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Small-scale Mining and Sustainable Development within the SADC Region

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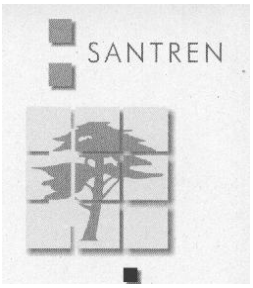

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Summary and Conclusions

Introduction

Broadly, speaking, it is difficult to make general conclusions about small-scale mining in Southern Africa. The historical, economic, developmental, geological and social backgrounds and circumstances in the countries of the region are very different in many cases. Similarly, there are wide differences with respect to the minerals; more than 50 different minerals are exploited. Mining, processing and marketing them presents several individual problems and challenges. Multiplying these with our 6 countries (ignoring the sub-areas) would give us at least 300 varied issues to investigate. This suggests that prescribing general solutions on small-scale mining issues in the region is not a very rewarding exercise. Such prescriptions are either too broad and shallow to be useful or not suitable to every case.

Nevertheless, this study tries to draw up some conclusions and suggestions from all the six country reports. These conclusions and suggestions should therefore be interpreted in the light of the caveat made in the preceding paragraph.

The Nature of the Small-scale Mining Sector within Southern Africa

Numbers of small-scale miners

	Malawi	Mozambique	Tanzania	South Africa	Zambia	Zimbabwe	Total
Mining contribution to GDP	0.9%	2.0%	2.8%	8.0%	12.1%	8.0%	
Formal large & medium scale mining employment	14,000	87,000	365,000	1,350,000	300,000	350,000	**2,466,000**
Number of small-scale miners (estimated)	40,000	60,000	550,000	10,000	30,000	350,000	**1,040,000**
% informal small-scale miners (estimated)	90.0%	95.0%	90.0%	n.a.	60.0%	85.0%	**84.0%**
% women in s-sm (estimated)	10.0%	30.0%	25.0%	5.0%	30.0%	> 50%	**25.0%**

There is about a total of more than 1,000,000 small-scale miners estimated to work within the 6 target countries (which should add up to about 1.5 million for the whole SADC region)
Main countries for small-scale mining activities are Tanzania (550,000 miners) and Zimbabwe (> 350,000 miners), where more people are involved in the small-scale, rather than in the large- and medium-scale mining industry.

All country research reports show, that small-scale mining is a fast rising sector. The figure below (Svotwa & Sibanda, 2000) shows an estimation of the number of small-scale miners in Zimbabwe, growing exponentially. According to this, small-scale mining activities are likely to triple within the next 10 years in Zimbabwe. The situation in other parts of the region should largely follow a similar pattern.

Ironically, the number of small-scale miners rises according to the problems within the large-scale mining industry, as well with general economic problems in the various countries.
Whenever large mining companies are forced to close down, retrenched miners are find in large numbers in the bush trying their luck to make a living, since mining is the thing they know best.

Women in Mining

Various estimations show, that about 25 % of small-scale miners in the region are women. (South Africa: <5%; Zimbabwe > 50%). However, even if these figures are indicating a relatively gender balanced sector, the imbalance is found within the hierarchies in the sector. Only a few claim owners are female (Zimbabwe <10%).

Most of the women are found at the very bottom end of the sector's hierarchy, doing subordinate work. Women are not employed in the regions large-scale mining industry, and therefore, they usually don't have the experience in mining. Women are also not that flexible and able to move around in the country. So, while men are often following the gold-rush in remote corners of the region, women are usually tied to their households and involved in seasonal panning activities around their home areas.

Most studies are handling women in mining and child-labour within the same chapter, or even the same sentence. However, while child labour is definitely a problem, which has to be combated, there is no reason why women should not be involved in small-scale mining successfully, as long as they manage to secure their place within the mining community. A few projects and programmes have shown that this is possible, even in this very male-dominated industry.

Child Labour

There are no reasonable or trustworthy figures about numbers of children, working in the small-scale mining sector. However, various case studies carried out in several areas of the region, show that child labour is a big issue within the small-scale mining industry in the SADC (and world-wide). It ranges from children, helping their parents after school in

gold-panning, just as they would have to do as well in small-scale agriculture, to full-time slave-like employment.
Mostly children are not directly involved in mining (digging) itself, but in activities like transport of water, minerals processing and gold panning.

Legality

Different estimations shows that 80% to 90 % of small-scale mining activities in the region are informal. The generally invisible character of this sub-sector does not allow more exact data, because there are no official figures available at ministries and other governmental institutions. Also the fact that the sector is extremely mobile and flexible hinders more accurate estimations. Mining activities and villages with some thousand people can appear and disappear over night, which makes it very difficult to control, even for local authorities and NGOs, working many years in the sector. Data is outdated, even before it is printed and distributed.

The level of legality depends on the scale and the character (shaft mining or panning) of the operations, as well as the accessibility of the area for mining authorities. It is estimated that only about 10% to 20% of legally registered small-scale claims are in active production.

Minerals mined

There are more than 30 different minerals mined in small-scale mining operations throughout the SADC region. However, the sector is dominated by easily marketable minerals as gold and gemstones (e.g. Zimbabwe: gold > 90% of all small-scale mining activities)

	Malawi	**Mozambique**	**Tanzania**	**South Africa**	**Zambia**	**Zimbabwe**
Main Minerals for SMALL-SCALE MINING	Lime, Building-materials, Gemstone	Gold, Gemstones	Gold	Gold, Gemstones	Gemstones	Gold, Tantalite
Minerals mined:						
Baryte						X
Bauxite		X				
Chromium						X
Clay	X	X			X	X
Coal	X	X		X		X
Cobalt					X	X
Copper		X			X	X
Diamantes		X	X	X	X	
Feldspar					X	X
Gemstones	X	X	X	X	X	X
Gold	X	X		X	X	X
Graphite				X		X

Gypsum			X			
Iron						X
Kaolin				X		X
Lead					X	
Limestone	X	X	X	X	X	X
Lithium						X
Magnesite						X
Nickel						X
Ornamental & Dimension Stones	X	X	X	X	X	X
Phosphate				X		X
Platinum						X
Quartz					X	X
Salt	X			X		X
Sand	X	X	X	X	X	X
Silver				X	X	X
Sulfur					X	X
Talc	X	X		X	X	X
Tin						X
Tungsten						X
Zinc					X	

Small-scale Mining and Sustainable Development

There is quite some debate about the contribution of small-scale mining to sustainable development and sustainable livelihoods. For the thousands of poverty stricken and hungry people in both rural and urban areas, small-scale mining is a welcome solution to their problems. To many people, particularly those involved in gold and semi-precious minerals like emeralds and diamonds, small-scale mining represents the "fast track process to their earthly riches". And yet there are those who view small-scale mining with high contempt. This contempt is based on the belief that small-scale mining represents the "greatest environmental disaster-in-the making". The question is who gets the benefits from small-scale mining and who pays the environmental costs? We provide a few case studies on some success stories and failures that have been encountered in the field of small-scale mining in the different countries.

Support Programmes and Success Stories

Shamva Mining Centre (Zimbabwe)

Project outline

Shamva Mining Centre was established in 1989 as a joint initiative between the Ministry of Mines, ITDG, the Small-scale Miners Association of Zimbabwe (SSMAZ) and donors. Donors that supported the project included GTZ, DFID and the EU. 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 and improve incomes of miners;

- create jobs;
- train miners in health, safety and sustainable mining methods; and
- 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 the centre. The catchment area of the centre had extended to a radius of 200km.

The lessons and experiences of the centre were widely shared and disseminated. This led to the replication of the model in other African countries with support from donors and international agencies like the World Bank. Similar centres have been created in other parts of Zimbabwe, Burkina Faso, Mali and Tanzania.

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.

Key success factors

The SMC project was successful because it addressed a real need of small-scale miners through improvement of their 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, miners incomes increased by as much as 30%.

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 they are competitive to give the centre a profit. The project was a collaborative initiative from all key stakeholders, viz., 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.

Problems encountered

Problems encountered at 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 not adequate to meet the growing needs of miners. The mill had capacity to process one ton of ore per hour which was too little compared to quantity of ore supplied to the centre. As a result, miners had to wait between three to six weeks to have their ore processed.

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

Above all, the single biggest problem encountered at SMC were the 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 cashflow 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 take over of the centre by SSMAZ.

Lessons learnt

A number of important lessons have emerged from SMC project. First, there is need for development agencies 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 to leave the management of commercial projects to experienced and 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 monopolise benefits created for individual gain.

Second, technology unlocks the potential of small-scale miners to run viable mines. Access to processing facilities at SMC has enabled miners to increase productivity and improve the viability of their mines until management problems emerged in January 1999.

Finally, 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 and access to credit and profitable markets.

Chenkumbi Limeworks Project (Malawi)

Project outline

ITDG's technical assistance to small-scale lime burners of the Chenkumbi Hills started in 1984 in response to a request from the Government of Malawi. The project was funded by USAID Shared Project and ITDG worked in collaboration with the Lime makers Association, a body that had been created in 1982 to address the problems of small-scale lime burners. The key problems faced by lime burners included the following:

- Small-scale quarrying methods were found to be wasteful of the limestone resources and detrimental to the environment.
- Inefficient and wasteful utilisation of hardwood fuel was destroying the environment through rapid depletion of forests. By 1985, it was evident that the Chenkumbi Hills were getting completely denuded of forest cover.
- The quality of lime produced was poor and producers failed to realise economic returns for their efforts. They could neither meet the quality needs of more discerning

consumers nor those of large building contractors who require consistent quantities and quality.

Given the above problems, the objectives of the project were to:

- Develop and disseminate improved lime burning technologies in the Chenkumbi Hills.
- Facilitate development of euclayptus plantations and reduce the cutting down of indigenous hardwoods to provide fuel for lime burning.
- Create jobs and incomes from lime burning
- Develop the skills of lime burners to supply increased quantities and higher quality lime to the market.

Achievements and impact

An improved vertical shaft kiln was developed to replace the traditional box kilns and increase efficiency of lime burning. Unfortunately, the cost of the kiln at K100,000 (1984 prices) was well beyond the reach of individual artisanal lime burners. A high degree of entrepreneurial and managerial acumen is required to run the kiln at full capacity and efficiently. The introduced technology was therefore not taken up and lime burners continued to use their traditional and fuel inefficient box kilns.

A small eucalyptus plantation was planted at Chenkumbi but it was not large enough to reduce the depletion of hardwood forests for fuel. Consequently, the depletion of forests continued.

Chenkumbi Limeworks was established as a private company in June 1991 and commenced operations in September 1992. A total of 100 jobs were created at the peak of operations in 1993. The average number of employees at Chenkumbi Limeworks was 45 up to 1996.

The quantity and quality of lime produced by small-scale lime burners improved considerably as a result of the project. However, the quality was not always consistent and so it proved difficult to meet the demand for higher grade product.

Problems encountered

There are some strong similarities between the problems encountered at Chenkumbi and Shamva. The most critical problem at Chenkumbi, just as at Shamva, was the wrong assumption that involvement of the producers association in the management of the business would guarantee sustainability. Management capabilities were clearly absent among members of the Lime makers Association. A few powerful individuals were keen to take over the business for their own personal benefit.

The business was grossly undercapitalised. Large quantities of water are required daily for slaking lime and yet the nearest water point was located some 4km from the kiln. No tractor was available to ferry the water and instead a one ton truck was used. This led to rapid depreciation of the truck and constant break downs.

Uptake of the introduced vertical shaft kiln technology was limited due to the high investment cost required vis-à-vis the incomes and borrowing capacities of target beneficiaries. Despite the clear fuel utilisation and production efficiencies of the kiln, small-scale lime burners continued to use their traditional box kilns. The opportunity cost of adopting the vertical shaft kiln was simply too high.

Lessons learnt

There are interesting parallels between the lessons from Chenkumbi and Shamva projects. First, performance of Chenkumbi Limeworks suffered from the wrong assumption that involvement of the Lime makers Association in the management of the business would ensure long term sustainability and viability of the business. The strong influence and potentially negative impact that a few powerful individuals can exert on a project must be recognised in project design and implementation. Experience suggests that it may well be more beneficial to leave the management of commercial projects to experienced and professional managers. Producers benefit from access to an efficient service that processes their product at an affordable and competitive price.

Second, great care needs to be taken to ensure that the scale of technology introduced can be adopted and replicated by beneficiaries. Clearly, the vertical shaft kiln improved fuel utilisation and production efficiency. It was however not replicated because investment required was beyond the reach of target beneficiaries.

Finally, to succeed, businesses require a complete rather than piecemeal package of support. There was need to develop strong linkages between Chenkumbi Limeworks and financial institutions. This would have facilitated access to capital and mitigated the undercapitalisation problems later suffered by the project.

Amethysts I, (Zambia):

An amethyst mine owned by a woman and located in Mapatizya area of Kalomo was initiated in 1987. The mine started with four partners and after some differences it remained under the full control of the lady and her father. In the early years the mine was financed from family resources and within 6 years the operation reached full production. By using the proceeds from the amethyst sales, the owner financed marketing trips and thus participated in gemstone fairs in different parts of the world and secured markets in Austria, Germany, India, Thailand and Hong Kong.

The mine seems to be one of the richest mineralized parts of the Kalomo amethyst fields, with regards to the number of veins, quality of the amethyst and the proportion of medium to high grade material. There are 27 known veins so far which range in thickness from 0.1, 0.2 and 0.5 m extending over 100m and even more than 200m in strike in some places. Good quality amethysts have been found even at shallow depth of 4 - 6m depth. The resources have so far been estimated to a depth of 5 - 18m.

The major problem facing the operations of the mine is inaccessibility to investment finance. In 1994 efforts to get a loan from the Zambia National Commercial Bank failed because small-scale mining ventures are regarded to be too risky. This mine has been able

to produce between 500 - 1000kg per month from thinner veins with a work force of 25, using predominantly pick and shovel. For wider veins of about 0.5 m, the mine can produce between 1500kg and 3000kg per month. In contrast, a D8 bulldozer operating for 8 hours produces 4000kg of saleable material from wide veins. In thin veins, the bulldozer produces 2000kg of cobbed material from which 200kg yielded 35kg of knocked material. Of the knocked material 1.5kg was the highest quality and fetched US$ 1/gram while the remainder of 33.5kg sold for US$ 135/kg during a Gemstone Trade Fair in Thailand. The rest of the 1800kg crystals were exported to Hong Kong at US$ 3/kg. This amounted to total revenues of US$ 11422.

During the rainy season, that is, from mid-December to mid-March mining operations are adversely disrupted because pits get flooded and the mine has no capacity to acquire the right equipment to pump out the water. This problem forces the operator to open up new pits on sloppy ground resulting in sporadic production. Besides, the pick and shovel method gives very low productivity of about 1 - 4 Bank Cubic Metres (BCM) per man-hour.

The mine had secured an insatiable market following the aggressive market research overseas, such that the demand for amethyst can not be met. The company wishes to increase its output and productivity so as to satisfy this market. Efforts to establish co-operative marketing arrangements to meet this demand have failed due to mistrust among the small-scale miners. One obvious way of satisfying the market is acquiring heavy-duty mining equipment to increase output and productivity.

Amethysts II, (Zambia)

A family firm run by a woman has demonstrated the entrepreneurial characteristics essential for success in small-scale mining. This mining enterprise has managed to get into a joint venture with an international company to access a loan. Besides, the company has established business relationships with amethyst buyers in India (Jaipur), USA (Tucson), RSA, and Hong Kong.

At the beginning, the miner tried to conduct mining operations in Lundazi but could not access the area and later tried Kaindu area close to Lusaka. This operation was abandoned because the available variety of amethyst (Amatyrine) was not in demand. This operation had cost about US$5,000 of the owner's pension savings. They moved to Kalomo (Mapatizya) amethyst area where they started with a repossessed mining plot where they established the mining operations. Unfortunately, after some litigation process, they lost the plot to the owner. Apart from a plot producing Zebra Amethyst which had little market demand, they rented a mine from a licence holder from which they were able to produce the highly sought lavender Amethyst and have acquired three other plots with very good potential. From the foregoing, it is evident that the company never relented despite several unsuccessful attempts. It took the skills of a retired teacher and advice from the Ministry of Mines and Minerals Development to achieve this.

The mine is not able to satisfy the market established through the services of a professional gemmologist who has been able to establish markets in India (Jaipur), USA (Tucson), RSA,

and Hong Kong. The demand for the high-grade amethyst from Tucson in USA alone was 4 000 kilograms (4 tonnes). A market for Zebra amethyst had been discovered in Hong Kong. This company now wishes to purchase mining equipment such as bulldozer, a generator, jackhammers and military tents to increase its production rate and productivity in order to satisfy the market. The company had in the past tried to use hired mining equipment but the rates of US$120/hr plus transportation charge of US$3.0/km were found to be too high and thus prohibitive for the mine. The mine is further threatened with illegal mining activities that have established market camps close to the production sites.

Ndola Gemstone, (Zambia)

A holder of a gemstone license started an emerald mine in Ndola Rural, about 60 km south west of Kitwe in the Copperbelt Province of Zambia. Mining operations started in 1988 after trenching and pitting for about a year. The mine was highly productive for the first two to three years but did not realize much revenue because of poor prices offered by the market. During this period, emeralds could only be sold through the parastatal company Reserved Minerals Corporation and its subsidiary, ZEIL. Due to these marketing restrictions, the company was compelled to withhold its production with the hope that such restrictions would be lifted. The bank interest charges for storage of the production forced the company to release the production through the same authorized channels.

With the advent of market liberalisation in Zambia in the early nineties, the gemstone marketing restrictions were virtually eliminated and the company was able to sell the emeralds on the open market. Prior to liberalisation, the Company relied on hired earthmoving equipment from an Equipment Hire company established by the copper mining giant Zambia Consolidated Copper Mines (ZCCM). Liberalisation led to the restructuring of this mining conglomerate into several that are concentrating on core business of copper mining. All the equipment that was being hired out was withdrawn and re-deployed to its former operating Divisions. In its place came the proliferation of equipment-hire companies whose charges were very high and reliability very low. As a result, equipment supply became very erratic and never on time. For instance, equipment ordered and intended to work in the dry season would only be made available in the wet season, which is operationally difficult. As a result of the difficulties, the company's operations have been drastically reduced.

The company has a compressor, an explosives magazine and fuel tanks on site although it lacks heavy earthmoving equipment. Efforts by the company to secure loans for capital investment and working capital from commercial banks have over the years proved futile. However, in 1989 the company only succeeded in securing an overdraft for working capital by using the gemstone production deposited with it as security. In the end the facility was discontinued because the company could not sustain the high interest charges. Efforts to secure a leasing facility of about US$ 75,000 from an international Corporation failed at the last minute because project was considered too risky. At an Investment Forum (FORMIN 94), representatives from international banking institutions showed little or no interest in gemstone projects and instead preferred gold or base metal projects. An arrangement where the company agreed with a buyer to swap its production in exchange for mining equipment was made in 1994. However, the deal failed because after receiving the first consignment of

200 kg of assorted emeralds, the buyer attempted to alter the terms and proposed for an outright purchase of the mine instead.

