relevant, and an integrated approach is needed if changes are to be successful. The use of the simple double-tin retort in Papua New Guinea illustrates such an approach (see Box 7).

BOX 7 Case study: The Tin-Fish-Tin Retort in PNG

Sporadic gold mining in the Milne Bay province of Papua New Guinea dates back to 1896. A common feature of all the areas in Milne Bay is that customary patterns of land tenure are officially recognized, which means that people actually mine their own land.

On Misima Island in the Milne Bay province a large gold mine has been operating since 1989. Plans drawn up to assist the community after mine closure include agricultural income-generating activities, but as there is little agricultural land and the area is far from potential markets this is not a viable solution. Small-scale mining, on the other hand, has the potential to extend benefits across the community beyond the scope of traditional landowners.

An outreach programme was initiated in 2001 with the PNG Department of Mining and AUSAid to help develop the existing economic infrastructure and support alluvial gold miners on Misima Island. Efforts were made to improve methods of gold recovery and address environmental and health issues. A series of workshops were held to explain the dangers of mercury and teach various safer methods of burning amalgam. Manufactured retort are too expensive for most miners. But a simple retort can be made from fish tins, and since tinned fish is consumed in vast quantities in PNG, used tins are readily available.

People were also taught how to recycle mercury, save money and reduce the health risks associated with using mercury. Until then, people burned amalgam cakes in their huts or on the blades of knives that were subsequently used to prepare food, and sometimes sat downwind in smoke fumes. The issue of environmental degradation arising from these practices was also widely communicated, and people were made aware of how this could affect their ability to garden and feed themselves and future generations.

A number of lessons have been learnt as a result of the many assistance programmes for environmental protection in ASM in the recent past. The Bolivian MEDMIN programme demonstrates that the environment can be protected better, even under harsh conditions. Box 8 summarizes the main 'lessons learnt'.

6.5.1 Occupational health and safety

Occupational health and personal safety issues are frequently on the agenda when artisanal or small-scale mining is discussed. However, reliable data or official statistics about accidents or occupational diseases are generally unavailable.

According to the ILO there are five major health risks in small-scale mining and processing (Jennings, 1999). These are:

- exposure to dust (silicosis);
- exposure to mercury and other chemicals;
- effects of noise and vibration;
- effects of poor ventilation (heat, humidity, lack of oxygen); and
- effects of over-exertion, inadequate work space and inappropriate equipment.

The five most frequently cited causes of accidents in small-scale mines were: rock falls, subsidence; lack of ventilation; misuse of explosives; lack of knowledge, lack of training, violation of regulations; and obsolete and poorly maintained equipment (Jennings, 1999).

Inappropriate working conditions (either lack of safety equipment or unsafe working practices) suggest that accidents in small-scale mining should be significantly more likely than in formal medium- or large-scale mines. In reality this is not always the case (especially in non-coal small-scale mining). The nature of small-scale mining (self-employment, low mechanization, low productivity) means that some accident-related risks may have a lower incidence than in formal medium- or large-scale mines. In small-scale coal mining, however, accidents (methane and coal-dust explosions) are significantly worse.

For self-employed artisanal miners, the use of safety equipment depends almost exclusively on their own conscience. Artisanal mineworkers employed by small-scale mining concession holders usually use their own safety equipment (if they use any). Even basic safety equipment like helmet, safety boots, gloves and dust masks represent significant investment for most miners. And as this does not contribute directly to their daily income, it has low priority for small-scale miners.

The causes of occupational health and safety deficiencies in small-scale mining can be summarized as:

- Most small-scale mines are working under marginal economic conditions, providing no more than a daily living for their owners or workers. As even basic safety measures have some cost (in cash or kind), a small-scale miner is unlikely to spend money in a way that does not generate income.
- Safety regulations for medium- or large-scale mining are not generally appropriate for small-scale mines without adaptation. Exaggerated safety requirements tend to discourage miners, leading them to simply ignore all safety advices as 'utopian'.
- Enforcement of mine safety requirements is frequently used by authorities as a device to identify guilty parties of accidents and to apply corresponding sanctions. Fear of sanctions is the main cause of the under-reporting of accidents or diseases, and is an obstacle to improvements.
- There is a lack of awareness of risks, especially risks of chronic occupational disease (dust, vibrations, nitrous gases, mercury, cyanide, etc.). This often stems from inadequately implemented education and training. Education and training programmes need to be designed according to the social, cultural and ethnic characteristics of the miners' communities.

BOX 8 Case study: Lessons learnt from the MEDMIN programme

- It is necessary to work in an integrated way, considering the organizational, social, economic, legal, technical and environmental issues.
- It is essential to guarantee social, economic and environmental benefits for the miners; these 'win–win options' are the basic conditions to ensure success.
- It is imperative to demonstrate to the miners that environmental or health protection measures can produce more benefits than costs.
- Health and/or safety are important issues for the miners and should be on the agenda of any project concerning small-scale miners.
- It is necessary to ensure that the miners participate in developing plans, including in decision-making.
- Prior to any technical implementation it is crucial to create an atmosphere of friendship and trust with the miners, initiating campaigns of sensitization, information, education and awareness raising by means of audio-visuals, posters, informative pamphlets, seminars, workshops, and by taking into account the issues of interest to the miners.
- Government collaboration can be helpful, but is no guarantee for success; at times it can even be counterproductive (poor image, lack of control and/or application of the law, corruption, lack of acceptance on the part of the beneficiaries).
- As the environment issue is controversial among those involved, one should always try to find better ways to come to an understanding and negotiate to attain favourable solutions.
- Get the population affected by mining pollution to work together with the miners.
- It is essential to develop integrated technical and environmental plans; simply introducing isolated equipment (retorts, centrifuges, etc.) will not bring about the desired results.
- Ensure that new equipment works properly before introducing it. Equipment failure could easily wipe out the trust that has taken a long time to build.
- It is preferable to adapt and optimize existing simple technology before introducing new and more sophisticated equipment. Equipment produced locally at low cost and with reasonable efficiency has the best chance of being implemented. Instead of searching for sophisticated technology, it makes more sense to use technology that will be accepted.
- Due to the specific characteristics of each mining operation (type of deposit, mineralization, size, hydrography, socio-economic/cultural characteristics) a general technical solution is normally inappropriate. Individual solutions always have to be adapted and tailor made.
- When making technical changes it is imperative to carry out on-site tasks using well-trained technicians, mechanics and engineers.
- Implementing technical changes will require prolonged and intensive supervision and monitoring to ensure long-lasting usage.
- Technical changes can be disseminated widely most effectively by replicating successful pilot operations.
- Miners must pay for their project: 'It cost me, I use it and I take care of it.'

- Introducing fast-track mechanization without implementing complementary safety measures. While purely manual operations have relatively low safety and health risks, mechanized working requires the correct application of technology. Risks increase dramatically with activities such as blasting, pneumatic drilling, electrification in coal mines, or mechanical transport to access deeper stopes.