Conclusions and Recommendations

Overview

Small-scale mining is a commercial enterprise carried out to achieve high production and profit following universal business rules and principles. The widely semi-legal or informal character of the sector, operating outside any regulation framework often leads to the adoption of casual business approaches in the sector. Interventions in the sector must therefore consider regulations and formal recognition of the sector as priorities.

Building the capacity of small-scale miners to improve mining methods, business management, mineral processing and environmental management must also be looked at as priority areas for intervention.
The following broad recommendations and suggestions are based on our assessment of the key needs of the sector to enable it to make meaningful contribution to sustainable development and sustainable livelihoods.

Governmental structures & mining laws

Mining laws in Southern Africa are made mostly for large-scale mining and are not always supportive and appropriate for small-scale mining needs (e.g. the regulation of Exclusive Prospecting Orders (EPOs) in Zimbabwe). Therefore there is a need to lobby for a small-scale mining sensitive legal framework, giving equal opportunities to the big and the small players in the mining sector.

However, even if the legal framework is made more appropriate, government mining ministries and departments in many of the countries do not have the capacity and resources to address the needs of hundreds of thousands of small-scale miners. They also lack resources to implement and monitor regulations. There is a need for mining authorities to build grassroots structures fitting into existing small-scale mining communities to co-operate with the miners, instead of ignoring the sector. This will not help to improve the sector let alone make it a meaningful contributor to sustainable development.

In many countries in the region, NGOs are playing a very important role in closing the gap in communication between the small-scale miners, especially the informal sector, and the government and other development agencies.

Financial support, grants and loans

Usually, small-scale miners find it difficult to access loans from private finance institutions because of lack of trust and accountability in the sector. This especially applies for female miners and of course for the informal sector. It is almost impossible to get loans for working capital. Unfortunately, doubts about the ability and willingness of small-scale miners to pay back their loans are in many cases not baseless. Small-scale miners are by nature extremely mobile and therefore are prone to appear and disappear from one mining locality to another very rapidly. Nevertheless, it is still possible for small-scale miners to secure capital from at least three sources.

1. 1. Loans can be given by the buyers of mine products (e.g. tributor arrangements in Zimbabwe's chrome-industry.) and later be recovered from sales of products. Due to inequality of bargaining power between the small-scale miners and the big buyers, this arrangement can lead to quasi-slavery dependency for the miner if it is not properly designed.
2. Government support: There are several schemes to support small-scale mining, within the region. However, often, there is lack of transparency why or why not individual miners are supported. Support provided by government should be made transparent and eligibility criteria clearly defined.
3. NGOs & international donors: There are some programmes and projects which provides soft loans and grants to small-scale miners. However the main problem is still unsolved. Either the requirements for the miner are so complex and strict that an ordinary small-scale miner out of the target group could never fulfill it, or chances to get any money back for redistribution are limited. The administrative and management costs associated with disbursement off the loans or grants are often much higher than the capital provided. As a result, setting up sustainable revolving loan scheme has proved elusive in many cases. (for example the case of Austrian Foundation for Small Mines in Zimbabwe). Because of these problems some NGOs and international donor organizations (e.g. EU Micro Projects Fund) give grants, based on the knowledge that recovery loans costs more resources than can be recovered.

Capacity building

The small-scale mining sector in Southern Africa consists of several kinds of groups, syndicates, associations, co-operatives etc. Miners with common goals and needs are increasingly realising the need to work together and jointly find solutions to common problems. Collaboration is widespread on such issues like sinking a shaft, setting up a processing plant, fulfilling a market contract together, applying for support, or advocating and lobbing for underprivileged groups (e.g. women in mining) or the small-scale mining sector itself.

However, there is always the lingering danger of these groups getting controlled by one or a few influential individuals with a better economic status and possibly political connections. Consequently capacity building projects are therefore of critical importance for the sustainable development of the small-scale mining sector. Marginalized groups within the mining communities (e.g. women) need to be specially supported to strengthen their role in the sector.

Need for collaboration forum and co-ordination

There is a need for integrated solutions to the problems of the sector and improved cooperation between the various institutions. The sub-sector needs to establish a forum that would provide a coordinated approach to assessing and addressing some of the problems with this sub-sector as opposed to a piece-meal approach. The sector needs clear policy

guidelines, advices, best practices and exchange of experiences. The forum, probably under CASM will:

4. help miners and their families to improve their health and living conditions by introducing and investing in more appropriate environmentally responsible and safe mining techniques;
5. give miners and their families the opportunity to increase their incomes from mining to above-subsistence levels by forming cooperatives or miners clubs and using more advanced mining techniques;
6. decrease environmental and health risks imposed by small-scale mining on surrounding communities by introducing more environmentally friendly techniques; and
7. help protect surrounding communities, in particular indigenous people, from illegal mining activities by ensuring property rights and mining rights;
8. create conditions to enable artisanal and small-scale mining development to contribute to a wider regional development program;
9. accelerate the regularization of artisanal and small-scale mining sector
10. reduce tensions between the large mine sector and the artisanal and small-scale mining sector.

Technical support and appropriate technology

Technical support & appropriate technology dissemination has been main task for many development organizations (e.g. Intermediate Technology Development Group). Machinery and mining equipment is usually developed for medium to large-scale mining operations and is not always fitting for small-scale mining. Old and outdated machinery and mining equipment used to be (and still is) exported from industrial countries into developing regions following the partenalistic argument that *"for them, it still can do…"*. Nothing could be more wrong. This equipment was developed to match the situation in the 70s and 80s, when the industrial countries' mining sector faced a desperate lack of labour force and extremely high labour costs, while at the same time financial capital for investments was not an issue. Therefore, mining equipment was developed to save human labour at any cost.

Unfortunately, this machinery is found in Southern Africa's small and medium scale mining industry where in some cases unemployment is as high as 50 % and labour costs are extremely low. At the same time investment capital is not at all available to the miners. It is therefore necessary to develop technology appropriate to the scale of mining operations, but as well according to the special needs of the region.

Training and information

Besides access to financial and technical resources and a supporting legal framework, knowledge and information is another major pillar for a prosperous small-scale mining sector.

Technical mining-skills and even geological experiences are largely available within the mining communities, thanks to the fact, that a major part of the small-scale miners have been working for years in the region's large-scale mining industry.

However, there is still an enormous demand on training and information in the following areas:

Management skills

- *Legal knowledge*: Lack of knowledge and information is the main reason for small-scale miners remaining under illegal conditions hiding in the bush. Especially if their mining operations become successful, they are often kicked out of their own mines by better informed individuals or bigger companies, legally high jacking the claims and mining operations.
- *Business skills:* Since small-scale mining is a commercial exercise, at least a minimum of business skills and understanding is required. Lack of basic knowledge, how to manage an enterprise is most likely the main reason hindering sustainable growth of small-scale mining operations, even if natural resources are promising and production is reasonable.
- *Marketing skills:* Besides gold which finds a ready market everywhere, market research is often widely ignored by small-scale miners. As a result, the major share of profit is not achieved by the miners but by both legal and illegal traders and larger mineral consuming companies. It is necessary to provide information to small-scale miners about market requirements and demands, prices and how to achieve the required qualities and quantities.

Technical skills

- *Mining: B*asic technical mining-skills and even geological experiences are largely available within the small-scale mining communities. However, updated appropriate technology has to be introduced to the miners on a regular basis.
- *Minerals processing:* Appropriate minerals processing is obviously the weakest spot within small-scale miners technology skills. In the industrial minerals sector minerals processing is the most important part of a mining operation in order to match market demand and to optimise profits. Minerals processing is also mainly responsible (rather than the mining itself) for environmental damages.
- Awareness raising and information
- Obviously, any training for small-scale miner has to include awareness raising and information about negative environmental and social impact of their operations and how to avoid it. Training and information dissemination workshops should include not only the miners but also all members of the community and other stakeholders.

Research

The needs of the small-scale mining sector identified by this research demonstrate that more research is required for a better understanding of the sector and its contribution to

sustainable livelihoods. Priority areas for research include documentation and dissemination of best practice projects; sustainable environmental management and R&D in order to develop more efficient and affordable technologies for use by small-scale mines. Resolution of these and other issues offers the best hope for the sector to contribute to sustainable livelihoods and development.

Introduction and Definitions

The question of defining small-scale mining has been debated at some length but there is no single definition satisfactory to all stakeholders. Most of stakeholders have defined small-scale mining to suit their specific requirements. Some of the definitions applied to date are as follows.

South American perspective: Individual or collective extractive work, using rudimentary tools, manual devices or simple portable machines for immediate exploitation of a mineral which, by its nature, dimension, location and economic use, can be worked, independent of previous exploration work, according to criteria set by the National Department of Mineral Production.

African perspective: Small-scale mining refers to operations of individuals or organised groups (four to eight individuals), or co-operatives of ten or more individuals, which are entirely financed by exiting resources at a certain limit, and carried out on a full-time basis using simple traditional techniques and tools or low mechanization levels.

Asian perspective: Small-scale mining is the exploitation of mineral deposits which, due to their mode of occurrence and their size, can be mined economically by simple means and techniques. It has the following characteristics: either open-cast or shallow underground mining using simple equipment and methods; minimal investment on infrastructures and processing plants; heavy reliance on manual labour.

UN perspective: Small-scale mining is any single unit mining operation having an annual production of unprocessed materials of 50,000 tonnes, or less as measured at the entrance of the mine.

ILO perspective: In defining small-scale mining, ILO reports that, small-scale mining means different things to different people. To some it is dirty, dangerous, disruptive and should be discouraged. To others it is profitable, productive, or simply the only way out of poverty. The exact definition varies from one person or group to another in terms of: level of employment or number of workers in a particular mine; annual production statistics; level of mechanization; capital investment; size of claim being worked; limitation to nationals only

ITDG perspective: Small-scale miners are poor people, individuals or small groups who are dependent upon mining for a living, use rudimentary tools and techniques (e.g. picks, chisels, sluices and pans) to exploit their mineral deposits.

Artisanal mining: Individual work performed using low levels of mechanization, panners with rudimentary forms of mining using manual or portable equipment, and applied only to alluvial, colluvial and eluvial deposits.

Global Artisanal and Small-scale Mining

Artisanal or small-scale mining is a poverty-driven activity, typically practised in the poorest and most remote rural areas of a country by a largely itinerant, poorly educated populace with few employment alternatives. Such mining activities have substantially increased over the last years, in particular in many countries following the financial crises that drove many poor people, in particular women and children, into artisanal mining. Today, an estimated 13 million people in about 30 countries across the world are small-scale or artisanal miners, with about 80 to 100 million people depending on such mining for their livelihoods.

Miners and their families expose themselves to harsh working conditions for minimal income in a high-risk context, endangering their health as well as the surrounding environment. In areas where miners are invading the lands of indigenous or tribal peoples, there can be very serious cultural conflict, bordering on warfare, as well as environmental degradation and diseases brought to these regions by the miners. Meanwhile, much of the actual economic potential is lost due to the absence of a legal or fiscal framework for small-scale mining and due to rudimentary production, processing and marketing techniques. Public or private services to provide essential health care and education typically do not exist

Small-scale Mining in Southern Africa

Small-scale mining is commonly associated with informal, unregulated, under-capitalized and under-equipped operations, where technical and management skills are lacking. They are also believed to produce limited amounts of minerals erratically from uncertain reserves. Yet, while small-scale mining can lead to a wastage of non-renewable resources and be hazardous to human and environmental health, it can also enrich nations and economically empower disadvantaged groups by virtue of its low investment costs and short lead time from discovery to production. It is also important to note that this subsector produces minerals from deposits which are uneconomic on a large scale.

Small-scale mining is particularly labour-intensive and thus provides employment and incomes to large numbers of people who are generally uneducated, poor and live in remote areas where few opportunities exist for formal employment. It is estimated that in the Southern African region alone, more than 1.5 million people are directly employed by the sector and several million more benefit directly or indirectly from the activities which involve more than 30 different minerals dominated by gold and a variety of gemstones. In most of the SADC countries, mining is the only known economic alternative to agriculture and figures for those working within the sector jump dramatically during the recurrent droughts in the region. More than 50 per cent of those employed in it are women and children. It is estimated that small-scale mining sectors in most SADC countries contribute up to 5 per cent of GDP. In Zimbabwe and Tanzania for example, small-scale miners contribute up to 25 per cent of total gold production.

Small-scale mining is an important part of the livelihood strategy for more than 11 million people around the world according to recent ILO estimates (Jennings, N S (1999) *Social and Labour Issues in Small-Scale Mines.* ILO). This statistic came out of a rare, geographically wide-ranging survey of social and economic issues relating to the sector. The review of the

literature so far has not unearthed any study with field data exploring the ways in which small-scale mining contributes to poverty reduction. Sustainable Livelihoods (SL) analysis appears to be a promising approach to structuring research on the modalities of the sector's current contribution to poverty reduction, starting with the premise of looking at the full context of the capabilities, assets and sources of vulnerability. This contrasts with the traditional monolithic view of mining which has looked at it simply in terms of full-time employment. ITDG's own experience suggests that seasonality is a significant factor, but data are lacking. The SL framework also offers a way of elucidating the links between the micro and the macro-levels, looking at the market and policy environments. Also, combined with stakeholder analysis, it should be possible to look at the potential negative impacts on different groups.

The exact definition of a small-scale miner has been a source of considerable controversy in many SADC countries. This is because different criteria have been used in different countries to help define the sector. This has left governments, non-governmental organizations and donor organizations in a dilemma with regards to possible interventions. The Southern African Network for Training and Research on the Environment (SANTREN) has been working for the past five years on issues relating to small-scale miners. Specific topics in this field included standardizing definitions of small-scale miners in the various SADC countries as well as establishing the extent of the activity within SADC member countries and their contribution to wealth creation and poverty alleviation. SANTREN has so far produced training materials and conducted training courses for small-scale miners in Tanzania, Zambia and Zimbabwe. A considerable amount of baseline data on the sector has already been accumulated.

Small-scale mining is a Cinderella sector in the development context, probably because it has been assumed that it is simply not a major source of livelihood for many people. However, the ILO study mentioned earlier suggests that in a small number of poor countries, small-scale mining is a very significant source of livelihood for the poor in rural communities. Some work has, of course, been done, and ITDG is among the few development organizations which has documented intervention-based experience. Partly as a result of this marginalization, and partly because its origins are in non-renewable natural resources, the growing body of work, that has used the principles of SL, has barely touched on the small-scale mining sector.

Terms of Reference

This report is the output of a research study commissioned by MMSD Southern Africa and conducted by ITDG Southern Africa and SANTREN. The terms of reference for the study are the following. The first is to characterize the nature and extent of small-scale mining in six Southern African countries: Malawi, Mozambique, South Africa, Tanzania, Zambia and Zimbabwe, including but not limited to the following:

- The nature of the sector to determine the percentage of small-scale miners involved in: seasonal activities which complement other activities (e.g. agriculture) and have become integrated into the economic cycle; activities which supplement other incomes; activities which result from distress situations such as drought; activities which are

traditional and the principal livelihood and do not form part of a mixed economic system; and the number of women and children involved in the sector.

- Numbers involved and minerals mined (current and potential future).
- Production figures by mining methods (current and potential future).
- Purification methods.
- Waste disposal.
- Scope for environmental technology assessment (EnTA) and environmental impact assessment (EIA).
- Review of legislative and institutional arrangements (roles and responsibilities).
- Marketing arrangements.
- Sustainable development issues: economic, social and biophysical?
- What kind of technical assistance projects have taken place in the last ten years? Who were the principal co-ordinators, were they government initiated or donor financed?
- What was the nature of interaction between large- and small-scale mining, both positive and negative? Refer to issues such as land, land invasion and disenfranchisement?
- Characterize the nature of laws and changes made to laws over the past ten years. Note where no changes have occurred. Have any laws incorporated improvements?
- What kind of small-scale mining organizations exist? What is the nature of these organizations?
- What financing or credit schemes exist for small-scale miners. Are they effective and active?

The objective of the study is to establish the nature and extent of small-scale mining activities within the SADC region in terms of economic, social and environmental impacts and their role within rural SL strategies.

Study Methodology

The study covers six Southern African countries: Malawi, Mozambique, South Africa, Tanzania, Zambia and Zimbabwe. One researcher was contracted to gather data and compile the draft country report in each country. Since every target country has its own background and working environment, each researcher was given space to apply their own methodology to fulfil the terms of reference within the given time frame. Time and budget constraints meant the study was mainly conducted as a desk study and literature survey with limited fieldwork.

The researchers were monitored, supervised and coordinated by SANTREN and ITDG-Southern Africa. This final report was compiled in Harare.

Selection of Target Countries

The selection of target countries was partly an arbitrary exercise and was obviously determined by accessibility, state of the sector and the limited resources available. Tanzania, Zambia and Zimbabwe were chosen because of their long histories of small-scale mining. Considerable amount of data are known to be available through both the work of national governments as well as non-governmental organizations. This has resulted in some well-documented case histories of both successful and unsuccessful operations. Conversely, in Malawi, Mozambique and South Africa, small-scale mining is a relatively new phenomenon. Data are not easy to find and even harder to verify. The quantity is limited and the quality questionable. Governments in these countries used to ignore or avoid the sector if they were not too sure about how to deal with it. Mozambique has been taking a more serious focus on the sector recently as has been the case in South Africa. The size of the sector in Malawi is largely a reflection of the limited mineral resources in that country.

Despite the limited development of the sector and therefore the paucity of data, it was felt that research work in these countries is equally important and challenging. The development of the small-scale mining sector in these countries is fast catching up with the former group of countries and the lessons learned can be used for interventions in the latter group. Furthermore, the latter group provided the much needed contrast between the two groups.

Other SADC-countries were not chosen due to logistical considerations and, above all, the limited resources available for the research.

Research coordination and data compiling was done by Alex Mugova and Bernd Drechsler, ITDG and Doreen Vhevha, SANTREN. They were assisted by country researchers: Victor Chipofya, University of Malawi, Malawi; Salvador Mondlane Jr. and Eduardo Mondlane, University Mozambique; Hudson Mthega, MEPC, RSA; Post-graduate students University of Dar-Es-Salaam, Geology Department Tanzania; Munyindei Masialeti, University of Zambia, Zambia and Richard Svotwa, University of Zimbabwe, Zimbabwe.

Constraints and Limitations

Time was the major constraint, given the geographical area covered and the number of researchers who needed co-ordination. There were only 12 weeks between the launch workshop in Johannesburg (RSA) and the deadline for the draft submission. Certain data sources could not be followed up. Another was a limited budget which had to be shared among six countries and the coordinating organizations in Harare. As a result, nearly all data gathering was conducted through desk studies and literature surveys. There was little scope for fieldwork.

The majority of small-scale miners are in the informal sector. Naturally, data are sparse or not available at all. The legal status of the sector is not always clear and this makes access difficult. Ministries and other governmental organizations used to ignore the sector in the belief that regulating it would represent a waste of scarce financial and technical resources. However, in areas and countries where small-scale mining has a high profile traditionally, for example Tanzania, Zimbabwe, local and international NGOs, universities and other

organizations have had a positive input to the sector. Studies and research work has been undertaken and some data are available. While single case studies gave relatively exact data, because of the informal and highly mobile nature of players in the sector, the bulk of the data available must be treated with caution as they are mostly based on estimates. In areas and countries where small-scale mining is a new phenomenon (for example, South Africa), data on formal as well as informal small-scale mining are hard to access and even harder to verify. In some of these countries, significant information gaps could not be closed. However, the finding that there are significant information gaps in some countries is a positive and progressive step in the study of the sector in these countries.

Malawi

Introduction

The aim of this research project was to characterize the nature and extent of small-scale mining activities in Malawi in terms of economic, social and environmental impacts and their role within rural sustainable livelihoods strategies.

The information contained in this report was gathered through personal interviews with various technical staff at the Department of Mines Headquarters in Lilongwe, Malawi, as well as technical staff at the Department of Geological Surveys in Zomba, Malawi. Some data were obtained from relevant technical reports available at the two institutions, and where it became necessary to verify certain information, this was accomplished through personal interviews with appropriate personnel in the two departments.

Mining Methods and Timing

All mining activities in Malawi fall within the small-scale mining category. The total number of artisanal small-scale miners in Malawi is approximately 40,000. The number of people formally employed in the mining sector is about 3,700 (see Annex II).

The following are seasonal small-scale mining activities which complement other activities (mostly agriculture) and have become integrated into the economic cycle. No data are available on numbers of small-scale miners involved in the above activities.

- Mining of limestone for lime production is artisanal. Picks are used for digging; and shovels are used for shoveling out the limestone. Where the limestone rock is homogeneous, the rock is heated, as it cools it contracts and cracks. Lime production (except Portland cement production operations) is undertaken in the dry season only as the operators engage in subsistence farming during the wet season.
- For cement production, there is open-pit mining and the mining method is mechanized. Initially, waste rock is removed. Thereafter blast holes are drilled. The rock is then blasted before being hauled to a crushing plant
- The mining method of gemstones is artisanal. Miners use picks for digging, shovels for removing and hammers for cobbing out undesired minerals. Gemstone mining is undertaken in the dry season only because of difficulties in access to mining sites during the wet season. In addition, the operators concentrate on subsistence farming during the rainy season.
- Stone aggregates are mined using an artisanal method. Picks and shovels are used, with final napping using a hammer. With ornamental stones the mining method involves waste removal before drilling and blasting. For terrazo the mining method is artisanal using a pick and a hammer for sizing.
- Brick kilning is undertaken during the dry season only because of difficulties in kilning during the wet weather.

- River and Dambo sand mining involves shovelling and scooping. This is an alluvial product and is mined in the rainy season only when conditions are suitable for its regeneration.
- Ceramic clays are mined artisanally, using a hoe. Clay for moulding pots is processed in the dry season only to facilitate burning.
- Coal mining uses the adit mining method involving room and pillar. Alternatively, coal may be mined using the open-cast method.
- Salt is mined artisanally using a hoe and some facility for sieving.

All small-scale mining activities in Malawi supplement other incomes except in lime-making where the 5,000 or so people (12.5 per cent of total number of small-scale miners) involved in this process rely entirely on this mining activity for their livelihoods. Their farming involvement is for food purposes only. The areas involved in this regard are Balaka, Chipoka and Lirangwe.

It is only the 2,000 lime-makers in the Balaka area (representing 5 per cent of the total number of small-scale miners) who go into this activity solely because of the distressful drought situation in the area.

Some miners participate in the moulding of clay pots on a non-commercial basis. No reliable figures of the number of small-scale miners involved are available. The areas involved in this activity are Lilongwe (Nkhoma) and Dowa.

Involvement of Women and Children in SSM Activities

About 300 women (approximately 0.75 per cent of total number of small-scale miners) involved lime production in Lirangwe formed a lime-making association, with funding from the European Union.

There are only three women involved in gemstone mining in Malawi. These three come from Mzimba, Usisya (Rumphi) and Ntcheu, respectively. The number is this low because the mining process is very taxing, and the risks are high in that one is not sure of the outcome even after extensive prospecting.

Quite a number of women are involved in handnapping of stone aggregate. These women operate illegally, and government is working on a system where these women will be able to form associations, so that their activities can be facilitated and government can tax them.

There is no documented information on the number of children involved in SSM activities, although it is believed that children do assist.

Where Minerals are Currently Mined

The following are the most important minerals currently mined in Malawi (see Table 1 for amounts). Gemstones of different sorts (aquamarines, rosequartz and beryl which are mined in Mzimba; sapphire and ruby, mined in Ntcheu; agates mined in Chikwawa; and

amethyst mined in Chitipa) are mined. Almost all gemstones are exported, except <1 per cent which are used locally within Malawi. Limestone is mined for liming and for Portland cement production. The Portland Cement company mines its limestone from Changalume in Zomba district; while the Shayona Cement Company mines its limestone from Kasungu district. Stone aggregate is also mined. River and Dambo sand are also exploited. Beach sand processing is currently being tightened by government in order to minimize degradation of beaches. Ceramic clays are mined in Linthipe (Dedza district) and Senzani (in Ntcheu district). Coal is mined moderately in Malawi. Approximately 44,000 tonnes of coal is mined at Mchenga coal mines (in Rumphi) annually; 21,520 tonnes is exported to Mbeya, Tanzania; while the remaining 22,500 tonnes is used locally (Department of Mines, 1999). The ornamental stone amazonite is mined in Mzimba, principally for export as in terrazo. Salt is mined at an artisanal scale in the Lower Shire area (Chikwawa), and around Lake Kazuni (Rumphi).

Table 1 Annual Production Figures for Current Minerals Mining

Mineral	1994	1995	1996	1997	1998	1999
Coal	23,500	15,000	*72,000*	*37,000*	*55,000*	44,000
Cement	195,000	*145,000*	175,000	175,000	170,000	180,000
Lime	n.a.**	1,000	250	125	2,750	3,250

*No data are available for the year 2000 and for other years prior to 1994. In addition no data are available for other minerals

**n.a. implies no data available

Table 2 Potential Mineral Deposits and Reserves (1999 base year)

Mineral	Location	Reserves (millions of tonnes)
Bauxite	Mulanje mountain	28.8
Vermuculite	Feremu, Mwanza district	2.2
Rare earths	Kangankunde, Balaka	11.0
	Nathache, Phalombe	0.6
	Songwe, Chitipa	1.4
Strontianite	Kangankunde, Balaka	11.0
Phosphates	Tundulu, Phalombe	2.0
	Chingale, Balaka	8.8
Graphite	Katengeza, Dedza	2.7
Limestone	Bwanje, Ntche	14.9
	Chenkumbi, Balaka	10.0
	Chamama/Livwezi, Kasungu	30.0
Kaolinitic clays	Linthipe, Dedza	15.0
	Senzani, Ntcheu	0.5
	Mchinji	1.6
Glass or silica Sand	Lakes Chiuta and Chirwa	25.0
Titanium minerals	Tengani, Nsanje	100.0
	Salima	70.0
Uranium	*Ilomba and Kayerekera, Chitipa*	0.063

Table 3 Expenditure highlights government's efforts in mining exploration

Year	*Expenditure (Malawi Kwacha '000s)*
1994	2,500
1995	3,000
1996	16,000
1997	20,000
1998	30,000

Purification Methods

Only four of the minerals mined in Malawi require some form of purification as follows. Ceramic clays are soaked and stirred in order to get the fines moving through the tanks. Finally they are pressed to remove water in order to get the final material which goes for pottery production. The desired end-product limestone is determined by the kilning method. For normal lime, the heated limestone rock is simply ground into powder and packed. For hydrated lime, however, water is applied to the heated rock in order to facilitate the hydration process. Where limestone is being processed for cement production, the limestone first goes into a crusher. Afterwards, it is milled to the required size, mixed with shale and kilned using coal. Gypsum is added to the pellets that are formed after the kilning process before the final milling process to produce cement.

The purification of coal involves crushing to different sizes. This results into the production of either duff, peas or cobbles. Salt is purified through soaking of the soil and filtering. The section below outlines the different types of wastes and how the same are disposed of after mining different minerals.

- In gemstone production weathered rock and soil are merely pushed aside. The final unwanted rock is disposed of haphazardly.
- Limestone (for lime production) requires the disposal of soil and poor-quality limestone around the mining area. Limestone (for cement production) generates topsoil and poor quality stones as wastes (see Plate 1).
- Stone aggregate only generates topsoil as a waste material. This is disposed of around the mining area.
- River sand mining generates no waste except ground disturbance.
- Dambo sand also generates only topsoil as waste material, and this is disposed of around the mining area.
- Beach sand generates no waste.
- Ceramic clays generates topsoil and other unwanted soil as waste. This is disposed of around the mining area.
- Clay mining only wastes topsoil. This is disposed of around the mining area.

- Coal generates wasted topsoil through open-pit mining. The other wastes are over-burden rock, sandstone, mud-stone and shell from inside the mine. Duff is also left behind.
- Ornamental stone mining only generates topsoil and poor quality rock wastes. The latter are disposed of haphazardly around the mining area.
- Terrazo generates only topsoil waste. This is disposed of around the mining area.

Marketing Arrangements

The different types of minerals that are mined in Malawi have different marketing arrangements. Apart from commercialized operations like coal mining, and limestone processing for cement production, these arrangements generally depend upon the individuals or groups of individuals or associations mining the particular minerals.

Gemstones are marketed through the Gemstone Association of Malawi to the government. Limestone in the Balaka area is marketed through formal arrangements instituted by the Lirangwe Limemakers Association.

There are no formal marketing arrangements for stone aggregate, river sand, dambo sand, beach sand, and clays (pottery and brick-making). Although these miners are statistically unknown, they are quite important to the economy of the country because they support the construction and jewellery industries. In addition they support their families and dependants hence contributing positively to poverty reduction.

Table 4 Export values

Product	Quantity (tonnes)	Destination
Coal	21,520	Tanzania
Gemstones and industrial Corundum	8.4	Europe, USA, Asia
Limestone flux	6	Mozamboque
Quick lime	1	Zambia
Slaked lime	7	Mozambique
White lime	19	Mozambique
Portland cement	327	Mozambique, Zambia
Hydraulic cement	15	Mozambique
Dimensions stones	44	Mozambique

Note: the exact export values, especially for gemstones, are likely to be higher than the figure given, smuggling is a main reason

Financing Schemes for Small-scale Miners

Formally associated small-scale miners in Malawi can go to banks and get loans if their projects are viable. Within government, there was a proposal to set up a revolving fund for credit and machinery, especially for the gemstone sector. However, in view the philosophy of liberalization, the mining and mineral sector as a whole was left to shift for itself. This has negatively affected small-scale miners who can no longer borrow money from a government-supported revolving fund.

The Malawian government, however, does recognize that small-scale miners can spearhead development, particularly at the grass-roots level. That is why government encourages the formation of associations. With the exception of Lirangwe (Women) Limemakers Association which was funded by the European Union with a view to promoting women entrepreneurs, all other mining associations in the country are not funded. The Lirangwe (Women) Limemakers Association were provided with funding to purchase mills.

Environmental Monitoring

Scope exists within small-scale mineral and mining operations in Malawi for both environmental technology assessment and environmental impact assessment.

Sustainable Development Issues

Interesting infrastructural developments have taken place within the premises where medium-scale mining operations have been developed.

A primary school, health clinic and piped-water scheme have been developed at Mchenga Coal Mines in Rumphi. These serve both the employees and their families as well as local villagers. Another primary school and a health clinic have been built at Chingale limestone mining site; also serving employees, families and local villagers. A primary school was built at Namadidi lime-making factory serving the entire community. In addition to the above developments, small markets have mushroomed at most small-scale mining sites in Malawi.

From the point of view of environmental degradation, there is a need for an environmental management programme to be put in place in Malawi because currently the minerals and mining sector operates without much regard to protection of the environment and the sustainable utilization of natural materials.

There are insufficient resources targeted at both the Department of Mines and the Geological Department in the field of environmental management because government in the past did not view mining as an important sector.

Technical Assistance Projects

The only technical assistance project that has taken place in the past 10 years is the one that targeted the Lirangwe (Women) Limemakers Association in which the association was provided with European Union funding to purchase mills. Before that, ITDG carried out a research project to develop kilning of lime. ITDG did not run the project themselves. They asked the Ministry of the Commerce to identify an institution that could run the project. The ministry then identified Lirangwe (Women) Limemakers Association which they assisted to secure funding from EU to help them procure mills for the project.

Nature of Interaction between Small-scale Mining Operations

In the context of a regional and international perspective, all mining activities in Malawi fall under the SSM category. Some degree of interaction exists between workers at the

Mchenga coal mines and lime producers in Uliwa (Rumphi district) where the latter supply lime to another Mchenga coal mine where it is used as a fire suppresant (in case of a methane leak). In addition, some degree of interaction exists between Portland Cement Company which is involved in limestone mining for cement production, and the Mchenga coal mine which supplies the coal which powers the cement manufacturing process.

There is some negative interaction between small-scale miners of stone aggregate who process it through hand-napping (see plate 2), and intermediate-scale miners who quarry the stone aggregate. The two parties act as adversaries.

There is some hostility in gemstone mining between villagers and operators. Sometimes customary landowners or ordinary villagers do not want to give access to operators even if they possess the necessary permits from the Mining Department. This arises out of jealousy. Local legislation on gemstone mining stipulates that mining up to about 2m involves land that belongs to a customary owner. Beyond that, the law permits operators to mine in accordance with authorization obtained from government. Even so, customary landowners would still object. There is also some disenfranchisement between operator and customary landowner.

Approaches and Strategies in the Management of Small-scale Mining in Malawi

The Malawian government has encouraged small-scale mining operators to be licensed in order that they may operate legally. This has helped the government to monitor the SSM sector. It also helps government to provide the operators with proper mining techniques.

In terms of financing for operators, the government did try to create a revolving fund for the sector. Efforts in this direction came to nothing, however, with the principles of trade liberalization. Under a liberalized economy, the mining sector has to find funding for itself.

As an alternative way of facilitating funding for the sector, the government encourages operators to form associations under which their operations would be streamlined. Under such associations, lime-making groups in Malawi have become quite successful.

Lessons Learnt

In lime-making, an improvement was observed in production and remuneration through improved processing techniques following the establishment of associations.

In contrast, there has been a failure to organize themselves into associations in gemstone mining. The main reason for failure is the mistrust between the operators and the workers, thus there has not been much increase in production and earnings.

A major negative aspect about SSM operations in Malawi has been the damage the operations have caused to the environment. Following the abandonment of vertical shaft kilns for lime-making, allegedly because of their high capital cost, operators opted for using firewood. As a result there has been extensive deforestation and land degradation in almost all lime-making areas in Malawi.

A lesson from this is that government should have been more aggressive in promoting the vertical shaft kilns which were more environmentally friendly as well as best practice.

In terms of the protection of natural resources, operators need to be educated about the need to rehabilitate mining sites after exploitation, as opposed to believing that rehabilitation is the responsibility of government. After fulfilling the driving principle for venturing into small-scale mining — which is poverty reduction — operators should know that it is their responsibility to rehabilitate degraded areas, in the interest of future generations.

Ways Forward to Sustainable Small-scale Mining in Malawi

In order to facilitate the transition to sustainable development of SSM in Malawi, it is necessary that legislation be improved. An attractive mineral policy should be formulated to encourage local Malawians to invest in the mineral sector and to maximize the country's mineral production. Obstructions like fees, taxes and royalties should be such that they do not discourage prospective operators from investing in the mining and mineral sector.

Government should facilitate the provision of markets for mineral products within the country. In addition, it should nurture value adding to its mineral products. It should encourage the operation of cooperatives and associations at the grassroots level in order to reduce poverty. Alongside this, government should facilitate easy to access loan provision, donor funding, and access to extension facilities.

Government should also facilitate the formation of an institutionalized mining industry. In the case of minerals which are being exported without the knowledge of the government, the issue should be taken up with the National Revenue Authority (formerly the Customs Department) to ensure that corrective measures are put in place.

Where best practices and technologies are to be developed, a participatory approach in developing them should be adopted to ensure that they are acceptable and adopted by the operators. As far as possible, the bottom-up approach should be used during the development of these best practices and technologies.

Government should develop personnel capacity in the areas of mining and geological survey. It was observed during this study that in the past five years, no efforts in capacity building have been undertaken for the departments of Mining and Geological Survey, respectively.

Capacity building in these two departments needs to be enhanced in order to make more qualified people available for extension work, feasibility studies and civic education about the importance of the mining and mineral sector in Malawi. With an enhancement in capacity building, the target of improving the mining sector's contribution to GDP to over 3 per cent could be achieved. Minerals and mineral products contribute to the economy through import substitutions and export earnings, especially gemstones.

Legislative and Institutional Arrangements

Legislative instruments for the mineral and mining sector in Malawi are administered by the Mining Department in association with the Geological Survey Department. The main focus for the Geological Survey Department, however, is exploration. The Mining Department is also responsible for processing of all applications for mining and subsequently licensing them. It also guides miners on appropriate mining methods. In addition, the department is responsible for inspection of technology and safety.

The Mining Department liaises with the Department of Environmental Affairs in evaluating EIAs specific to the mining sector. The Ministry of Labour oversees the Occupational Health and Safety Act for the mining sector.

Arrangements are currently in hand to change legislation so that the Ministry of Labour only oversees occupational health in industries and factories while occupational health aspects pertaining to mining will be covered by the Department of Mining.

Laws Governing Small-scale Mining in Malawi

Mining operations in Malawi are governed by the Mines and Minerals Act 1982 (Cap 61.01). This Act is expected to be revised in 2003.

Up to April 2000, any proposals for the prospecting of minerals were accompanied by a complete EIA. Thereafter, regulations changed to allow prospecting proposals to come without an EIA. Then it was up to the Department of Mines to decide whether a full EIA was required or not.

Regulations pertaining to fees in the Mines and Minerals Act 1981 were changed in December 2000 to update them. The Explosives Act 1969 (Cap 14.09) was last revised in 1986. There have been no other changes to the act since, except for a change in fees in December 2000. Other legislation relevant to mining in Malawi are:

- Environmental Management Act, No. 23 (1996).
- The Water Resources (Water Pollution Control) Regulations (1978) require a permit for effluent discharges from industrial sources, including mines.
- National Parks and Wildlife Act (1992).
- Land Act (1965).
- Fisheries Management and Conservation Act (1997)
- The National Environmental Action Plan (NEAP) is in preparation.