Education, training, demonstration and surveillance are the key elements of any programme to improve occupational safety and health in small-scale mining. Both mineworkers and owners or concession-holders must be helped to realize that accident prevention and improved occupational health are valuable goals. In the short term, safety and health has a cost; in the mid to long term it generates revenue.

Technical 6.6

Technical issues play a major role in ASM and SSM. In the past, however, this has led to a series of misunderstandings.

Most ASM problems are related to technical issues, and many of the problems can only be resolved by appropriate technical solutions. An obvious example is the frequently mentioned mercury emissions from artisanal gold mining, which require end-of-pipe technology (retorts, filters, traps) or modifications of mineral-processing circuits. The misleading conclusion, which is frequently drawn from this apparent cause-and-effect relationship, is that technique-related ASM problems can be solved by a technique-oriented approach.

Implementing technical change, modification and improvement once again requires detailed knowledge of the cultural, social, economic and organizational context of the miners. Technical solutions can only be introduced by changing some of the conditions, hence an interdisciplinary approach is crucial. This finding can be summarized as 'technical problems require technical solutions, but an integral approach for implementation'.

A futher misunderstanding originates from one of the usual definitions of ASM, as 'mining activity realized manually or with low mechanization and simple machinery'. A general concept among decision-makers unfamiliar with ASM is that 'improving simple techniques is simple'. This is definitely not the case. Whilst we do not face major technical limits in designing next-generation spacecrafts (assuming sufficient funding), we may face serious problems trying to design an

alternative to simple stone and mortar amalgamation mills, which can be easily built by artisanal miners with very little money.

While 'brain trusts' of engineers design mining machinery for industrialized small-, medium- and large-scale mining, artisanal miners do not constitute an attractive target group for whom to develop specific mining equipment. Conventional mining equipment is therefore frequently modified by the miners to fit their needs, sometimes suppressing security features (like water supply for drill hammers). Nevertheless a surprising variety of technical solutions for ASM are available. These are often developed locally over long periods of ASM activity. These techniques may only be known locally, with no diffusion into other mining regions.

Although universities with faculties of geology, mining or metallurgy are relatively common in the developing world, in most cases their curriculum is only marginally related to ASM – if at all. ('Any metallurgical engineer in South America knows how to design a 10m autogenous mill, but it is hard to find anyone who knows how to use a gold pan' (Wotruba, 2001).)

Local techniques have frequently undergone evolutionary optimization processes over decades of use. Thus, improving existing techniques is not always as easy as an engineer might expect. The recovery rates of artisanal miners are often underestimated. Artisanal miners, underreporting their production, usually back this point of view (in fact some miners with only rudimentary equipment may be able to achieve recovery rates of up to 95 per cent).

6.7 Types of mining operations

ASM operations can be subdivided according to type of deposit in the same way as conventional mining:

- underground mining (hardrock and coal);
- open-pit mining (hardrock and coal); and
- placer mining.

Type of mineral resource:

- base metals and poly-metallic;
- precious metals;

- coal;
- non-metallics, industrial minerals and construction material; and
- gemstones.

Steps in process:

- prospecting;
- exploration and exploitation (in ASM these activities are not usually separated); and
- mineral processing.

Although this subdivision is not new, it is worth pointing out as ASM is often assumed to be a synonym for artisanal gold mining. Individual technical information for each sub-sector is too detailed to be discussed individually in this report.

Guidelines for technical solutions 6.8

Cheap and simple techniques, even if not completely, have a higher potential for dissemination than technically optimized but more sophisticated processes. Technical and environmental innovations, even if they are not literally 'innovations' but results of technology transfer from other ASM regions and/or adaptations to local conditions, should be developed and tested in a participative way which involves artisanal miners. It is usually preferable to improve or optimize existing technologies rather than introducing new processes, although this is not always possible.

Any measure successfully implemented, no matter how insignificant it may appear, will create confidence among the miners and open the doors for further changes. Any failure will be eternally remembered by the miners, reinforcing their view that 'engineers do not understand'.

Technical solutions have to be compatible with the economic potential of the target group. Solutions have to be replicable without external aid. Measures always need to be accompanied by education and training for the target groups.

Special attention should be given to understanding the socio-cultural and socio-economic structures and the organizational context of different local stakeholders such as miners, concession holders, landowners, processing plants, mineral traders

and supply shops as well as the religion and customs of the different groups involved. Generally, these factors are much more difficult to change than technical processes. Integrated solutions, which take into account issues such as environmental protection, production, health, and energy should be considered.

Proposals to improve artisanal mining techniques require time to be widely accepted. It is not uncommon to find exact working replicas of technology from the 16th or 17th century in ASM regions. Trying to implement state-of-the-art technology may be akin to taking a journey in a time machine, jumping across several centuries in a few years. ASM projects that require cultural adaptation are often problematic.

Projects should aim beyond the pilot scale towards larger scale 'diffusion' of technology. Externally financed pilot projects are almost always technically 'successful'. However, this success gives no guarantee of diffusion and replication by artisanal miners.

New or modified techniques will only be taken up if they are accepted by the artisanal miners as 'their own' solution. As soon as miners start to make 'unauthorized copies' of the new solutions, diffusion has occurred.

6.9 Finance and credit

Most small enterprises would like to upgrade production capacity and/or develop new reserves. This requires investment capital. Generally, the ASM sector needs better access to financing. However, in practice, access to credit and formal banking is difficult for ASM miners, and they face serious problems obtaining it.

Many financing institutions consider the artisinal mining sector to be too risky for them to be a part of. Financial institutions that are willing to deal with small-scale miners tend to charge high interest rates. This challenges the viability of many projects.

Ideally, the financing of ASM projects should be tailor-made for the sector, and develop creative solutions such as:

- using the miners' own capital resources;
- joint ventures;
- equity participation;
- risk capital (such as in exploration funds or mining development banks); or

- leasing of equipment.

For credit financing (occasionally considered an appropriate tool by international donors or governments for technology transfer or dissemination of innovations regarding mining and mineral-processing tools) experience from international ASM-promotion projects should be taken into account, such as:

- Finance means not only credit, but also savings. Self-financing or savings should be included in the finance programme.
- The sustainability of the financial service must be considered from the very beginning. Features of a sustainable financing programme are: the lender is independent in its loan decision and bears the full lending risk; interest rates for final borrowers must at least cover the cost of inflation, operation and loan losses; an appropriate financial system for lending to small enterprises starts with small loans, and later goes to larger loans.
- Significant outreach and/or a large number of clients, is important in achieving development impact; it also makes the programme economically viable through economies of scale.
- Potential financial intermediaries should be screened using existing donor guidelines. Measures for institution building are often required since financial institutions in ASM countries are generally unwilling to lend to any small enterprises, much less the mining sector. Funds for these measures have to be provided.
- Subsidies to ASM should not be given in the form of subsidized loans, but in training or other technical support.
- Regular control and supervision of the financial institution as well as guidance are required.

Credit schemes should not be set up for the one-off delivery of equipment, but rather focus on financing a business over a long period.

BOX 9 Case study: Negative experiences from Bolivia

In Bolivia there are two credit lines for the ASM sector: the MEDMIN Foundation and the APEMIN Project. MEDMIN has a credit fund (US$200,000) managed jointly with CEPAS (Episcopal Commission for Bolivia), which contributes 50 per cent of the credit. The beneficiaries are individuals or legal entities that CEPAS and its approval committee consider fulfils the requirements qualifying them as small miners or mining cooperatives.

A year and a half after launching, CEPAS's requirements have made access to the fund extremely difficult, especially for the mining cooperatives — or the group that most requires the credit. They were asked to provide the following documents (which they could not provide): proof of market (sales contracts for the period of the loan), mortgage guarantee (a house in one of the three principal cities), and a technical assistance contract for the project covering at least the loan repayment period. These CEPAS requirements stem from bad experience with mining credit in past years, but make it extremely difficult for small miners to get any credit.

The other institution that supports small mining is APEMIN. It is important to compare this line of credit with that of MEDMIN. (It should be pointed out that the APEMIN credits also go through the CEPAS channels.)

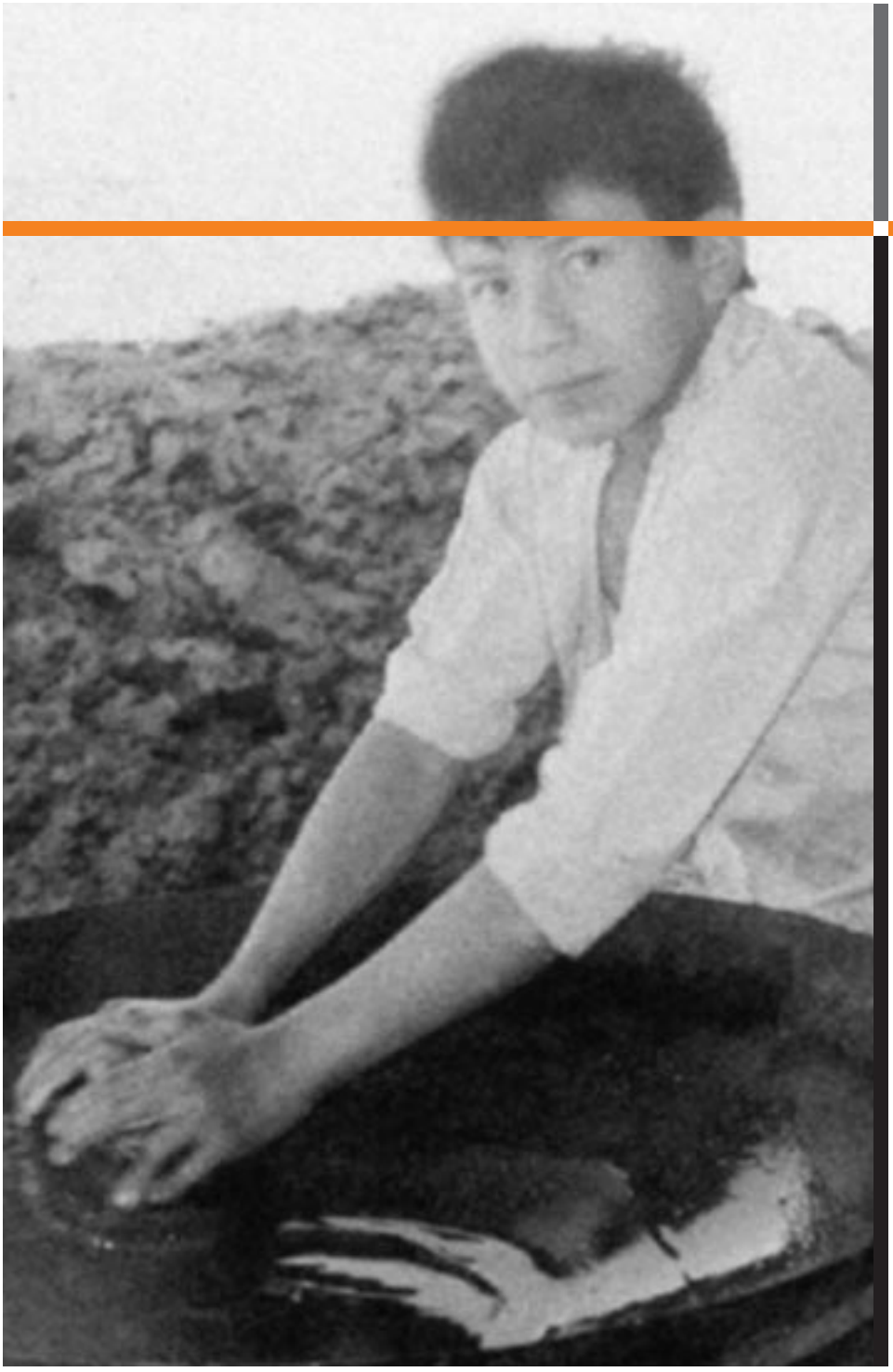
TABLE 5 An analysis of the APEMIN credits and some comparative figures*

	MEDMIN	APEMIN
Interest rate	17%	17%
Size of fund	US$200,000	US$216,000
Beneficiaries	Small mining and coops	Small mining and small borrowers for activities derived from mining
Reason for credit	Technical assistance, equipment, environment	Working capital
Applications received	34	17
Applications approved	2	14
Credits disbursed	1	13
Maximum assigned	20,000	31,500

*Note: According to CEPAS's internal report, credits from APEMIN reach the sum of US$215,982

As we can see, the credit lines are very different. Both the approved credit and grants from APEMIN-CEPAS are well above the MEDMIN-CEPAS credit limits. In the case of APEMIN credit, CEPAS only administers and request the guarantees, which are nowhere near as rigid as the MEDMIN-CEPAS requirements (where CEPAS funds are also at risk). Additionally, MEDMIN-CEPAS credits have a strong environmental component that increases the risk that funds will be diverted to other ends due to a lack of environmental conscience on the part of the miners.

A 2001 report shows conclusively that CEPAS was right in demanding so many guarantees of the mining sector. According to this report, of the 13 credit funds disbursed, only four companies and cooperatives have paid off their debts and nine of them are running up interest. But the most worrying cases are the 'uncollected's. According to CEPAS, it is difficult to predict how work will evolve with credit. Small mining has asked for the price of its products to be subsidized because it cannot honour its obligations. The 24 per cent of uncollected APEMIN credits may convert to 50 per cent or more.



7 ASM Mineral Economics

Use of mineral resources 7.1

Deposits of potential interest to small-scale artisanal miners have some common characteristics. Mineral deposits in general are characterized by three factors (two 'native' factors and one 'derived'):

- Quality (all characteristics influencing revenues)
- 'Mineability' (all characteristics influencing costs)
- Quantity (reserves/resources according to relation revenue-cost)

Generally, quality factors (grade, purity, heat value of coal) do not have a significant influence on the appropriateness of a deposit for small-scale mining. On the market side, the price depends on the quality of the commodity. This is usually the same for large or small producers. Poor quality, however, can be a limiting factor for artisanal miners, as their processing technology is usually not capable of processing low-grade ores.