Mining and Environmental Policy and Law

The Mines and Minerals Act (1982) contains detailed environmental provisions, which the institutional framework has not been able to enforce. An environmental impact statement must accompany all applications for mining rights with proposals for mitigating

environmental impacts (pollution prevention, waste treatment and progressive reclamation and rehabilitation).

While the EIA is mandatory, the environmental management plans are to be drawn up. Again it is worth mentioning that all mining activity is small-scale.

Small-scale Mining Organizations

There are five main formal small-scale mining organizations in Malawi. They are: Gemstone Association of Malawi for those people involved in the mining and dealing in gemstones; Malawi Association of Women Miners for women only involved in the mining of gemstone, limestone and salt (those members involved in gemstone mining would also be members of the Gemstone Association of Malawi); Lirangwe (Women) Limemakers Association is for those lime-makers living in Lirangwe area (they have a mill for communal use); Balaka Limemakers Association is for those living in the Balaka area (also with a communal mill); finally, the Chikhumbi Limemakers Association is for those in that area.

The following are informal small-scale mining associations which have yet to be recognized by government: Stone Aggregate Association; Dambo Sand Association; River Sand Association.

The government has been encouraging the move towards the formation of associations in order for it to be able to render more focused assistance to small-scale miners, raise revenue through fees, and also in order to control environmental degradation. There is also a Chamber of Mines in Malawi which is, however, currently dormant.

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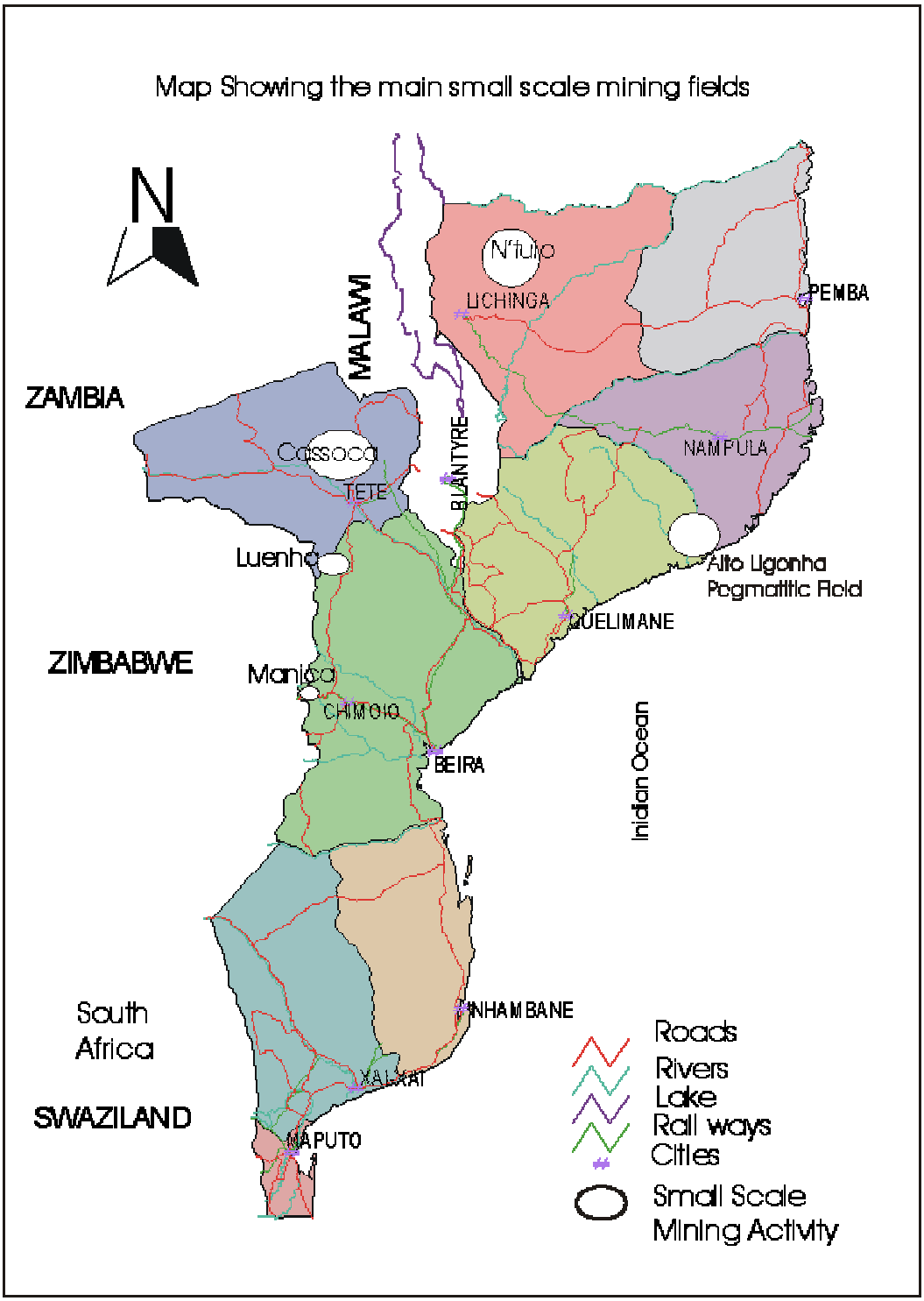
Mozambique



Introduction

The mining industry in Mozambique is dominated by a small number of small- to medium-scale open-cast mining operations and a large number of informal (artisanal) mining operations. Currently, foreign companies in joint ventures with local entrepreneurs or alone, are seeking to develop small- and medium-sized mines producing tantalum ore,

granite and marble blocks and bentonite. Formal mining production accounts for about 4 per cent of the country's total exports (in 1998 this figure was US$250m).

Small-scale mining and artisanal activities account for over 90 per cent of mining activity. Artisanal and small-scale mining operations in Mozambique are concentrated in the greenstone belt of Manica, the pegmatitic area of Alto Ligonha (Nampula and Zambézia provinces), and other mixed environments in Tete, Niassa and Cabo Delgado. The main products extracted by small-scale miners are gold, precious and semi-precious stones (emerald, tourmaline, morganite and aquamarine). Less-valuable products, such as clays, aggregates, dimension stones and heavy mineral sand (for tantalum) are also produced.

In this study we will look at all small-scale mining including artisanal. Mozambique's small-scale mining is very similar to that in other parts of Africa and is characterized by intensive labour, lack of finance, unskilled labour, use of poor technologies (artisanal), low productivity, insufficient safety measures and very poor knowledge of the geology or deposits concerned.

The informal sector has been contributing to the discovery of new mineral resources in Niassa, Manica, Tete, Zambézia, Nampula, Gaza and Cabo Delgado Provinces. Small-scale mining in Mozambique usually degrades the environment due to the backward mining methods and processing techniques used. The use of mercury in gold amalgamation causes severe health problems to the miners.

The main objective of this study is to determine how the small-scale mining component of the mining and minerals sector can best contribute to Southern Africa's regional transition to sustainable development. Another objective is to learn more about the nature of the small-scale mining sector and identify approaches and strategies used in dealing with and managing small-scale mining within the region.

Study Methodology

The study was mainly conducted as a literature survey with limited field work in the Manica area where field observations and role player interviews were conducted in order to gather additional information.

Relevant literature for the study was found at: the National Directorate of Mines in Maputo; the provincial delegation of the Ministry of Mineral Resources and Energy; the National Directorate of Geology; the Fundo de Fomento Mineiro (Mining Development Fund); the directors and marketing operators of the Mining Fund (MF) and specialists from the National Directorate of Mines were all interviewed in order to get additional information from their personal experience in addition to information from reports and open files.

Previous Work in Mozambique

The National Directorate of Mines (NDM) of the Ministry of Mineral Resources and Energy is the national institution responsible for issuing mining and exploration licences, regulate, promote, facilitate and supervise the mining activities in Mozambique. The NDM

has organised two national seminars on small-scale mining (1991, in Maputo and 1999 in Nampula Province).The main objective of the seminars were to define the role of the government in the sector and also determine the nature (potential and constraints) of the small-scale mining and its contribution to the national economy. The second CDI EU-ACP (Centre for the Development of Industry European Union – Africa Caribbean and Pacific) mining sector on the Small-Medium scale mining in Africa, exploration, development and the environment was held in Maputo in 2000.

These actions have been coupled with mining sector policy reforms and presently a new mining law is being ratified by the Parliament. The new law emphasises the role and nature of small-scale mining in the national economy, the need for environmental impact assessment, the environmental management program and finally the environmental rehabilitation (mine closure plans).

An artisanal mining baseline survey was conducted by the NDM in 1999 in the Murrupula region, a pegmatitic area in the North of Mozambique (Valoi, 1999). A second baseline survey on artisanal mining, this time at national scale, was conducted by a private consultant team in 2000 and was funded by the World Bank. The results of the later study are not yet of public domain. This shows clearly the interest of the government in defining the nature and the role of the small-scale mining in Mozambique.

Other works on small-scale mining and environment include Manuel and Vicente (1999 and 2001), and the annual reports of the Ministry of Mineral resources and Energy,

Nature of the Sector

Artisanal mining is one of the oldest economic activities of humanity. Gold panning in the Archaean part of Mozambique is reported since the Monomotapa Empire time (14th century). Gold panning used to be prohibited in Mozambique and it was only in 1989 that small-scale/artisanal mining became acceptable by the authorities. The long drought of 1990 –1993 drove many peasants to gold panning in many provinces of Mozambique. In 1999 the number of gold panners reached the number of 20000 in Manica Province and in the entire country over 60000 people were involved in small-scale mining. In general most of the mining activities are practised during the dry season while in the wet season most of the people resume their agricultural activities. Table 1 suggests that in Nampula and Tete mining is mainly seasonal while in Manica and Niassa this activity is in general non seasonal.

Table 1 Mining (part-time) Seasonal or Main Source of Income

Mining seasonal or main source of income	Niassa %	Tete %	Nampula %	Manica %
Main Activity	70.6 (48)	0	35.3 (6)	71.7 (43)
Seasonal activity	29.4 (20)	100 (10)	64.7 (11)	28.3 (17)

Table 2 Sources of Income for Artisanal Miners

Sources of Income	Niassa %	Tete %	Nampula %	Manica %
Agriculture	10.6 (7)	91.7 (11)	31.3 (5)	43.9 (25)
Fishing	4.5 (3)	8.3 (1)	0	3.5 (2)
Hunting	1.5 (1)	0	0	3.5 (2)
Mining	83.3 (55)	0	68.8 (11)	49.1 (28)
Total	66	12	16	57

The real numbers of people involved in economic activities such as agriculture, fishing, hunting and mining are unknown. Nevertheless, the survey conducted last year suggests that the main income of the artisanal miners is from mining activities except in the province of Tete where agriculture accounts positively and predominantly for 91.7 per cent of respondents. Table 2 shows the contribution of complementary activities to the income of mining communities and also shows that everywhere agriculture is the mainstream economic activity.

The closure of 90 per cent of larger mining and agricultural companies in the Manica, Nampula and Zambézia provinces in the 1980s and 1990s has resulted in artisanal mining becoming one of the main sources of income for local communities.

The majority of artisanal miners are men. Women are predominantly involved in transporting, washing and panning. Other supplementary services performed by women in support of artisanal mining include child care, household chores, food and drink selling. Children between the ages of 6 and 10 are involved in activities similar to those of the women. Women and children directly make up one-third of small-scale miners (i.e. 20,000 in 1999).

Mining Methods

Mining methods for artisanal miners consist mainly of digging pits. In these open-pit mines, the overburden is about 1 to 1.5 metres, and removed by shovelling. Once the ore is reached, it can be extracted using picks and shovels, chisels and heaped on the ground. The transporting of ore from the pits to the surface is conducted using ropes and buckets. Once enough ore has accumulated, it is separated from coarse and unwanted material, in case of gold, or is hand picked in case of gemstones (Baseline Survey, 2000).

Table 3 Mining Methods Used in Small-scale Mining

Mining methods	Niassa %	Tete %	Nampula %	Manica %
Open pit	98.6 (68)	100 (12)	100 (17)	98.3 (59)
Underground	1.4 (1)	0	0	1.7 (1)
Other	0	0	0	0

Table 4 Processing Methods

Processing Method	Niassa %	Tete %	Nampula (gemstone area)	Manica %
Sluice box	39.4 (26)	16.7 (20	-	29.5 (44)
Panning	60.6 (40)	83.3 (10)	-	35.6 (53)
Amalgamation	-	-	-	34.9 (52)
Total	66	30	-	149

Source: Baseline Survey, 2000

The pits (see photo) are often close together with only 1.5–3.0 metres between. Some pits can be as deep as 10 metres. Rudimentary ladders made from logs are used to get in and out of the mines. Very few shallow underground operations are reported in Manica and Niassa provinces (see Table 3).

Gemstone Mining Using Simple Tools in Namuhara, Nampula Province

For both mining methods, the overburden and the waste are dumped near the mine and only moved a matter of metres away if it is in the way of the work. For relatively large operations like Munhene and Mimosa, the dump of the overburden covers several metres (say, 50 x 200m) (see photo).

Processing and Beneficiation Methods

Washing using sluice boxes, wooden pans and amalgamation using mercury are the main processing techniques used in gold artisanal mining (see Table 4). Sluice boxes and wooden pans are made locally by craftsmen. Although made locally, these boxes represent a relatively expensive piece of processing equipment because of the high prices demanded for the 200-litre drums, used as screen and feeder to the sluice box. In N'tulo in Niassa, Munhena in Manica and Murrupula in Nampula an intensive use and hiring of more sophisticated sluice boxes is common. The sluice boxes used in some areas (for example, Sussundenga) are less sophisticated and made from tree bark.

The process of washing (gravity separation) begins with the ore being transported, mostly by women and children, and then fed into the feeding drum. The feeding drum is made from a 200-litre drum cut longitudinally with small holes punched at the bottom (see photo).

On top of the feeding drum, a large screen is used to separate the ore from the unwanted material. For water feeding to the washing process, a 20-litre tank with punched small holes on the lower part of one of its sides is used. This is used for washing, transporting and separating the fine gold particles from the 'gangue' material. The material is washed down into a series of elongated riffled boxes fitted with a piece of blanket type or sack where the gold is caught and the tailing discharged directly into the river. The blanket is then washed into a pan were the gold pre-concentrate is then separated from the rest of the accompanying minerals.

In N'tulo (Niassa), Murrupula (Nampula) and Munhena (Manica) the sluice boxes are actually placed near or on the riverbanks. To accumulate water for washing, rivers are diverted to form pools. In Sussundenga, miners dig on the river bed, riverbanks and in trenches and galleys opened by the watercourse. Both mining and processing take place directly on the river bed. The water used in the process is obtained by diverting, collecting and channelling it through to metal pipelines. The system benefits all the miners in the area, where groups or individuals queue for washing.

The gold produced is generally very fine. Recovery rates, using the locally built sluice boxes (see photo) and pans, vary between 20 and 35 per cent, as most of the finest gold particles get lost during the washing process (Baseline Survey, 2000).

A locally built sluice box, equipped with a 20-litres gallon for water-feed used to recover the gold in N'tulo, Niassa Province

In Cassoca, Tete Province, coarse gold particles are reported. During the dry season, the miners here dig pits of about 30 to 50 centimetres to accumulate water for washing (see photo).

Sluice box built from tree barks in Sussundenga, Manica Province

Reports in the Baseline Survey observed that the processing methods used to recover gold are very inefficient and the recovery rate is low. The main reason is that most miners are either not aware of other technologies or cannot afford them anyway. The fact that women recover gold by simply reworking tailings left behind by men shows that the processing methods are inefficient. The amount recovered by women in this exercise is close to half of the quantities produced by men in the same situation.

Mercury is intensively used in gold processing in the Manica and Niassa Provinces where primary gold quartz veins are mined. In Manica and parts of Niassa, the use of mercury in the amalgamation process for recovering very fine gold is common. Gold amalgamation consists of mixing the pre-concentrate of gold with mercury to obtain an amalgam, which is then heated in the open air, and the gold is recovered. Mercury has the capacity of collecting microscopic gold particles to form Au-Hg amalgam.

In the process of amalgamation, part of the mercury is released directly into the river system, part of it inhaled by the processor as no masks are used and part of the mercury is released into the atmosphere. This gold amalgamation is often done near a river and in open places.

Gemstone Processing Methods

Gemstone-processing methods consist of hand sorting with the aid of the visual characteristics of the gems (fluorescence, shine, colour). No equipment is used in this process. The next step in the processing of gemstones is 'cobbing'.

Cobbing involves the removal of non-gem material from coloured gemstones (see photo). Normally, the pieces recovered during hand sorting in the pits and trenches still need further cleaning using hammers, chisels, pliers or pincers or even a grinding wheel. This has to be done with utmost care in order to prevent cracking the gems.

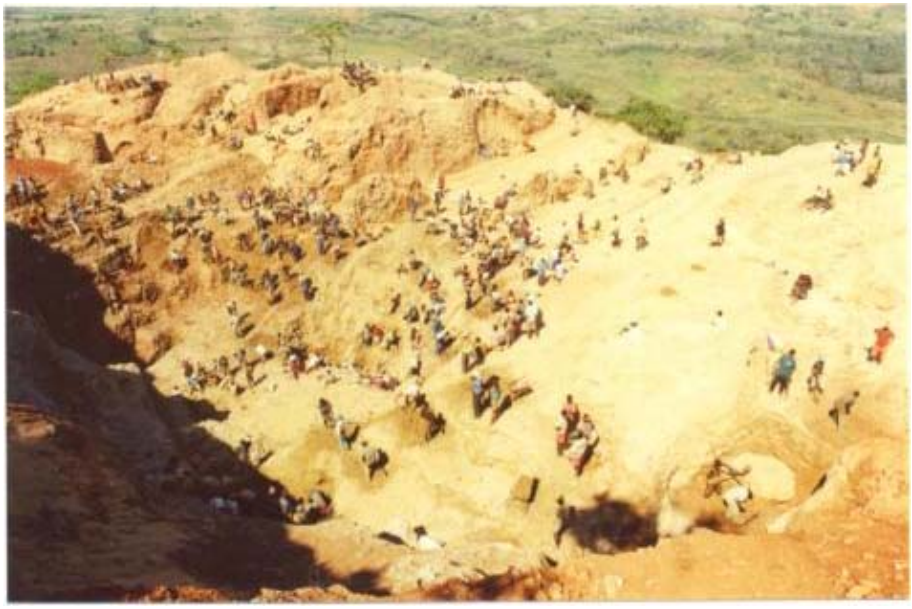
Pits used for panning gold in Cassoca, Tete Province

Knocking is the final stage in the processing of coloured gemstones. The most important tool is the knocking hammer which requires great care in handling.

The mining (digging) of gold reefs does not follow any mining and safety criteria. This is driven by a desire to quickly get to the reef and consequently the miners dump the overburden very close to the pit and only move it away when the pit becomes unstable due to presence of the dump (see photo).

Small pieces of gem-quality aquamarine obtained after the cobbing process

During processing (washing and panning for gold) tailings are dumped directly into the rivers (see photos).



Dump next to mine at Munhene mine in Manica

The provincial delegations of the Ministry of Mineral Resources and Energy (DPMIREME) have been involved in helping the miners with guidance for safe mining methods and more appropriate dumping. In order to prevent miners from discharging the tailings directly into rivers, the DPMIREME is training the miners to divert the river into a dam and then wash and pan using a basin outside of the main river bed. These efforts have been giving good results in the Manica Province. The most immediate result is reduction in river siltation and river contamination by mercury. It was observed in Manica, that in order to make the miners follow the above technique, regular inspection by the DPMIREME is required. The DPMIREME does not have enough funds to guarantee regular inspections of the mining sites.

Trade in gold and gemstones is dominated by private dealers. It is estimated that about 250 private mineral traders deal in gold and gemstones every year. Because of the uniqueness of the market arrangements, the gold and gemstone markets are described separately.

Gold

The gold market is a complex network of private dealers (buyers), the Fundo de Fomento Mineiro (FFM) a mining development fund and anonymous individual buyers. The complications of the market structure is compounded by secrecy in dealing with illegal buyers and illegal producers. The legal framework dictates that all gold producers sell their gold to the FFM. The FFM is a Ministry of Mineral Resources and Energy instrument created with three main objectives:

- To contribute to increased knowledge of Mozambican mineral resources and to fund the policy for development of mining industry in Mozambique.
- To fund and assist the promoters of small-scale mining activity.
- To assure investment in and output from the small-scale mining activity contributes to the further development of the mining sector in Mozambique.

The FFM has also been involved in the buying of gold produced by small-scale miners in Manica, Niassa and Tete provinces.

A study conducted last year discovered that in Manica, Nampula and Tete provinces, most of the gold produced by small-scale miners is sold to private buyers (see Table 6). The FFM is actually the second-largest buyer of gold, because the private dealers offer higher prices than the FFM. Niassa Province is the only place where most of gold is sold to the FFM (see Table 5)

Table 5 Different buyers of small-scale/artisanal mining products

To whom do you sell your gold?	Niassa %	Tete %	Nampula %	Manica %
Dealers or traders	14.7 (10)	81.8 (9)	64.7 (11)	51.7 (31)
Government (FFM)	82.4 (56)	18.2 (2)	35.3 (6)	43.3 (26)
Commercial licence holders	-	-	-	-
Others	2.9 (2)	-	-	5.0 (3)
Total number	68	11	17	60

Source: Baseline Survey 2000

Some producers travel to the provincial Capital City or even the country Capital City, or neighbouring countries (Zimbabwe, Zambia and Malawi) to sell their gold personally.

The dealers or traders usually do not hold any licence for trading in minerals to avoid high taxes and because of the lack of institutional monitoring and supervision by governmental authorities.

In Niassa, the access is relatively easy from Tanzania to the gold-mining areas. Most gold buyers come from this country and most miners sell non-quantifiable amounts of gold produced in Niassa directly in Tanzania.

In Manica and Nampula, because of easy access to the mining areas, gold marketing is dynamic. Dealers from the capital city of Nampula and Zambézia Provinces, Nampula and Quelimane respectively, control the gold business. These dealers later sell the gold in the cities, where a number of gold craftsmen work the products for jewellery. The jewellery is sold locally in these cities, Maputo, and most of the gold is exported illegally.

The relationships between buyers and miners are purely commercial with no pre arrangement or credit. The selling is on cash basis only. However, in Manica, buyers may provide mercury in advance to the miners in order to guarantee the purchase of the product. Although, this action does not seem to influence the price fixing for gold, it has had a tendency of creating dependency and indebtness among the miners, who have to produce and sell the gold to the same traders.

The FFM plays a very important role in supporting the marketing of gold in Tete, Manica and Niassa. It channels the gold produced by the small-scale miners to official markets and helps in establishing production records (see Table 6) that have been nonexistent until now.

Table 6 Estimate of gold commercialized by the formal sector in Manica Province

Year	1997	1998	1999	2000	2000	2001	2001
Months	Aug–Dec	All	All	All	Jan–Feb	March	April
Au (g)	2,067	9,527	11,535	15,837	740	5,086	5,438

Note: During January and February the formal sector bought very little gold because of the rainy season in Manica. In March and April the roads to Maputo and Beira were closed by flooding in the central part of the country, hence the limited presence of buyers from other provinces and capital cities.

The FFM in Manica Province also offers technical assistance to the miners and at a certain stage it tried to organize the miners into cooperatives and supply them with mechanized working instruments (see photo).

Concentrator Knelson property of the FFM for supporting the small-scale miners

The FFM determines the price according to the reserve bank's determination which it then offers to the producers. The dealers determine the price of gold and usually offer more lucrative prices. In Murrupula and Namuhara traditional chiefs in consultation with the mineral traders also play a role in price fixing for gold (Baseline Survey, 2000). As a result different prices are in place and vary from $6.6 to 7.0 per gram. The highest prices are reported in Manica and Niassa and lowest prices in Tete.

The Gemstone Market

The gemstone market is very similar to the gold market described above with the important exception that the FFM is not involved as a buyer. During this study I was not able to find anyone who could explain to me the reason why the FFM is not involved in the buying of gemstones. Private traders come from cities within the country, neighbouring countries and as far as Germany, Taiwan and the US. South Africa and a number of West African countries dominate the marketing of gemstones in Mozambique.

The local dealers sell the stones in the big cities or in neighbouring countries to the lapidarians for jewellery or for illegal export. A good-quality sizeable aquamarine in Namuhara is normally sold at up to $25 a gram.

In general most of gold and gemstones are bought by private traders, the majority of whom have no licences (thus illegal operators). The gold and gemstones collected by private buyers may represent over 80 per cent of the total production of the small-scale mining sector.

The production figures are inaccurate because of the nature of the marketing structure in place (see also previous section). The miners do not declare real production figures in order

to discourage interest from potential bigger mining companies or legal operators, which might expel them from the area. The other reason is that the environment is secretive and they worry that government may be interested in taxing them.

The Baseline Survey reports about 600 to 900 grams of gemstones on average are sold per month in Namuhara, for example. Nation-wide these figures would translate into tens of kilograms.

Gold production is estimated on the basis of FFM records of gold bought, suggesting that in Manica only an average of 6–10kg is produced by small-scale miners (see Table 6, March and April 2001, when there were few buyers in Manica due to floods in the central Mozambique). The fact that Manica is not the leading small-scale gold producer and that the FFM does not account for all production, it is clear that nation-wide (Niassa, Zambézia, Nampula and Tete provinces) gold production might be in a range of 30–40kg per month.

Gold production is estimated to be 10–15 grams per month per miner. In Manica, production levels reported were stable and slightly higher. Because of a lack of tools and inefficiency in methods, women produce half and children even less of the quantities that are produced by men miners (Baseline Survey, 2000).

Legal Framework in Mozambique

The mining law in Mozambique was last revised in 1986, 16 April (no. 2/86). The 14 years of application of this law has shown the need to adjust it in line with recent developments in the sector on one hand and to meet the new mining activity challenges within the recently approved Geological and Mining Policy guided by resolution 4/98, 24. The ongoing review aims to harmonize it in relation to recently approved economic laws such as the Land Law (no. 19/97), the Environmental Law (no. 20/97), the Fiscal Law and the Arbitrage, Conciliation and Mediation (nos. 5/99 and 11/99, respectively).

The mining law has had amendments on its fiscal regime on the light of the new Fiscal Law no. 5/99, the other amendment was that in the new Land Law, mining activity no longer represents a zone of partial protection. The present Mine Law allows four types of licences: the prospecting and exploration licence; the mine concession title (for the exploitation of mineral resources); the quarry licence; and the mining certificate.

The revised Mine Law includes several changes such as its inclusion of the mineral medical waters, the introduction of a Reconnaissance Licence for preliminary stages of exploration, the introduction of Mining 'Senha' which authorises small-scale mining activities in designated areas of less than 1,000 hectares. The new law will encourage private investment in the development of the mining sector and will leave the government the role of regulating, facilitating, promoting and monitoring this activity. The state will, however, continue to do geological activity and national mineral inventory.

The new Mine Law will include a specific section on the environment according to the Environmental Law. It also introduces the priority of mining activity over other economic activities. It will introduce a section on the marketing of mineral resources. At the moment the marketing of mineral resources by individuals or companies is regulated by Decree

31/95. The operators apply for a licence, which entitles the individual or company to buy and sell mineral resources. There are basically three categories of licence: the first includes those operators buying minerals for their own use (including jewellery); the second is for those operators buying one in order to sell it on to other operators (nationally) with or without added value; the third is for operators buying and selling with or without added values at national and international level. Each licence category is issued at fixed rate of $250 for category one, $500 for category two and $1,000 for category three. All are valid for one year.

This new Mine Law is at its final stages of drafting and will be put before parliament before the end of the first semester of 2001. The Baseline Survey has shown that most of small-scale miners do not have mining titles (see Table 7) as required.

A National Commission for the Environment has been set up, existing acts and regulations include:

- General Environment Act, No. 20 (1997);
- Sectoral Legislation/Regulations with mining relevance;
- Land Act (1979);
- Water Act No. 16 (1991); and
- Pesticides Regulations (1987).

Table 7 Artisanal Miners having Mining Titles

Have you any mining title?	Niassa %	Tete %	Nampula %	Manica %
Yes	3 (2)	9.1 (1)	0	3.4 (2)
No	97.0 (64)	90.9 (10)	100 (17)	96.6 (57)
Total	66	11	17	59

Source: Baseline Survey, 2000

Table 8 Work Organization Among Artisanal Miners

For whom do you work?	Niassa %	Tete %	Nampula %	Manica %
Self-employed	49.3 (33)	100 (12)	56.3 (9)	83.3 (50)
Family	0	0	0	0
Do you have employees?	0	0	0	5 (3)
For someone else	0	0	12.5 (2)	5 (3)
Working groups	50.7 (34)	0	31.1 (5)	5 (3)
In co-operatives	0	0	0	1.7 (1)

The Mining Act (1986) only sets out a general framework for mineral exploitation, but there are no provisions concerning environmental issues. The Mining Regulations (1987) has sections with restrictions on mining activities in designated areas. There are specific provisions within legislation for: EIA; auditing; monitoring; rehabilitation; pollution control; and financial provision for rehabilitation.

Small-scale Mining Organizations

Small-scale miners are mainly organized in small groups (up to five) composed most often of members of the same family (Manica) or very close friends (Matos, 2001; pers. comm.). The reason for this is the need for trust during the operation. Self-employed individual workers (49.3–100 per cent) are more common and the working groups are the second important form of organisation in Niassa, Nampula and Manica (see Table 8).

According to the Baseline Survey, local authority structures play some role in the relationship within artisanal mining communities especially local government, state administration and traditional and religious authority (*curandieros, mwenes or barozos*). The police, mining departments, traditional chiefs (or *regulos* in some cases; a remnant authority of the Portuguese colonial administration), village secretaries and leaders of miners' camps are all reported to exercise some authority in these communities.

For example, the traditional chief's representative declares rest and workdays for the miners and is also responsible for settling social disputes at camps. If mediation through the chief fails, cases of crime at the camp or in the villages are referred to the local police. In return for his work, miners 'pay' the traditional chief's representative a sack (c. 50kg) of gold ore in honour of his role and power.

Financing Schemes

Small-scale miners are eligible to get funding from commercial banks and are expected to have at least 20 per cent of the required resources to co-fund a project. The FFM is the only source of direct credit for small-scale miners. The figures and the number of beneficiaries of this credit scheme are unavailable. It is reported that the fund has financially assisted several miners especially in the gemstone field of Alto Ligonha (Matos, 2001; pers. comm.).

To qualify for funds, candidates need to make a request to the president of the FFM and if the funds required are for purchase of equipment they should append quotations. They should also append the following documents: a copy of their mining licence; a feasibility study of the project; proof of possession of 20 per cent of the amount requested; guarantees of a property equivalent to the requested amount (say, a mortgage); repayment plan for the credit; proof of a market for the product to be produced. These requirements are completely prohibitive to an ordinary small-scale miner.

Most of the miners who have managed to get the credit neither honour the payback plan nor invest the funds in mining. Some invest it in buying and selling, while others acquired luxury commodities (for example, vehicles).

The fund has no adequate means of monitoring the progress of the implementation of the projects and for disbursement of funds, it relies on progress reports, usually not the reality on the ground. In general the fund is ineffective for helping the growth of the small-scale mining sector. This has been identified and a new regulatory scheme with recommendations from the World Bank is being discussed with all players.

Table 9 shows that very few miners benefit from credit schemes with exception of Niassa where over 68 per cent have benefited from credits (source not specified).

There are no reports of non-governmental financial support to small-scale miners in Mozambique.

Technical Assistance Projects

The are no donor-funded projects for the technical assistance of small-scale miners, except for the SASOL Company of South Africa, which offered wheelbarrows, shovels and picks. SASOL decided to offer mechanical equipment to the Munhene miners in Manica, but the miners refused, alleging that the spirits did not want any noise caused by machinery in that area. The only technical assistance reported in the Manica, Niassa and Tete are part of Provincial Delegation of the Ministry of Mineral Resources and Energy. These initiatives include assistance in the mining methods and correct procedures on the use of mercury for gold amalgamation (Manica) (Annual report, 1999).

Table 9 Support Schemes to Artisanal Miners

Do you get any kind of support?	Niassa %	Tete %	Nampula %	Manica %
Financial	*21.4*	100	100	91.1
Equipment	*7.1*	100	100	55.4
Other	21.4	100	100	97.1

Source: Baseline Survey, 2000

The provincial delegation also promoted awareness campaigns to explain the norms and regulations that guide the geology of mining activity and the marketing of gold and gemstones.

A change in mining methods includes use of sedimentation basins opened alongside of the river to be used for gold panning and washing in order to prevent direct washing into the river. This method minimizes siltation and contamination of the rivers.

The use of mercury for gold amalgamation requires special protection and care in handling. The provincial delegation of Manica (PDM) has been training the miners safe ways of handling mercury and they introduced the technique of retorts for recovering the mercury during roasting of the amalgam. The retorts are given free of charge by the FFM in Manica Province.

Another initiative of the PDM to bring in programmes of environmental rehabilitation by the gold panners after mining an area. This has been a successful experience because the PDM team worked with landowners, who are respected by the miners and thus obeyed. The FFM organized the miners into cooperative schemes and supported them technically by letting them use the Concentrator Knelson to treat their ore (see Figure 7). This initiative later failed because miners prefer to be independent and to process even a very small amount of ore. It also failed because they do not trust machines and suspect that they lose gold during mechanical processing.

In 1999, the UN was interested in implementing an environmental project with the aim of reducing the contamination of rivers by mercury and raising the awareness of miners on the consequences of mercury on human, animal and plant organisms.

The Baseline Survey reports that picks, shovels and sluice boxes are the most common implements used in all areas. The use of ore-smelting techniques such as fire is reported in Manica (28 per cent) and Nampula (5.9 per cent).

If one looks into the backgrounds of small-scale miners in Mozambique, one finds that most of them have no formal training in mining-related subjects as shown in Table 11. The only exception is Manica Province where miners received hands-on training in the recently closed down mines Benicon, Monarch Mine, Mundonguara and Alma.

Table 10 Implements and Techniques Used in Artisanal Mining

Tools used for mining	Niassa %	Tete %	Nampula %	Manica %
Pick	58.2 (39)	77.8 (7)	52.9 (9)	86.4 (51)
Shovel	26.9 (18)	22.2 (2)	35.3 (6)	88.1 (52)
Sluice box	14.9 (10)	0	5.9 (1)	54.2 (32)
Explosives	0	0	0	0
Fire	0	0	5.9 (10)	28.8 (17)
Compressors	0	0	0	0

Source: Baseline Survey, 2000

Table 11 Mining-related Training Received by Small-scale Miners

Training related to mining activity	Niassa %	Tete %	Nampula %	Manica %
Geology	0	0	0	50 (11)
Mining	0 (3)	0	0	31 (7)
Processing	0	0	0	13.6 (3)
Gemologist	0	0	0	0
Others	25 (1)	0	50	4.5 (1)

The general picture suggests that any intervention in technical support to the sector should include training for the miners in the basic subject matter of mining methods, environmental science and management skills.

Interaction between Large- and Small-scale Mining

There was competition between large- and small-scale mining activity when the two activities coexisted in Mozambique. The large-scale exploration companies stopped all activity in the late 1990s (see Table 12) because of lack of money. There was also land conflict between large-scale mine (exploration companies) with small-scale miners because the latter used to mine (sometimes at night) in the concessions of the large-scale mining companies. An example is the discovery of very rich reef in 1998, within the exploration concession area of North Rand Company in Manica where police was called into guard the place day and night.

Small-scale miners sometimes mine areas already rehabilitated by big companies, for example in Manica at Chua River alluvium where artisanal miners worked in areas rehabilitated by ALMA/BENICON company.

Table 12 Exploration and Mining Companies in Manica Province

Exploration company	Mining company	End of activity	Remark
Ashanti Gold Fields		1999	Insufficient reserves
Trillion Co.		1998	Insufficient reserves
North Rand		1998	Insufficient reserves
	Mincor (Monarch)	1997	Financial problems
	Alma/Benicon	1995	Insufficient reserves
ZIMOZ		1998	Reason not known
AUSMOZ		Active	

Large- and small-scale miners can work together for mutual benefit by using the small-scale miners in sections that cannot be mined profitably by the large mining companies. Small-scale miners can do the work and sell the proceeds to the large-scale mining company. An example is the mining of chromite at Great Dyke in Zimbabwe where small-scale miners organized in cooperatives mine chromite ore and sell it on to Zimasco and ZimAlloys. Another example is in Mozambique where small-scale miners were allowed to operate in the ALMA/BENICON concessions as long as they sold their product to the company.

The positive impact of this interaction is the guarantee of a market for the small-scale miners and the possibility of having better working tools supplied by the large-scale mining company. Negative impacts relate to social benefits, working hours, safety regulations and pricing of the product — which is determined by the company. These scenario tends to lead to the over-exploitation of the small-scale miners by the large-scale mining companies.

Scope for Environmental Technology and Impact Assessment

The environmental impact of small-scale mining is quite visible and includes soil erosion, deforestation and the use of mercury in the gold recovery by amalgamation in Manica Province. Mercury discharged into the environment contaminates the food chain and consequently causes severe health problems to humans and the rest of the ecosystem.