'Mineability' factors, however, are crucial for determining the appropriateness of small-scale mining. In general all factors that encourage mechanization and economy of scale (uniformity of deposit, width of ore bodies, depth, overburden) tend to mitigate against small-scale mining. However, adverse conditions for medium- or large-scale mining (irregular ore bodies, steep dipping seams) create a niche for economically viable small-scale mining.

In a particular reserves-to-operating cost scenario for a commodity, the position of a deposit 'appropriate' for small-scale mining can appear in two different locations: at the high end of operation costs (industrialized mining), and at the low

BOX 10 Repetitive scavenging of artisanal small-scale mining

Mine transport is a frequent bottleneck in small-scale mines. High grading by hand selection of the mineral still in the stope is frequently done to minimize transport costs, leaving the lower grade ore as mine fill. Minefill ore may then be exploited again as a subsequent mine operator may find it economically attractive. Any mineral that provides a living will be exploited, sooner or later.

The next typical bottleneck is the processing plant. Further selection usually takes place before the mineral is fed into the plant. Lower grade mineral and mine tailings will be dumped. None of this mineral is usually wasted. These dumps are frequently re-worked again and again by women or children until nothing is left. Whatever the opinion regarding women's or children's work might be, this activity provides a living to those involved — and apparently is the only possible activity for them. At the same time total resource recovery increases.

Small-scale processing plants are usually technically basic. Recovery in a single processing step may be low. This leads to the widespread misunderstanding that artisanal small-scale miners are wasting mineral resources, recovering only perhaps 40 or 50 per cent of the value matter. This misunderstanding arises when people look only at single processing steps. In fact, usually in small-scale gold mining the first step is amalgamation. Amalgamable gold is often less than 50 per cent. But the amalgamation tailings are usually accumulated and later sold or processed in cyanidation plants. Artisanal cyanidation is inefficient and allows recovery of perhaps 70 per cent of the remaining gold. But the cyanidation tailings are also usually stored in tailings dumps for later reprocessing, when oxidization liberates the remaining gold.

The whole process cycle, from the mine to the final dump, may take months or even years. But time and money are interchangeable and artisanal miner's capital lies in time.

end (small-scale mining). The opposite would occur, when evaluating a 'large-scale' deposit (say, porphyry copper) under small-scale mining conditions.

Although artisanal small-scale miners do not generally use sophisticated concepts of reserve and resource classification systems, their basic thinking does not usually differ conceptually from industrialized mining, as the next section will demonstrate.

7.2 Economic strategies of ASM miners

Time and money are interchangeable. Artisanal small-scale mining is characterized by abundant time and chronic lack of money. Hunter's question in Harare 1993: 'Slow build or fast track?' can therefore be answered in the following way. Experience in the last decades shows that only a slow-build approach is feasible for artisanal small-scale mining operations.

Artisanal small-scale mines usually do not have reserves. The lack of investment capital does not allow for necessary geological studies or exploration prior to operating the mine. Whenever possible, small-scale miners start right away with

production, based on their geological experience. However, the criteria for selecting mineable 'reserves' for artisanal small-scale miners are similar to those applied in industrialized mining: any ore above the cut-off-grade that provides a living for their families is mineable.

High grading, (often considered to be 'degradation' or 'sterilization' of deposits by small-scale miners), is not so different from strict net present value optimization in many industrialized mining operations. Similarly, total recovery of small-scale mining is often not significantly below industrial levels after intensive and repeated scavenging.

Macroeconomic effects, taxation and foreign income 7.3

At macroeconomic level, the production of high-value metals (gold), gemstones and minerals from small-scale mines can make a major contribution to foreign-exchange earnings. For example, gold produced by ASM is more or less equivalent to extra foreign income. Here no consideration of 'repatriation of utilities' by foreign investors is taken into account, as the 'investors' are the local miners. In this case the value of artisanally produced gold can be considered as a net contribution to foreign income, as freely convertible currency is produced with only local input. It is unimportant if payment is received in the form of converted currency (dollars) or in form of imported goods (refrigerators). In any case, the livelihood and wealth of the communities involved, and with it the wealth of the national economy, are enhanced.

In countries which have VAT taxation implemented, the informal status of miners may constitute a quiet incentive for the government to maintain this situation. The informal status of the miners makes them a VAT-end-user, since they cannot benefit from any fiscal credit or drawback from goods bought from their suppliers. If smuggling is not an issue, and the product ends up in the official domestic market, the final product is again taxed with the entire VAT. The double interruption of the VAT-chain at the producer (small-scale miner) and the consumer generates double fiscal income.

Smuggling, money-laundering and guerrilla activities 7.4

Significant increases or decreases of official export statistics from small-scale mines may occur when changes to purchasing arrangements or taxation schemes

TABLE 6 Different cost-benefit aspects of ASM

Costs	Benefits
Geological – Mining costs ■ Exploitation of a non-renewable resource ■ Losses: – irrational working of high grade material – incomplete exploitation – processing methods – transport	Geological – Mining benefits ■ possibility of exploiting smaller deposits ■ ASM achieves successful prospecting without high cost ■ Working of abandoned pillars, tailings, etc. ■ Small-scale miners discover important deposits in remote areas
Effects on the environment ■ Environmental risks, emissions and damage to: – earth – soil – water (underground and surface) – air – flora and fauna – energy sources – ecosystems	
Social costs ■ precarious working conditions ■ negative health consequences (sickness, accidents) ■ infra-human living conditions ■ complicated dependency relations ■ child labour ■ unbalanced development between men and women ■ violation of resident and indigenous community rights ■ changes in the system of ethical values and its consequences ■ insufficient social security	Social benefits ■ labour qualification ■ source of income (in money) ■ job creation .../

TABLE 6 Different cost-benefit aspects of ASM (continued)

Costs	Benefits
Macro-economic costs ■ conflicts – due to land and water usage – with governing bodies (judicial conflicts) – with large-scale mining – with the indigenous population – with landscape protection objectives (national parks, protected areas) ■ Smuggling illegality (products profit) ■ no tax generation ■ costs of controlling the sector ■ continuous costs resulting from social causes ■ uncontrolled development due to lack of planned exploitation	Macro-economic benefits ■ mobilization of natural resources ■ tax collection ■ active effect for the balance of payments ■ buffer for the labour market in cases of programmes for structural adaptation ■ provides personnel reserves for large-scale mining ■ contribution to regional economic development by – cash circulation (social product) – investment – demand for products and services – mobility – structural consequences (alternative to agriculture) ■ avoids rural exodus ■ infrastructure development (road building, schools, energy supply) by small-scale mining and neighbouring population ■ comparative financial advantages (products with a high labour coefficient in countries with high labour availability) ■ relatively stable product supply even with market fluctuations ■ contributes to product diversity and exports ■ substitutes imports