Erosion destroys riverbanks, diverts rivers from their normal course and increases siltation (caused by direct panning in the river systems). In Manica and Nampula, rivers are diverted and water accumulates in open pools for gold washing. Last but not least, are problems caused by concentrating so many people in places without infrastructure and digging great holes in mountain slopes. The mining of gemstones too causes extensive excavations, which are left open and unprotected and damage the environment.

Table 13 shows the environmental problems resulting from small-scale mining in the Manica, Tete and Nampula provinces. Water contamination, river siltation, soil erosion, destruction of vegetation and health-related risks are the main ones.

Table 13 Environmental problems as reported by communities

Environmental problem	None (%)				Significant (%)				Very significant (%)			
	N	T	Nam	M	N	T	Nam	M	N	T	Nam	M
Water contamination	100	71.4	66.7	72.7	-	-	33.3	27.3	-	28.6	-	-
River siltation	-	83.3	-	50	100	-	100	50	-	16.7	-	-
Soil erosion		83.3	100	66.7	-	-	-	33.3	100	16.7	-	-
Destruction of access roads	100	91	100	66.7	-	-	-	33.3	-	9	-	-
Destruction of religious sites	-	91	100	75	-	9	-	25	-	-	-	-

N= Niassa, T=Tete; Nam=Nampula; M= Manica

Table 14 Amount of mercury used to obtain a gram of gold

Quantity Hg/gAu	Number	%
<1 gram	17	53.1
1–5	11	34.4
5–10	1	3.1
>15 grams	3	9.4

Table 15 Waste mercury in Manica Province

Waste mercury	Number	%
Burned off	10	17.9
Discharged into environment	6	10.7
Recycled and reused	28	50
Other	12	21.4

The amount of mercury used to process one gram of gold (au) (see Table 14) is an indication of how much mercury is consumed in gold recovery by amalgamation in Manica Province. Table 15 shows that about 30 per cent of the used mercury is discharged into the environment in Manica.

The contamination of water and rivers is not only because of Mozambican mining. The Mazoe, Luenha, Revue and Zambezi (drains 8 of the 14 SADAC countries namely: Angola, Botswana, Malawi, Namibia, Tanzania, Zambia and Zimbabwe) rivers flow through Mozambique into the Indian Ocean from Zimbabwe, Zambia and Malawi. These three countries contribute to water contamination downstream by their own miners' mercury use. In the long term, this could lead to substantial mercury accumulation in river sediments, become methylated by microbial activity and transformed into highly toxic methylmercury. If this occurs methylmercury, which is readily accumulated in fish and other aquatic organisms can undergo biomagnification up the food chain (Baseline Survey, 2000).

Communities in the vicinity of the mining sites are exposed to mercury through inhalation and drinking contaminated water. The non-gold mining communities, especially the downstream, are also at risk of exposure to methylmercury by consuming contaminated fish. Also the vegetables grown along the riverbanks are irrigated with contaminated river water.

The miners themselves are at high risk of exposure to mercury via direct skin contact. Handling or eating food with hands contaminated with mercury leads to food contamination and ingestion of mercury.

Environmental Technology Assessment (EnTA)

The mining and processing technologies are one source of environmental impacts. The mining technique can also contribute to environmental degradation. In Mozambique the main mining method used by small-scale miners is the open-pit method, coupled with exploration pits and trenches which are left open and unprotected. During the process of mining the dumps are spread all over the area which accelerates deforestation.

The processing of ore using techniques like sluice boxes, panning, amalgamation and others (see Figure 12) all lead to river siltation, river and air contamination by mercury, soil erosion, widening of river embankments and mercury poisoning of fish and other organisms. The miners interviewed claim that they use sluice boxes and pans because they are not aware of any other technique (see Table 16).

Table 16 Reasons given for using sluice boxes and panning technologies

Reasons for using the technologies	Niassa %	Tete %	Nampula %	Manica %
Unaware of any other	79.7 (51)	100 (12)	100 (12)	60.0 (36)
Affordability	14.1 (9)	0	0	23.3 (14)
Availability	3.1 (2)	0	0	15.0 (9)
Lack of confidence in other technologies	3.1 (2)	0	0	1.7 (1)

The FFM has made available a Knelson Concentrator (see photo) for small-scale miners in Manica, but they are not using it because it takes too long to accumulate enough ore to be processed in it and the miners are not prepared to wait. The other reason is because they do not trust the technique, they think some gold might get lost during the processing.

The miners using mercury for amalgamation are not aware of other amalgamation techniques except for miners in Manica where they know about Retorts and TermEx Tech developed by Mt-metal techniques & UNIDO (see Table 17).

Table 18 Gold miners' knowledge of other amalgamation technologies

Aware of other amalgamation technologies?	Niassa %	Tete %	Nampula %	Manica %
Retorts	3.6	0	0	50
TermEx tech.	3.6	0	0	50
Don't know any	92.9	100	0	0

In Manica they do not use the Retorts and TermEx Tech because they are expensive both to purchase and maintain. Some mines cited the availability and efficiency as other reasons for not using them.

The provincial delegation of Ministry of Mineral Resources and Energy has made available retorts to the miners at Mimosa mine in Manica. The miners do not use this technique due to lack of enough quantity of the amalgam to be roasted in the retort on one hand and lack of confidence in the technique on the other.

In general the miners do not use alternative techniques because they are not trained in the techniques and because of the prohibitive costs of purchase and maintenance.

Scope for Sustainable Development

This section discusses the social and economic issues relevant for the development of artisanal mining communities in Mozambique. Several authors have already discussed the gold panning and its socio-economic and environmental implications in Southern Africa (Hollaway & Associates, 1992; SARDC et al, 1994; Manuel et al, 1999). The same discussion is done in other countries and regions, e.g. Brazil (Marques, 1999), Colombia (Echavarria, 1996) just to mention a few. All these authors are unanimous in asserting fact that small-scale mining is a critical source of income for poor families in the rural areas (Bezerra et al, 1996; Manuel et al, 1999)

Infrastructure and social services are key issues for the sustainable development of small-scale mining. They are important factors because most if not all mining sites are located in very remote areas with difficult access (see Figure 8). Access to mining sites is even more difficult in the rainy season when the few roads that take people to the nearest point to the mines are destroyed. The maintenance of tertiary and rural roads is not a government priority. Some positive road maintenance initiatives are taken by non-governmental organizations in promoting food-for-work projects.

Example of the condition of access roads and bridges in Lupilichi, Niassa Province

Health and educational services are limited in mining communities, both in terms of number as well as the capacity to respond to the needs of local people (Baseline Survey, 2000). In general, basic infrastructure is located far from mining communities, and moreover, these facilities have not benefited from any upgrading or re-equipping since the civil war (which ended in 1992) and recent floods.

Many mining community members do not have access to potable water. For many, the source of water for drinking, cooking and mining activities are the rivers or pits dug by the river side.

The nonexistence of other economic activities in the vicinity of the mining areas is an important argument for the sustainable development of artisanal mining in any society. The experience of Mozambique is that with closure, in late 1980s and 1990s, of several mining companies in Manica, Zambézia and Nampula and agricultural companies (sugar, copra, timber) in Zambézia provinces, which employed a significant number of people, the small-scale mining then attracted the people who could not migrate elsewhere.

The Baseline Survey reports that only other economic activities include buying and selling at the markets and stalls that have been established in mining areas and camps, some of which are vibrant and operate daily. Items such as vegetables, fish, beer, soap, batteries, canned goods are sold in these markets.

Authority Structures in Mining Communities

Mining communities have authority structures which combine their own beliefs and local government. Authorities that interact with mining communities are the local government (police), state administration (the Mining Department), village secretaries, traditional (traditional chiefs or regulos) and religious (church)/spiritual authority (*curandeiros, mwenes* or *barozos*) and mining camp leaders.

The miners believe that to succeed in their work, they need protection from their ancestors. Ancestral worship led by traditional chiefs, include rituals and prayers performed at gravesites.

The Baseline Survey reported that *curandeiros* work in collaboration with the traditional chiefs. For example, in Manica, the traditional chief of *Munhena* area appointed a representative at the mining site. His main duty is to give mining plots and ensure through the *curandeiros,* that rituals and prayers were conducted at the mining sites.

The administrative authorities are involved in regulating and keeping law and order in the mining sites. Police and administration officials are said regularly to visit and 'tax' the miners or impose fines on them for not observing specific safety or environmental issues. This nurtures feelings of antagonism between miners and government authorities (Mining Department inspectors). This problem is related to the recent past (before 1994) when the authorities attempted to control illegal trade in gemstones, which resulted in confiscation of the products and sometimes imprisonment of gold miners or traders.

Artisanal miners are by nature nomadic, settling temporarily when the area is rich and moving away when a new site with better grades is discovered. These miners mix with local people who use the land for agriculture. The settlement patterns (post-war) in general are rather confused owing to several factors which include the resettlement of refugees during the civil war who never returned to their original areas and the remnants of communal village structures.

Small-scale miners' settlement at Munhene deposit, along the Revue River in Manica Province

In communities active in mining, two community types emerge: a village or existing rural settlement, and a camp, established on the mining site. The camp is a peri-urban environment where people are subject to more risks than those found in villages. People in camps have reduced food security, more social disintegration, more marginalization, increased mortality, poor sanitation and most of them are homeless and landless. The village settlement has the advantage of more space and greater opportunity to ensure family survival through agriculture.

Illegal immigrants from neighbouring countries are reported to be settling and forming or bringing families to camps. These artisanal miners and their children are subject to 'taxation', so as to guarantee 'legal' residence in the country by local authorities.

Small-scale Mining: Gender and Child Labour

Small-scale miners are generally men. Although some women take part in transporting and washing the ore, their other roles (mother, housewife, caretaker) still predominate.

Many cultural barriers hinder women's involvement in artisanal mining. In some parts (for example, in N'tulo) Niassa women are not allowed to work at the mine site because they attract bad spirits. Here women are only allowed to sell food and beer. In Manica women

are not allowed to dig trenches, but they can transport the ore to the processing sites and wash it (see photo).

Children of about 10 to 16 years of age (see photo) are reported to be helping their parents in Tete, left on their own in Manica or hired for transporting ore in Manica and Niassa. In Manica, Zambézia and Tete most of the children go to school in the morning, while in the afternoon they join their parents at the mine site. In Manica, there are reports of children skipping classes or leaving school in order to work at the mine (Baseline Survey, 2000).

Children and women re-working old damps and washing for gold in Murrupula, Nampula Province, Mozambique

Table 19 Kind of Support Needed by Artisanal Miners (%)

	Niassa	Tete	Nampula	Manica
Need support Education/training	Yes 68.2 (15)	Yes 100	Yes 100	Yes 68.6 (24)
Financial	13.6 (3)	100	100	62.9 (22)
Equipment	13.6 (3)	100	100	94.4 (51)
Technical	4.5 (91)	*100*	100	81.4 (35)
Other	0	0	0	88.2 (15)

Source: Baseline Survey 2000

Table 19 shows that the majority of artisanal miners welcomed support to them, especially in the areas of education/training, financial, technical and equipment. It is essential to engender the interest of miners together with that of the government in principles of sustainable development which can be introduced to them during education and training or by supplying equipment and technology (eco-friendly technology) that complies with national and international environmental standards.

Financial intervention can be linked to compliance with environmental regulations (environmental management plan) and sustainable development principles (ensuring access

to resources by both current and future generations). The mining department at provincial level can carry out the education and training of the miners with assistance from the Ministry. This supports the need for hands-on training and long-term assistance on site.

Financial support is to be channelled through mining development funds like the FFM where the prerequisite for application for funds could include, for example training in mining. The financing organization should guarantee phased funding and on-site inspections by independent institutions at the end of each phase. This would prevent misuse of funds and allow more transparency.

The equipment and technological assistance should consider the environmental technology impact and promote maximization by for example the use of central processing units where miners individually or as co-operatives or groups could book processing hours at a fee. For miners requiring their own equipment, private-leasing institutions should be encouraged to finance the small-scale mining activity.

Artisanal mining can be more effective for working small deposits than large-scale mining with multinationals, which require large reserves in order to justify the funds for opening a mine. Small-scale mining operates on small deposits that are uneconomic for big companies.

In conclusion I would say that the approaches, strategies, principles and guidelines that should be considered in the transition to sustainable development in Mozambique are:

- Review the current legislation with an emphasis on consultation with mining communities in which both government (social, economic and environmental) and community (cultural, social, traditional, ethnicity and religious) interests are preserved.
- Do an inventory of the real situation (number of miners, environmental degradation status, market structure, licensing) of the small-scale mining sector in Mozambique.
- Require licences for all operators in the sector (miners and buyers) and implement an instalment arrangement for payment of the fee.
- Encourage and promote the setting up of mining cooperatives and associations of miners in order to simplify the control and assistance (financial, technical and equipment) and guarantee the sustainability of the activity.
- Promote the installation of central processing units in order to minimize the environmental problems caused by disorganized waste disposal.
- Promote environmental awareness (use and handling or mercury) and environmental rehabilitation of the sites after mining. The mining authorities should guide the rehabilitation.
- Promote training on mining and processing methods that are environmentally acceptable in order to improve skills and competency and reduce health risks to miners and their dependants.
- Develop basic infrastructure in the mining communities (such as schools, hospitals and access roads).

- Stimulate and enhance financial assistance to artisanal miners.
- Promote participatory principles at every level of small-scale mining activity.
- Promote interaction and consultation between different groups exploiting natural resources (land, forests, minerals)
- Finally, empower small-scale mining activity with capacity (financial, technical, human skills and competency) that allow its sustainable development and active and progressive contribution to the national and regional economy.

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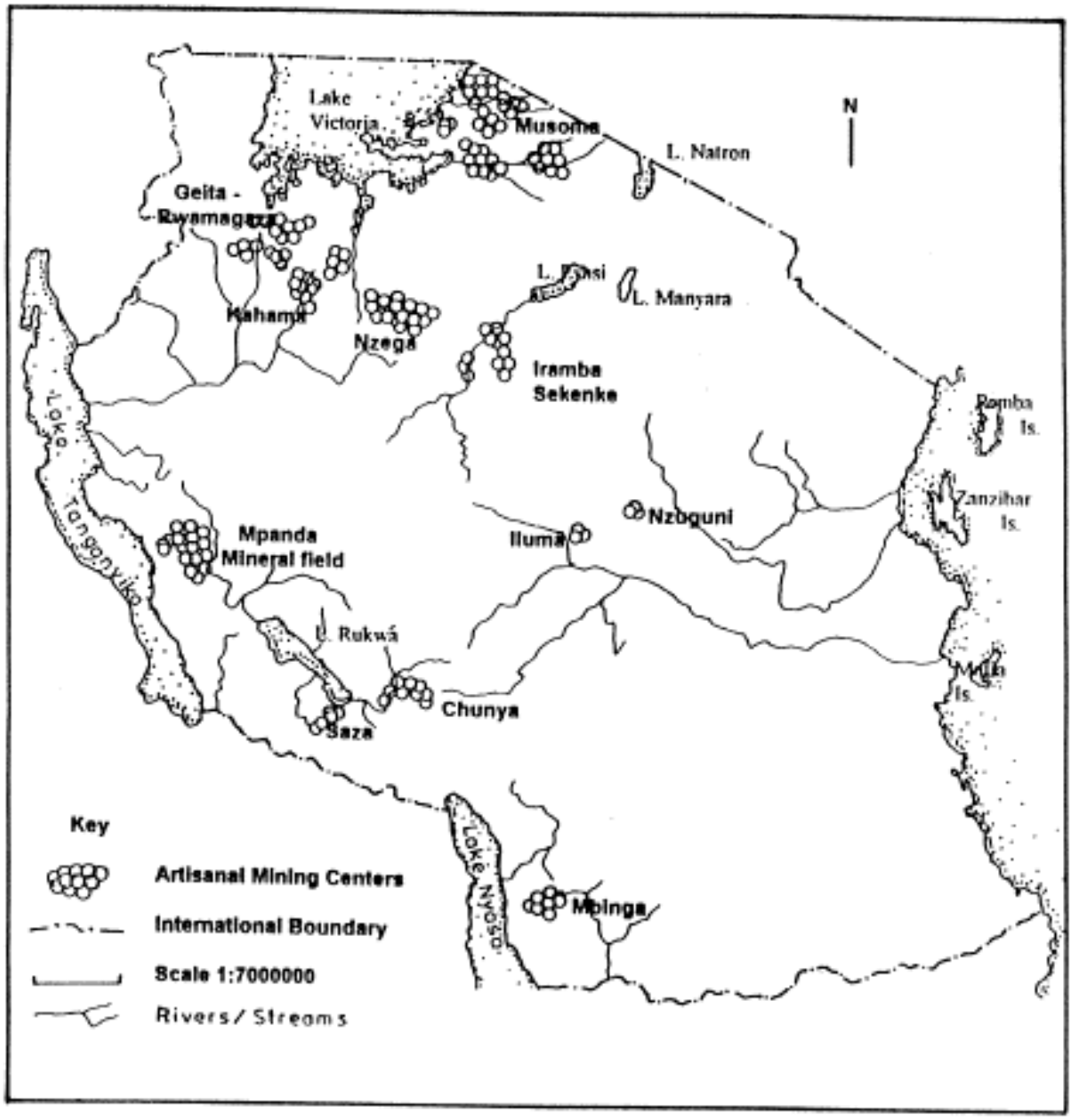
Tanzania



Introduction

Tanzania has great potential and variation of mineral resources, which include gold, base metals, industrial and construction minerals as well as a wide variety of gemstones, some of which are unique (for example, tanzanite). Artisanal miners have worked most of these minerals since the independence of the country in 1961.

Statistical data indicate that, prior to independence, mining activities contributed about 10 per cent to the country's gross domestic product (GDP). This amount was produced solely by large-scale gold and diamond mines. The post-independence political structure emphasized state-owned production, including in the mining sector. However, the state

enterprises, which were entrusted to develop the mineral sector, had inadequate technological, human and capital resources. Meanwhile, individuals resorted to informal artisanal mining activities of easily marketable items such as gold and gemstones. These informal mining activities were not officially recognized and mineral commodities were illegally marketed or smuggled out of the country.

Only in the late 1980s to early 1990s did the government recognize the need to control the activities of artisanal miners and stamp out smuggling. In 1987, it introduced economic reform programmes for mining and other sectors. The opening up of the economy brought with it licensing requirements for private gold and gemstone dealers which provided a wider market for small-scale miners.

In addition to reform programmes, the government passed the National Investment Act of 1990 with the objective of attracting investors. Concerted actions have been taken aimed at creating an attractive investment environment including replacement of old National Investment Act by the Tanzania Investment Act 1997. The new act created the Tanzania Investment Centre, a one-stop shop that promotes, coordinates and facilitates investment. Government changes have attracted several small-, medium- and large-scale private mining investors to Tanzania. This has resulted in the growth of the mineral sector and a greater contribution to the national economy as detailed below.

The sector recorded the highest growth rate of 24 per cent in 1992 and mineral exports rose from US$15.8 million in 1989, to $53.2 million in 1992, to $184 million in 2000. The number of mineral dealers' licences has increased from 17 in 1989, to 180 in 1995 to 2,000 in 1997. The number of registered claims has increased from 1,998 in 1990 to 4,123 in 1995. The number declined to 230 in 1998 and 149 in 1999.

From January 1992 to 1996, the government has granted more than 312 reconnaissance and prospecting licences to public and private companies of both local and foreign nationals. In 1999 there were over 6,000 validly registered mining claims, 1,333 large-scale prospecting licences and 51 mining licences.

During the period 1980–99, the Tanzanian mining sector in has shown positive growth, but much of its success is attributed to the development of small-scale and artisanal mining operations because most of the big mining companies, which have decided to invest in Tanzania, are still in the exploration phase of their operations. Therefore, small-scale and artisanal mining has so far been the most productive sub-sector of the mining industry in Tanzania.

The importance of small-scale and artisanal mining in Tanzania is also reflected by the fact that: it offers attractive employment to many people, particularly from the rural community; and it resettles those who have lost their jobs in the cities due to the newly adopted structural adjustment programmes. For example, the number of people involved in artisanal mining increased from an estimated 100,000 in 1989, to 300,000 in 1992. This number increased to over 550,000 according to statistical data gathered in 1997.

Although small-scale and artisanal mining is such an important sub-sector in Tanzania, artisanal mining is usually carried out by people with only informal operational

organization, with poor technology, using cheap crude tools and limited marketing knowledge.

Characterization of the Nature and Extent of Small-scale Mining in Tanzania

The nature and extent of the growth of artisanal and small-scale mining sub-sector in Tanzania is influenced both by social, political, economic structure and geological setting of the country. The growth therefore is attributed to several factors. One is the attractive geological environment, which has various sites of high-grade mineralization easily workable with simple tools. These include alluvial gold and mineralization and gemstone occurrences in numerous locations in and on ancient river beds. There is also a search for sustainable livelihoods in the mining sector due to collapse of other productive sectors such as a poor market of agricultural products and droughts. Lack of public and private employment, including the closure of both the state-owned mines in the 1980s and privately owned mines in Tanzania in the early 1970s, has forced semi-skilled people to resort to artisanal mining. Another factor is that from 1970 to 1990, government had long and complicated process for granting mineral rights to applicants. This increased the number of informal artisanal miners. The discovery of numerous gold deposits south of Lake Victoria in the mid-1970s attracted indigenous people into mining as a fast way of getting rich. Finally, the economic policy reforms on mineral trade liberalization and the new legal and regulatory framework has encouraged the growth in artisanal mining.

Several attempts have been made to define and characterize artisanal and small-scale mining according to gathered information on technology, distribution, sales and institutional factors. In Tanzania, part IV of the 1979 Mining Act describes small-scale mining as mining and prospecting operations that do not involve substantial expenditure or the use of specialized technology.

Small-scale mining in Tanzania can be characterized as mining operations which are labour-intensive for operators with informal technical knowledge of mining and mineral processing and little capital. They can embark on mining with simple tools like picks, shovels and pans. Leading on from this, their operations are coupled with wastage of minerals due to poor ore and mineral recovery during mining and mineral processing, respectively; wide scattering of mine waste products; and poor handling of mineral-processing chemicals, for example mercury.

Yet in a few instances organized small-scale mining is carried out on a formal basis where operators abide by official mining and mineral marketing procedures. They keep production and sales records, which are furnished to the relevant authorities. They use appropriate technologies such as retort systems and special amalgamation ponds in gold mines, as approved by relevant authorities.

Contrary to the organized small-scale miners, artisanal miners basically conduct their operations on an informal basis without adhering to laws, regulations and technologies. They shift from one site to another, working on both registered and unregistered land. They are disorganized, lacking work preparation before production, and totally omitting the prospecting stage and having no reserve estimation. Finally, gold and gemstones,

particularly for alluvial deposits where the minerals can be accessed easily and without mineral-processing complications.

According to the sectoral report on the Baseline Survey Study on Artisanal and Small-scale Mining Activities in Tanzania, conducted by Tan Discovery in 1997, it is estimated that the sub-sector employs 550,000 permanent workers. But, it is hampered by number of problems, which prevents the miners from improving their participation in mining. On one hand, use of inadequate mining and processing techniques leads to low productivity. On the other hand, the government is often unable to control artisanal mining because it lacks adequate operational resources to enforce existing regulations.

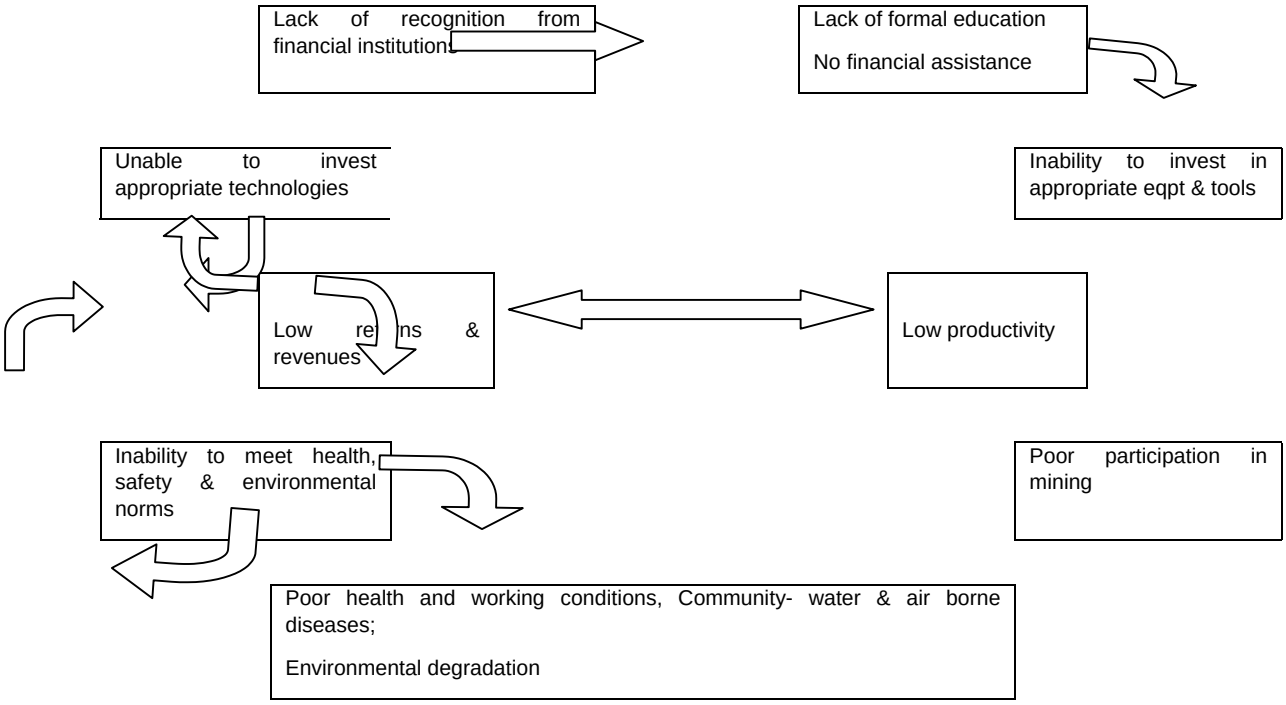


Figure 1: Organochart of artisanal and small scale mining activities

Participation of Women

Tanzania has about 550,000 artisanal and small-scale miners of which 25 per cent are women that are engaged directly or indirectly in mining activities. Table below illustrates women participation in different mineral commodities.

Table 1 Women's Participation in Small-scale Mining

Commodity	Direct	Indirect	Total
Gold	8,400	41,810	50,216
Diamond	523	505	1,028
Gemstone	17,866	56,430	74,296
Salt	9,876	7,585	17,464
Aggregates	14	37	62
Dimension stones	9,920	7,699	17,619
Grand total	36,709		143,153

Factors that contribute to women's involvement in the sub-sector include low prices of agricultural commodity, low demand or lack of public and private employment, lack of trading commodities, effect of droughts on farmlands, lack of farmlands, high inflation rate, high birth rates and extended families, greater economic independence and maintaining a traditional family structure.

In general, the main reason for women's participation in small-scale mining is that the majority of women who rely on deteriorating subsistence farming in order to support their families are forced to look for a new means of survival at lowest cost.

Regardless of the area or the type of mining there are specific problems that beset women who work in small-scale mining compared to men. The first is economic hardship. Women provide up to 50 per cent of the work force but they do not get 50 per cent of the rewards. They also lack access to credit and finance. As a result, they are prevented from full participation in small-scale mining activities. Specifically, they must work without credit, which traps them at a subsistence level of mining, extracting what is easiest and confining them to a precarious existence.

The second problem for women is their lack of technical know-how. Less know-how than their male counterparts is compounded by illiteracy among women, and disadvantageous in many mines. The anarchic nature of much small-scale mining and the poor working and living conditions at mine sites are sometimes sufficient in themselves to prevent women from engaging in it.

The third specifically female problem is family commitments. Social productive issues such as lack of representation and support; lack of management and administrative skills, perceptions about their status; and cultural barriers impose a heavy family burden which limits their independence and mobility. Women are not considered to be the head or joint head of a family and have no property or income in their name. Married women face opposition from their husbands and families to run a mining business, which takes them to remote areas for long periods of time, thus making it difficult to combine work with family and other household responsibilities.

Child Labour in Mines

Child labour is used in small-scale mines in many countries in Africa, Asia and Latin America. These children work long hours, without adequate protective equipment, clothing and training, and are exposed to high humidity levels and extreme temperatures. Hazards include exposure to harmful dusts, gases and fumes, which cause respiratory diseases that can develop into silicosis, pulmonary fibrosis, asbestosis and emphysema after years of exposure. Child miners also suffer from physical strain, fatigue and musculo-skeletal disorders, as well as serious injuries from falling objects. Mercury poisoning endangers those involved in gold mining.

The percentage of the population of children living in mine areas in Tanzania is high. Poverty has an obvious relationship with child labour. Mine families need money to survive and children are a source of additional income. The combination of poverty and the lack of a social security network form the basis of the even harsher type of child labour: bonded child labour.

Although poverty is cited as the major cause of child labour, it is not the only determinant. Inadequate schools, a lack of schools or even the expense of schooling leaves some children with little else to do but work. The attitudes of parents also contribute to child labour; some parents feel that children should work in order to develop skills useful for the job market instead of being formally educated.

ILO Convention No. 138 suggests that the minimum age for employment should not be less than 15. According to an ILO report of 1999, many governments have embarked on a review and updating of national legislation on child labour and have adopted practical policies and programmes on child labour (Brazil, India, Indonesia, Kenya, Nepal, Pakistan, Philippines, Tanzania, Thailand and Zimbabwe). The ILO's International Programme on the Elimination of Child Labour (IPEC) is now in force in more than 25 countries, Tanzania included. All of the policies that the government has in place are in accordance with the legislation of the country, and all support the eradication of child labour. The problem of child labour still remains even though all of these policies exist. Enforcement is the key aspect that is lacking in the government's efforts. No enforcement data for child labour laws are available.

Child labour is a significant problem in Tanzanian mine sites. The Merelani Tanzanite Mines in Arusha region alone have more than 3,000 children called 'Snake Boys' who work in deep narrow mines. The prevalence is shown by the child work participation rates, which are higher in gemstone areas compared to gold-mining areas. Some parents also feel that a formal education is not beneficial, and prefer that children learn work skills through labour at a young age. Another determinant is access to education. In some areas, education is not

affordable, or is found to be inadequate. With no other alternative, children spend their time working.

Child labour cannot be eliminated by focusing on one determinant, for example education or by brute law enforcement. The government must ensure that the needs of the poor are met before attacking child labour. If poverty is addressed, the need for child labour will automatically diminish. This can be developed with a good institutional framework and capacity to carry out research and data collection, awareness raising, training, and legislative reform, as well as identifying target populations and strategic action programmes.

Government Strategies for Addressing Women and Children Issues in Mining

The government of Tanzania encourages and facilitates employment and involvement of women in mining development activities such as mining, processing and mineral trade, and in the provision of economic services in mining communities. It is also working against technical, financial and cultural barriers to the involvement of women as potential investors and owners of claims. Through the Mineral Resources Department and other governmental institutions, the government conducts awareness programmes to promote the acceptability of female participation in mining in form of seminars and workshops.

Some of the strategies taken to end child labour in mines include:

- Enforcing regulations against child labour and imposing stiff penalties where violated.
- Addressing the underlined poverty problem in mining areas and providing viable alternatives.
- Targeting children in mining areas for special effort in their education.
- Supporting and promoting productivity-enhancement programmes which can eliminate child labour.

Numbers Involved and Minerals Mined

Small-scale mining operators in Tanzania are mainly engaged in mining gold, gemstones, some of them also work on salts, industrial minerals, gypsum, dimension stones, coal, lime production, diamond mining, salt, sand and aggregates. The number of artisanal and small-scale miners has increased from 150,000 in 1987 to 550,000 in 1996. The distribution of the number involved at each mineral commodity and each region in Tanzania is presented in Table 1 below.

Registered mineral claims have increased from 425 in 1991 to 4,123 in 1995 and the number of mineral prospecting licences is now above 330. Operations in these mineral properties are monitored and administered by Mineral Resources Department and mainly zone/district mines offices do the field inspections. In 1999 there were over 6,000 valid registered mining claims, 1,333 large-scale prospecting licences and 51 mining licences.

Mining methods for small-scale miners in Tanzania can be grouped into two categories. The first category covers open-cast mining which are shallow pits and excavations. Mineral commodities mined include alluvial gold, ruby, rhodolites, alexandrites, garnet, sapphire, chrysoberly (see Table 1), gypsum and sand and gravel. The second category includes underground mining operations, commonly for reef gold ores, gemstones (tanzanite and rhodolite) and coal.

Table 1 Population Involved in Artisanal and Small-scale Mining

Mineral commodity	Area	Men involved	Women involved	Total
Coloured gemstones	Arusha	37,644	11,809	49,453
	Tanga	2,686	1,157	3,843
	4 mine areas	4,420	2,334	6,754
	-	5,990	270	6,260
	-	400		400
	Morogoro	1,020	66	1,086
	Ruvuma	149,280	53,400	202,680
	2 mine areas	10,820	2,956	13,766
	Rukwa	20		20
	Mtwara	14,150	850	15,000
Diamonds	Shinyanga	80	8	88
	Mwanza	1,400	1,020	2,420
Gold	Shinyanga	2,696	878	3,574
	4 mining fields	9,328	3,160	12,488
	-	4,760	2,340	7,100
		4,820	680	5,500
	Musoma	930	318	1,248
	Singida	1,630	1,070	2,700
	Mwanza	73,950	15,600	89,550
	3 mining areas	3,880	820	4,700
		540	60	600
	Musoma	4,080	800	4,880
	Ruvuma	11,550	6,450	18,000
	Mbeya	32,394	13,409	45,803
		450	200	650
	Rukwa	20,105	5,768	25,873
Sand	Dar es Salaam	410	23	433
	2 mining blocks	462	113	575
Salt, lime and aggregates	Tanga	283	109	392
	Tanga	400		400
	Mtwara	7,640	17,360	25,000
	Dar es Salaam	176	88	264
Gypsum	Kilimanjaro	590		590
Dimension stones	Kilimanjaro	225	45	270
Grand total		**409,209**	**143,161**	**552,370**

Source: Tan Discovery Minerals Ltd.

Table 2 Classification of Gemstones Mined in Tanzania

Mine/region	*Mineral*	*Classification*	*Mining method*

Long'ido, Arusha	Ruby	Primary deposit	Open pit trench
Simanjiro, Arusha	Rhodolites	Eluvial deposit	*Open-cast and underground*
	Tanzanite	Primary deposit	Underground
Tunduru, Ruvuma	Sapphires, alexandrites, chrysoberly	Alluvial, eluvial	Open-cast
Umba, Tanga	Garnets, sapphire	Alluvial	Open-cast
Muheza, Tanga	Garnets, sapphire	Alluvial	Open-cast
Liwale, Lindi	Sapphires, alexandrites, chrysoberly	Alluvial	Open-cast

Research conducted by Tan Discovery Minerals Ltd. in 1997 found out that miners' work input can be correlated with the mineral product produced. The relation, labour productivity, is then defined as weight of ore mined or processed per day divided by the number of labourers.

The labour productivity in gold mining areas is as follows:

- Productivity of ore mined varies from 0.9–516kg/day/person with an average of 105 kg/day/person.
- Productivity of ore processed varies from 2.2–517kg/day/person with an average of 103 kg/day/person.
- The labour productivity in gemstone mining areas is as follows:
- Productivity of ore mined varies from 1.6–60kg/day/person with an average of 23.1kg/day/person.
- Productivity of ore processed varies from 1.6–60kg/day/person with an average of 18.8kg/day/person.

The production of mineral commodities in Tanzania during the period 1989 to 1998 is presented in Table 3 below. It is worthwhile to note that the reported figures are in addition to the commodities listed, modest quantities of unlisted varieties of construction materials such as sand, gravels, clays, stones are not included, which are important raw materials for the construction of towns and cities in Tanzania.

Diamond production in Tanzania is both under Williamson Diamond Mines, a large-scale mining company and artisanal miners. It is estimated that the latter contribute up to 50 per cent of the gem-quality stones to the overall production. Precious and semi-precious stones included amethyst, chrysoprase, emerald, peridot, rhodolite, ruby, tanzanite and tourmaline.
It should be noted that most of the ore is hand sorted underground and milled without further sorting. In most cases, for security, all the ore mined is milled instead of stockpiled.