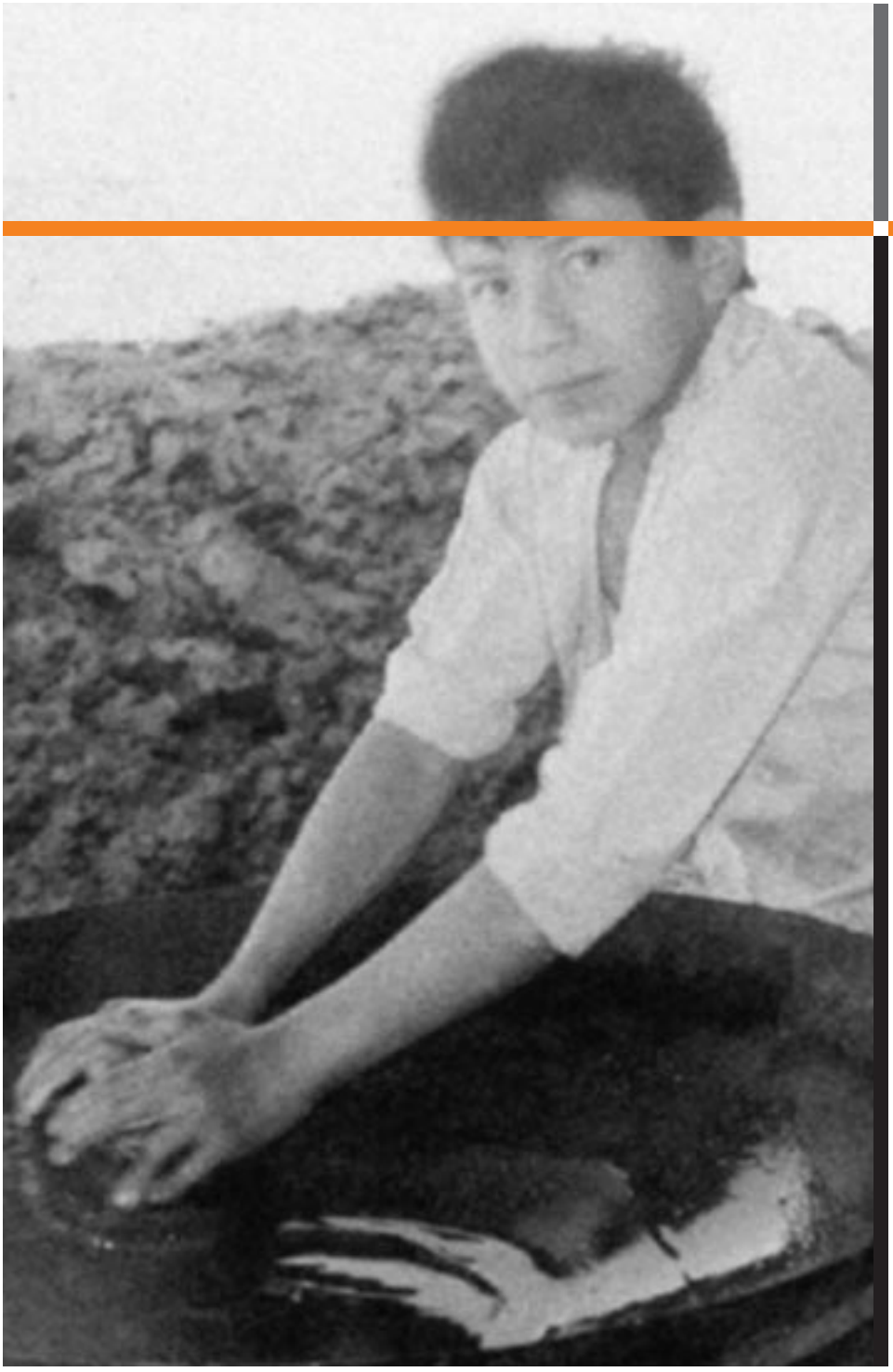
are made. This may also occur with alterations in the overall political framework in which the miners operate. These apparent movements occur even though physical production does not change at all.

Illicit marketing is primarily the result of inadequate government policies. In countries where commercialization is not based on free-market mechanisms and where sales are not transparent, smuggling is usually the first choice for miners and merchants. In these circumstances much of the benefit to governments will be lost. Nevertheless, smuggling or illegal trading usually happens in conjunction with an adjacent country where market conditions are more favourable. However, as developing countries are usually surrounded by other developing countries, the

regional positive effect of artisanal small-scale mining may not be lost, just a different developing country with a more open policy is able to take advantage of its neighbours. Moreover, even extensive smuggling does not significantly reduce the local development effect (at community level) that small-scale mining has. In some cases, positive overall macroeconomic effect due to additional foreign income may also accrue.

Smuggling is not usually performed by the artisanal small-scale miners themselves, but by intermediate or major illegal traders. Therefore smuggling is not generally a problem related to the miners, but to the product itself. The considerable capital required to smuggle efficiently means that traders are unlikely to belong to the typical artisanal mining social strata.

Artisanal gold and gemstone mining are frequently used as a vehicle for money-laundering or financing guerrilla activities. A common practice of money-laundering is to buy gold from informal artisanal small-scale miners with 'narco-dollars' and to declare it as part of the production of a formal mine. Again, it is not the artisanal miners, but the products of their activity that are the subject of these illegal practices. In some countries, the continual links between money-laundering, guerrilla activities and civil wars (such as 'blood diamonds') can provoke the complete outlawing of the small-scale mining sub-sector.



8 Relations between Large Mining Operations and ASM

Within the framework of growing social sensitivity and efforts to apply policies of sustainable development, large mining companies have begun to develop a new outlook towards communities that are located within the areas of influence of their mining projects. These areas are frequently inhabited by artisanal miners.

The existence of artisanal mining within the area of a formal mining project should be considered as a social risk that warrants special attention. When artisanal miners are not taken into consideration within the general context of a mining project, there may be serious problems.

Boxes 11 to 13 on the following pages illustrate experiences of relationships between formal and artisanal mining.

8.1 Actions and recommendations for the establishment of good relations between large-scale mining and the ASM sector

Some general recommendations are presented for the establishment of good relations. The mining company should respect the interests and affairs of the artisanal miners by creating an atmosphere of 'partnership'.

A mining company should create an honest atmosphere with the ASM sector, through open and informative policies. Artisanal miners must understand that a mining company cannot solve all their problems. A mining company has to understand how artisanal mining functions, and seek to answer the following: How many artisanal miners are there? How long have they worked in the area as artisanal miners? Where are they from? How important is mining to their subsistence? How important is mining to the community as a whole? What are the

BOX 11 Case study: the Ozizwenzi Kwa Zulu Natal project in South Africa

Ozizwenzi Kwa Zulu Natal is an extremely poor area with many open quarries and large mining company operations. Illegal clay and coal operations were operating in the region to produce bricks, made using simple coal-fired kilns. Each miner worked as an independent contractor by renting an 'allotment' and selling bricks to the local community for building houses in the area. An estimated 200,000 bricks were sold each month through these operations which secured employment for approximately 400 people.

While these facilities sustained the local community, there were adverse environmental and health and safety impacts because mining activities were taking place within the immediate precinct of the village. The bricks were found to be of sub-standard quality and a number of fatalities occurred from buildings collapsing and people being buried alive. Other legal irregularities include the use of child labour, and neither labour relations legislation nor basic conditions of employment were observed.

To develop the brick industry and capitalize on the entrepreneurial ability that existed in this region, in 1998 the Department of Minerals and Energy (DME) decided to assist the project by registering a trust, the Blaaubosch Trust, comprising 110 beneficiaries and a board of 15 trustees. Once the trust had been established it signed an agreement with the NSC to develop a business plan, which effectively placed ownership of the company in the hands of the 110 beneficiaries. Several problems prevented the plan from going ahead: a sufficiently qualified person could not be found in the area to run the plant and to assist with skills transfer, and the trustees also found it difficult to meet any of the financial requirements.

The business plan was presented to a large financing corporation for funding, which it subsequently approved, provided an equity partner could be found. Several potential partners were interviewed and a large-scale brick operation, Corobrick, eventually agreed to become the equity partner. Corobrick agreed to buy all of the bricks, provided a specified production and cost level was met. They also provided key management personnel to oversee the process.

relations between the artisanal miners and the rest of the community? What legitimacy do the artisanal miners have, for example, within the national, local and regional context?

Mining companies (large or small) should start the process of consultation/information/agreements with the artisanal miners as early as possible, preferably during the exploration phase. Consultations should be made, not only with the artisanal miners' leaders, but also with the other members. Leaders may have different interests. Agreements should preferably be signed by every one of the miners in the group. If the artisanal miners are composed of indigenous groups with some mining tradition, they may require much more sensitive treatment than those involved in a 'gold rush' scenario. Frequently, indigenous groups have a different understanding of the law, particularly with respect to natural resources. The company must take this into account and make things clear. Because of their informal nature, artisanal miners do not normally maintain good relations with central government. The company must evaluate whether or not it is convenient to involve the government in their negotiations with artisanal miners.

BOX 12 Case Study: San Simón, Bolivia

A formal mine exploration operation by the Bolivian/Canadian consortium Excalibur/Eaglecrest, is underway in the San Simón mountain range (on the Bolivian frontier with Brazil). When exploration work began, artisanal miners became active. Initially they were only local people but then artisanal gold miners from other parts of Bolivia and Brazil arrived. Finally, approximately 500 artisanal miners invaded the concession. These miners worked in an unplanned manner in the richest parts of the deposit and were responsible for contaminating the environment with about 15 tonnes of mercury per year. They have organized themselves under the name of the San Simón de Mategua Mining Company.

The Bolivian authorities in the region are largely unable to enforce legislation. The municipal authorities for the area are in the Baures community about one hour's flight away by small plane.

In order to continue its activities peacefully in the region, Excalibur entered into dialogue with the trespassers' company, and since 1996 there has been a signed agreement between both parties. The following are the salient points of the agreement:

- Excalibur agreed to suspend the legal proceedings it had initiated against the small miners.
- The small miners agreed to formalize the legal constitution of their company with the help of Excalibur.
- The small miners agreed not to place obstacles in the way of the exploration work.
- The small miners agreed not to permit more miners to join their company.
- Excalibur authorized mineral exploitation by the artisan miners for their own benefit under certain conditions (defined areas, limited daily movement of gold bearing minerals, no usage of heavy equipment).
- Excalibur agreed to pay the miners 1.5 per cent of their net smelter returns if they began large-scale production.
- Excalibur agrees to hire labour from the company when it starts large-scale work.
- Excalibur contributes materials to build a school and a sanitary installation.
- Excalibur helps the company to locate and obtain a mine concession.

Excalibur has complied with the agreement to date, the company only partially. However, relations of mutual respect are maintained between the parties that ensure their coexistence. In order to avoid mercury contamination, tripartite efforts have commenced between Excalibur, San Simón and the Bolivian Foundation MEDMIN.

If a mining company decides to assist the artisanal mining sector, it should take into account the following fields of action or areas of cooperation:

- Management or environmental measures
- Occupational health and work safety
- Emergency assistance and mine rescue
- Providing training and technical advice
- Buying services, tools and equipment from the local community

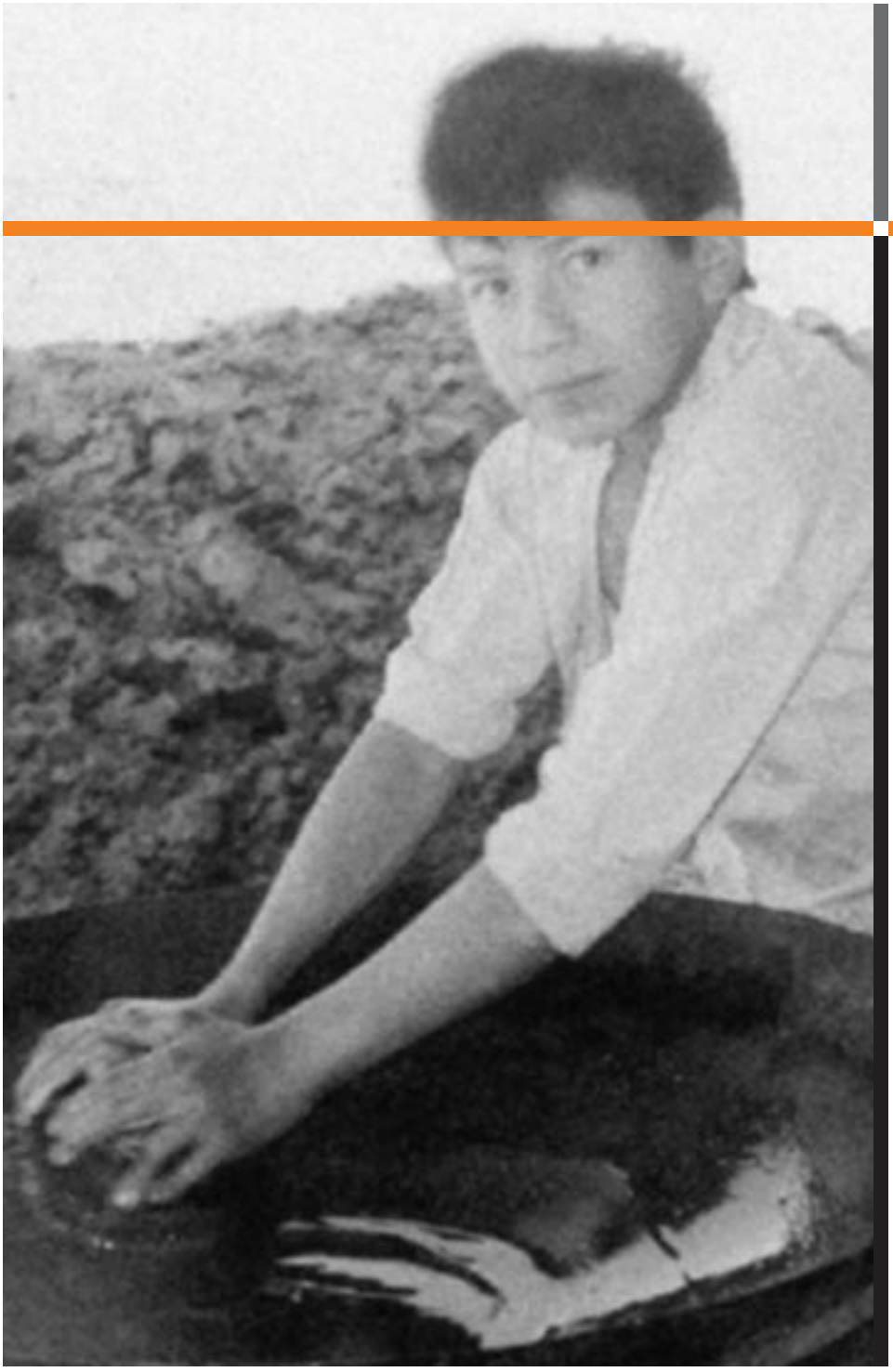
BOX 13 Case study: Junior companies in Bolivia

Before the fall in gold prices in the mid-1990s, several small start-up 'junior' companies (principally Canadian) were operating as joint ventures with gold mining cooperatives in Bolivia. The cooperatives provided the concessions and the companies pledged themselves to invest in exploration and/or capital for a more rational exploitation. Unfortunately, there was almost always inadequate communication between the parties. The mining cooperatives frequently thought that when 'the gringo' invests, they would no longer need to work and that all they had to do was to charge for their concession (normally 20 per cent of the production). Frequently, the junior companies had no interest in working, but intended to use the mineral deposit for speculation on stock exchanges. The small-scale miners never understood this situation.

In some exploration projects, the junior companies promised to purchase the concessions from the cooperatives, providing that the exploration work proved positive. The sums offered (some millions of US$) are a lot of money for mining cooperatives and many leased work in anticipation that they would soon be millionaires. There was not sufficient communication on the part of the junior companies to clarify the fact that very few exploration projects go forward to become successful projects.

Small miners do not differentiate between large and junior companies. As a result of this misunderstanding, the small-scale mining sector in this area lost all confidence in international companies. In the future, mining companies with good intentions to negotiate and cooperate with artisanal miners will have difficulty in creating an atmosphere of confidence.

- Assistance in the purchase and storage of explosives
- Creation of small concentrating plants
- Providing mineral processing services using the company's plant
- Laboratory services for sample analysis
- Share geological information
- Administrative and organizational training
- Advice on commercialization
- Legal and formalization assistance
- Mediation between artisanal miners and government and/or assistance programmes



9 New Trends and Issues

Collective solutions for environmental problems 9.1

During the last decade, concern over environmental problems has steadily increased. As a result, environmental laws have been formulated and governmental environment agencies have been set up. The implementation of these new laws has been fairly straightforward for large- and medium-scale mining enterprises. However, many countries have not yet been able to include the ASM sector in their formal legal–environmental system. Instead, the environmental authorities, being unable to handle multiple issues, push ASM further into illegal situations because of non-compliance with legislation. Sometimes the miners intentionally evade the legislation by doing so, making it even more difficult for the government to fulfil their control duties.

New concepts must be developed in the area of environmental management of ASM to combat the administrative overload of regulators in managing individual enterprises. Only collective solutions for ASM are likely to succeed. While organization of the sector is a prerequisite for substantial changes, incentives for environmental compliance are better based on collective solutions, as is shown in Box 14 (see next page).

Although this example demonstrates the positive experiences of collective solutions for ASM environmental issues, more research should be done to identify potential applications of collective solutions in complementary areas, for example in the area of collective mining titles.

Networking and communication 9.2

The basic idea of networking is to work together, to share information and to coordinate activities among network members with common interests. In this sense,

BOX 14 Case study: Water contamination in Potosí, collective tailings dam

Mining activity is very intense and important in the Cerro Rico of Potosí: there are about 8,000 artisanal and small-scale miners producing an average of 1,500 tonnes/day. This production is concentrated in around 40 processing plants using flotation tanks which are located in and around the city of Potosí. The flotation effluent, which amounts to more than 1,200 tonnes/day, is released without treatment directly into the La Rivera River, which is a tributary of the Pilcomayo River, and affects downstream communities and causes serious contamination problems nationally and internationally.

To solve this problem, in 1996 MEDMIN – after a broad consultation process and different studies (socio-economic, pre-feasibility, feasibility study and an integrated financial, institutional, administrative and economic concept) – proposed the construction of a collective tailings dam, where the tailings from all the plants of Potosí could be retained. The decanted water will be recycled in its totality so that there will be no emission of contaminated water anymore. This project, known as the San Antonio Tailings Dam, Potosí, was going to cost approximately US$4.5 million.

German Financial Cooperation (KfW) is now financing an integrated water project in Potosí (about US$15 million), which includes both the final design and construction of the San Antonio tailings dam and a sewage canal system and water treatment plant, so the water-pollution problem in Potosí will be solved in an integrated manner. Construction of the dam was due to start in late 2002.

networking is nothing new. What effect is the digital communication revolution likely to have on networking between ASM groups?

As the California gold rush of 1849 makes clear, networking among small-scale miners does not necessarily depend on communication technology. The same phenomena happened in Brazil in the 1980s (Serra Pelada) and is happening on a minor scale on a daily basis in all ASM regions and countries.

Without any doubt, the internet has changed the way institutions and individuals are working today in the field of ASM. Just one decade ago, most stakeholders depended mainly on one-way information provided by specialized journals or organizations. Direct communication was scarce due to the limited number of qualified network members in the same country, and international communication was either time consuming or too expensive (phone, fax or travel) for most stakeholders in developing countries. This situation has now changed fundamentally.

Nearly all information worldwide can now be downloaded immediately from the Internet and email enables relatively affordable communication between stakeholders in different countries. An apparently new way of communication was born: networking via internet.

There are two main types of networks:

- Informal decentralized networks, such as personal lists of contacts or the people one addresses on a regular basis. This type network does not require any further discussion.

- Formal centralized networks consist of network members whose data are stored (with their consent) in a central database.

Formal centralized networks related to ASM with international participation are relatively scarce, compared to other disciplines. A few examples are: Hg-net, Facome, MMSD, Redminera, and CASM; all are concerned with ASM and have websites. While networks in other disciplines tend to converge or to form larger clusters by reciprocal links or forming 'rings', this tendency has not yet been widely observed among ASM-related networks.

The new networking capabilities still have only an indirect effect on ASM communities. Members of the networks are generally institutions and individuals offering technical assistance to small-scale miners or responsible for the ASM sector. Improved access to information will improve the quality of services offered by the network members.

The main reasons for the nonparticipation of artisanal and small-scale miners in networks are obvious: insufficient communication infrastructure in rural areas and computer illiteracy among miners. Nevertheless, new communication techniques might change this situation within the next few years. Advanced satellite availability enables mining communities in remote areas to install Internet connections for only a few hundred dollars. Younger miners in some countries are becoming increasingly familiar with computers. Public Internet access (Internet cafés) are becoming more and more popular in small rural townships, and will extend into ASM villages and camps. (Satellite television has already become extremely popular in many ASM regions.)

When satellite telephones become affordable they will offer new possibilities to industrialized small-scale mines, but for now radio transmission is still the most popular means of communication for most ASM communities. These radios must also be considered networks. In some cases they can mobilize whole provinces within a matter of hours.

In the context of globalization, communication facilities will enable artisanal and small-scale miners to build up or strengthen their own informal decentralized networks. Formal centralized networks in ASM regions might become an issue within a few years. New concepts for ASM networking have to be developed.

Fair-traded ASM products 9.3

The mining of gold and precious stones throughout the world today is characterized by high social and ecological costs. Environmental scandals are

especially associated with gold mining, such as the gold-tailings dam that burst at the Baia Mare mine in Rumania, with its spills of cyanide and heavy-metal sludge contaminating the Tisza and Danube river systems, or the sad ties that connect diamond mining with the rebel armies of West African states, and have naturally created uncertainty in the trade and among end-users.

Anyone who buys jewellery today can no longer be sure that their purchase does not in some way either support child labour or slave-like working conditions in a struggling developing country or contribute to the wanton destruction and annihilation of a war.

This situation is a challenge for certain artisanal and small-scale mining operations. Reacting against these prevailing conditions, a number of small-mining experts, gem specialists and goldsmiths have formed an initiative which, under the patronage of Fair Trade e.V. (a German-based NGO) and with local NGO participation, has set out to establish fair trading in business dealings associated with precious metals and gems.

Under the principles of fair trading, small-scale producers in developing countries are to be given the opportunity to trade their products under better terms and conditions. The prerequisites and criteria for fair trade with small-scale mining products have been worked out and are strict, and the operations must fulfil the following criteria to be eligible:

- Candidates must be legally constituted small-scale producers operating within a democratically organized trade framework (e.g. in the form of a cooperative society or association, etc.).
- They must take an environment-friendly approach to mining.
- They must demonstrate a commitment to ILO conventions, including the elimination of child labour, with regard to the welfare of workers and their families.

These artisanal and small producers can profit from fair trade in two ways. The first is by improving the selling conditions for their raw products wherever possible by selling direcly to the end-user and cutting out the middlemen. The second is by ensuring that all the producers (the mining people and workers engaged in mining processing) benefit from the improved profit margin.

The miners must invest the additional payments in improving their social and environmental performance.

At the moment, the following operations are being examined and supervised by Fair Trade e V:

- Diamonds from Lesotho (a women's cooperative)

- Gold from Bolivian cooperatives
- Metals of the platinum group from South Africa (small-mine cooperative, working through the old stockpiles of a major mine)
- Precious coloured gems (garnet, tourmaline, sapphire, aquamarine) from Tanzania and Madagascar
- Grinding workshops in certified companies in India and Amsterdam
- Jewellery in Bolivia

All these operations are advised by ASM-experts or well-known organizations working with the ASM sector.

This system offers both the customer and the mine operators a variety of advantages:

- Through the extra charge the buyer is supporting the development of the 'sustainable mining' being created by advising consultants and services monitoring the mines.
- The buyer has access to producers whose products usually do not reach markets through the usual formal trading process, creating income for underprivileged small-scale miners living in economically weak rural areas.
- For gold and diamonds, the buyer receives a genuine quality guarantee based on the on-site presence and monitoring of both the production facilities and working conditions.
- The buyer receives accurate and current information about the producer and the welfare conditions at the mine.
- The fact that well-known institutions are supporting this group of producers with donor funding is an added guarantee of environmental and social conformity. Moreover, with this system, the demands that were made in the past to improve the environmental and welfare aspects of production through the use of public funds is now being funded by the end-user.
- This system gives the miners a financial incentive to improve the productivity of the mines on their own accord.
- The small mine, which normally produces erratic quantities, now has a steady demand to contend with, and this encourages more regular planning.
- Internationally agreed quality standards that have been worked out with Fair Trade e V are now in place.

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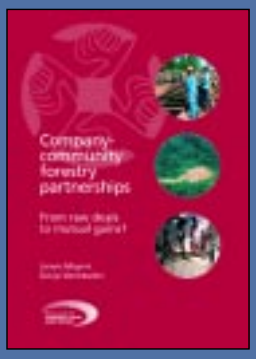

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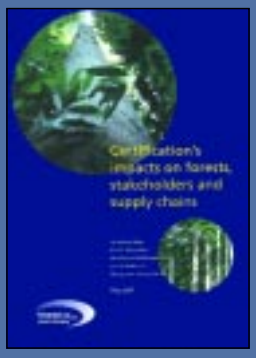

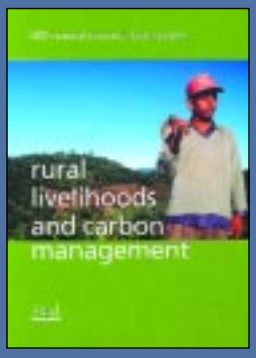

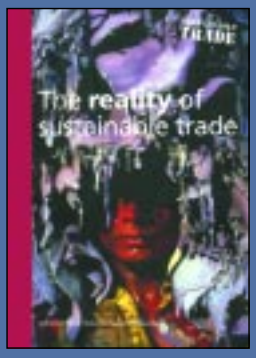

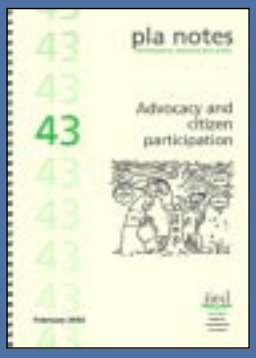

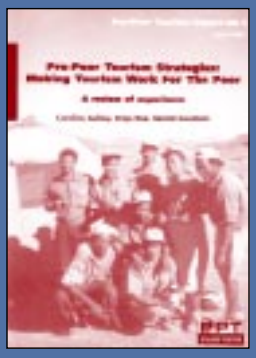

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More than 13 million people in the South are directly engaged in small-scale mining – many of whom are women and children – with another 80 to 100 million depending on it for some aspect of thei livelihood. These activities are often both illegal and environmentally damaging, and dangerous for workers and their communities. The illegality and lack of regulation often mean that improving the sector is difficult and many of the potential benefits are lost. This paper is an overview of the issues and challenges facing artisanal and small-scale mining stakeholders.

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