Table 3 Mineral Production from 1989–1993

Mineral	1989	1990	1991	1992	1993
Diamond (ct)	*75,885*	84,598	99,762	67,304	40,847
Gold (kg)	112	1,643	3,779	4,525	3,370
Gemstone (kg)	11,389	38,700	59,625	48,938	32,979
Salt (t)	20,010	39,315	64,419	77,281	83,400
Phosphate (t)	8,541	25,066	2,419	4,948	2,219
Tin ore (t)	15	14	6	8	12
Gypsum (t)	5,895	36,115	5,263	15,031	52,243
Silica sand (t)	13,101	6,365	4,263	0	916
Coal (t)	15,929	16,929	33,213	31,140	40,248
Kaolin (t)	1,021	2,021	1,738	1,360	477
Limestone (t)	na	na	na	na	1,617,991
Diamond (ct)	17,177	49,538	*126,670*	116,750	93,205
Gold (kg)	2,861	320	318	250	720
Gemstone (kg)	48,507	111,403	142,160	10,537	48,518
Salt (t)	84,298	105,000	86,700	119,710	97,000
Phosphate (t)/ Apatite/P_2O_5	na	6,700/ 2,080	28,020/ 8,686	3,000/ 930	1,935/ 600
Tin ore (t)	9	3	na	na	na
Gypsum (t)	7,536	1,052	8,765	8,800	8,800
Silica sand (t)	4,200	4,200	4,200	4,200	4,200
Coal (t)	45,027	43,200	52,000	35,000	35,000
Kaolin (t)	541	596	1,332	1,300	1,300
Limestone (t)	648,474	1,062,081	120,000	120,000	120,000
Graphite	-	359	6,776	11,000	-
Soda ash	300	300	300	300	300

Note: The data of mineral production 1999 to date were not available

In 1987 when the government changed from state monopoly of mining to private sector, two tracks of development in the sub-sector merged. Artisanal miners filed claims and worked formally in areas that were being illegally mined; while large local and multinational companies applied for exploration and prospecting licences. As a result, the Bank of Tanzania which is obliged to buy gold from artisanal miners, collected four tonnes of gold by 1994. Artisanal miners in many parts of the country discovered parallel, coloured gemstones. Legal gemstone exports increased from $3.2 million in 1993 to $6.5 million in 1994 and $7.3 million in 1995. Exports of minerals continued to rise from $92.8 million in

1997 to $103 million in 1998. Mineral earnings in 2000 were $184.86 million, a big jump compared to 1998. Gold alone increased to $120.4 million in 2000. The main reason for the increase in gold production is production by large gold-producing companies, which include Afrika Mashariki Gold Mines Ltd, Ashanti Goldfields Ltd, Lusu Gold Mine and others. Other export data for the period 1989 to 1995 are presented in Table 4.

Table 4 Mineral Exports in 1989 to 1995

Mineral	Unit	1989	1990	1991	1992	1993	1994	1995
Diamonds								
Diamonds (cut)	Carats	10,276	7,947	3,214			87	
Diamonds (contract goods)	Carats			648,139	8918	73674	1703	
Gold	Kg	111707	1643	3779048	4525	3364	2803	320
Gemstones	Kg	24621	32292	59625	26678	32979	48507	94296
Salt	Tonnes	2968	7081	9831	8590	6755	1596	n.a.
Phosphate	Tonnes	2529	3582	3334	3900	3541	n.a.	1149
Tin ore	Tonnes	6	7	6	6	11	6	2.7
Gypsum	Tonnes	n.a.	n.a.	n.a.	2320	3000	400	500
Total in million US$		16.75	26.29	44.4	53.23	41.53	35.29	14.94

Table 5 Precious Mineral Exports 1989–1999, Declared Value in Millions US$

	1989	1994	1995	1996	1997	1998	1999
Gemstone exports	0.78	6.46	7.28	9.58	7.94	8.13	11.86
Diamond exports							
Mine exports	14.21	5.04	4.34	13.39	15.84	10.47	12.42
Rough and contract sales	9.75	3.22	4.34				
Cut	4.46	1.82	0	0	0	0	
Export by dealers	na	na	na	0.46	0.004	0.007	0
Total diamond export	14.21	5.04	4.34	13.85	15.84	10.48	12.42
Gold exports							
Gold export by dealers			3.27	na	0.68	0.18	0.51
Gold export by BOT/Meremeta	1.15	25.68	None existed	None existed	1.10	2.95	2.60
Gold export by large mines	Did not exist						35.49
Total gold exports	1.15	25.68	3.27	2.18	1.78	3.33	38.36
Total precious minerals exports	16.15	37.18	14.89	25.62	25.57	21.94	62.64

Source: Ministry of Energy and Minerals, Tanzania. Some figures inferred from values, or projected

In July 1999 the local *Guardian* magazine reported that more than five tonnes of gold worth $45 million were smuggled out of the country through black market dealings in 1998. According to official records of the Ministry of Energy and Minerals, licensed gold dealers bought just 427kg of gold in 1998 of the 6,000kg of gold produced by artisanal gold miners annually. In 1997, licensed gold dealers purchased only 232kg of gold, the lowest figure recorded by the ministry since 1988. Financial analysts estimate the value of gold smuggled out of the country annually amounts to $200 million. In spite of the rampant smuggling, mining sector grew at 27.4 per cent in 1988 as compared to 17.1 in 1997.

From the estimates, the total number of annual export of gold and gemstones produced in Tanzania in 1995 to 1999 were as presented in Table xx.

Table 6 Total Annual Export 1995–1999

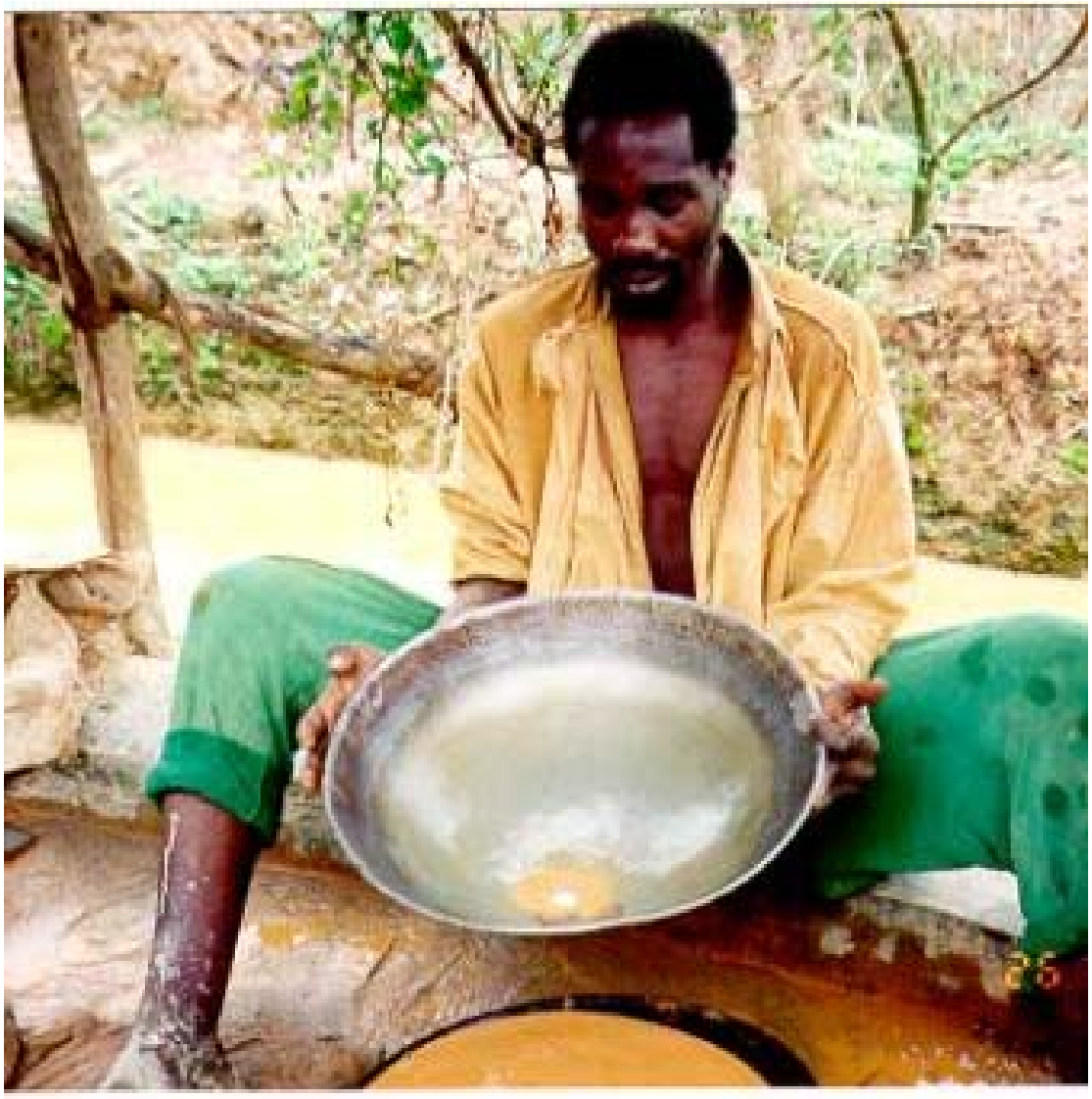
Estimated actual values	1996 in US$ millions	Assumptions	1998 in US$ millions	Assumptions
Gold	62.69	5T @ US$390/oz	93.24	10T@US$290/oz
Coloured gems	47.92	smuggled out: 60% 40% undervalued	29.55	45% smuggled out, rest undervalued
Diamonds	16.17	Artisanal production: 60% Smuggled out: 25% Mine production: 10% undervalued	12.85	Artisanal production: 45% Smuggled: 25% Mine production: 10% undervalued
Estimated actual total	126.78		135.64	

Source: USAID Research Paper 2001

Purification Methods and Waste Disposal

The mode of mineral processing is divided into two categories as follows: minerals which are mined and marketed without processing. Such mineral commodities include sand, clay, onyx; and minerals which are mined and processed prior to marketing. These mineral commodities include gold, diamond, gemstones, dimension stones, kaolin, lime, gypsum, construction aggregates.

Mining involves digging pits using simple tools such as hand hammers, picks, hoes and shovels. After mining the ore, gold is recovered through a repeated series of crushing, grinding, gravity concentration, and finally, an amalgamation process in which liquid mercury is added and mixed with ground gold ore in order to produce a gold/mercury amalgam. This is fired in the open air or in a distillation system (namely, retorts) to produce mercury vapour and elemental gold. Such technologies to recover gold, widely known as amalgamation, have been used for gold production since ancient times. During this process, mercury is introduced into the environment through disposal of process water and tailings, while open-air firing of the gold/mercury amalgam releases mercury vapour to the atmosphere. Mercury emissions from informal gold-mining operations represent a serious environmental problem in Tanzania.



There are broad varieties of gemstones mined and processed in Tanzania. Some of these include ruby, sapphire, tanzanite, green grossular garnet (tsavorite), tourmaline, emerald, aquamarine, alexandrite, amethyst, scapolite, iolite, spinel, apatite, chrysoprase, garnets (rose, rhodolite, almandite), zircon and malaya garnet (spessartine).

Because of the unique geological nature of gemstone deposits, whereby mineralization is localized in small pockets, processing of mined gemstones differs from one gem to another. In general, underground gemstone mining and processing includes breaking the rock using low-energy explosives, followed by material sorting by hand after cobbing.

A general flow chart for processing gemstones therefore covers cobbing, grading and sizing of the valuable stones. Alluvial gemstone mining includes the following procedure:

- gravels are wetted to loosen individual grains from rock matrices;
- washing and sieving; and then,
- hand sorting the gemstones.

- The consequences of poor technologies used during processing of the ores include:
- wastage of minerals due to poor ore and mineral recovery during mining and mineral processing, respectively;
- wide scattering of mine waste products; and
- poor handling of mineral-processing chemicals, namely mercury.

During the 1980s to mid-1990s the existing laws did not control mining and processing activities. As a result extraction and mineral processing have adversely affected the environment. The living conditions of the community are still characterized by poor sanitation, unsafe drinking-water and high congestion in shelters, which are poorly ventilated. The mining safety regulations were not being enforced, thereby resulting in high accident rates and pollution in living areas and bodies of water.

Since the reforms, major changes have taken place in mine centres. Through training programmes, processing of ores is now controlled to the extent that they have least impact on the environment, for example, now most artisanal gold miners wash and amalgamate ores in special ponds. Use of retorts in gold-mining centres has also become a standard procedure for miners.

While conserving the environment by use of impact assessments continues to be the policy of the country, most artisanal miners are not aware of it and do not practise it. Only in specific areas in gold-mining sites, are miners made aware of the consequences of mining to the surrounding communities and now practising environmentally sound technologies. An example of such technologies is presented below.

Abatement of Mercury Using EnTA

To date, artisanal gold miners in Tanzania use a variety of amalgamation methods because of the simplicity of the process, low investment and high gold recoveries, which expose mercury contaminants to air, water, soil sediments and food. Field data indicate that, miners use a gram of mercury to recover approximately a gram of gold. Using such data, one can estimate the mercury levels present in the country. Mercury has rather complex chemistry. In metallic form, mercury is oxidized into ionic mercury in the presence of dissolved oxygen and organic acids in water. Soluble ionic mercury binds with organic matter in sediments and forms an extremely toxic complex called methylmercury, which is rapidly taken up by certain fish species and bio-magnified in aquatic environments. Eating the fish leads to mercury poisoning. Symptoms of mercury poisoning are common and detected in many mining communities living near emission sources. Gold burners, women and children are the main victims because most lack information about the dangers of mercury. This means that future generations in mining sites will be severely affected by the continuing discharge of mercury into the environment.

It is in this context that Southern African Network for Training and Research on the Environment (SANTREN) runs a series of educational training programmes and courses on alternative technologies that lead to solutions for the affected communities to avoid future contamination. The network also emphasizes on the use of collective processing centres for amalgamation processes and retort systems so as to reduce emissions or even eliminate use of mercury by applying gravimetric methods. Since miners agree to use gravity-concentration equipment like sluice boxes and shaking tables (as observed in the Geita and Matinje mining sites in the southern Lake Victoria gold fields in Tanzania) the network is convinced that gold mining can be conducted safely and with no mercury emission to the environment.

As it has been long observed, an ultimate solution for the mercury-pollution problem has received little attention from governments, research institutions, NGOs and miners. In trying to reduce emissions, SANTREN is active in demonstrating simple technologies that are frequently ignored by miners or never demonstrated to them. Such technological improvements include the use of amalgamation drums or pans instead of bare hands for mixing mercury with gold-bearing slurry; building home-made retorts (with standard plumbing water pipes) instead of open-air burning of amalgam; use of protective gear during amalgamation and distillation of gold from amalgam; and application of alternative technologies such as gravimetric methods.

In trying to introduce alternative technologies in mine centres, SANTREN has adopted the new Environmental Technology Assessment (EnTA) which critically examines mercury technology and assesses alternative technology available. Developed by the UN Environment Programme (UNEP) as a new environmental management tool, it aims at building both the awareness of the need for technology assessment like the Environment Impact Assessment (EIA), as well as capacity in the assessment of alternative technologies.

The use of EnTA in amalgamation technologies used by small-scale miners in the Lake Victoria region has been very successful. A detailed EnTA technical manual for the abatement of mercury in gold mines can also be obtained from the Coordinator, Small-

scale Mining Project of SANTREN, PO Box 35052 Dar es Salaam, Tanzania or the SANTREN Head Office, Mount Pleasant, Box 167, Harare, Zimbabwe.

Review of Legislative and Institutional Arrangements

Tanzanian government institutions are responsible for the establishment and overseeing of laws and regulations. The institutions responsible for the sub-sector include the Ministry of Energy and Materials (MEM), Planning Commission, Ministry of Finance, Regional and District Administration and finally the Bank of Tanzania.

Mineral Resources Department (MRD) is responsible for administering the activities of mining on behalf of MEM. The MRD has four departments, namely Geology, Mines, Laboratory Services and Mineral Trading. The Department of Mines is responsible for granting prospecting rights and mining claims, administering law and regulations, offering technical assistance, monitoring of production and sales records and safety in mines. It is important to mention that since trade liberalization in 1987, the state has changed from its role as an implementing agent to a promoter and facilitator. Mining associations instead have taken the implementation role. Other associations include those listed below.

REMA countrywide has more than 17 registered associations, with active and inactive members rising from 150,000 in 1987 to 550,000 in 1996. The main objectives of REMA are: to unite small-scale miners at the regional level; hold meetings where miners can express their opinions and problems; assure stable mineral markets by working together through consultation with FEMATA (FEMATA represents REMAs at national level and its members are elected from REMA); bridge miners' interests with government through dialogue; arrange training programmes for miners.

TAMIDA started early in 1990 with more than 64 members in 1996. The main tasks are to bring together miners and brokers involved in gemstone trading activities. Its specific responsibilities are: provision of legal advice to dealers on mineral rights according to existing mining laws and regulations; working closely with FEMATA and REMAs in order to create conducive mineral markets between foreign buyers and dealers; arranging mineral auctions and fairs in collaboration with MEM.

Tanzanian Chamber of Mines was formed in 1994 with the objective of protecting the interests of both small- and large-scale miners and mining companies. Specifically, the Chamber is responsible for: promoting safety in mining areas; protecting the environment in the mining industry; reconciling mining disputes; and continual improvement of the mining industry through advising the government on matters of wages, labour, taxation, laws and legislation including minimizing risks and health hazards.

The major handicaps of these associations include lack of operational funds, uncommitted leadership, weak or bad planning and management, poor technical facilities to reach the members, lack of alternative sources of funding to finance association activities.

The Planning Commission, which is under the President's Office in Tanzania, support activities that strengthen MRD including provision of transport facilities. This in turn strengthens the provision of extension services to the small-scale miners. The Ministry of

Finance has the role of collecting revenues and overseeing budget allocation of the government departments. The lack of coordination between government departments in collecting the revenues from the sub-sector has resulted provision of incorrect mineral production and sales records, increased in informal mining and marketing operations, especially during the production peak of 1992 to 1996. Since 1998, efforts have been made in transforming informal mining and marketing of mineral products through close cooperation between MRD, Income Tax, Internal Revenue and Customs Departments. The Bank of Tanzania has the task of buying minerals from the miners and mineral dealers. Regional and District Administrations have the tasks of maintaining law and order in mine camps; providing social services like schools, health centres; settle land disputes between local community, individuals, claim holders or mining company.

Other Relevant Legislation

The National Environment Management Act (1983) set up a National Environment Management Council (NEMC). The Council (NEMC) is charged with advising the government on all matters relating to the environment. The government is drafting a general environmental legislation. Sector specific requirements are addressed in mineral titles. Other sectoral laws include:

- Fisheries Act (1970);
- Wildlife Conservation Act (1974);
- National Land-use Planning Commission Act, (1984);
- Water Utilisation (Control and Regulation) Act (1981);
- Public Health Ordinance CAP 336; and
- Protection from Radiation Act (1983).

The existing mining and environmental policies and laws include:

- Tanzania Mining Policy (1997);
- Petroleum (Biploration and Production) Act 1980;
- Tanzania Mining Act (1998);
- Mining legislation; and
- Mining (claim) Regulations.

The policy objects for the mineral sector are:

- To stimulate exploration and mining development;
- To regularize and improve artisanal mining
- To ensure the mining wealth supports sustainable economic and social development;
- To minimize or eliminate the adverse social and environmental impacts of mining development;
- To promote and facilitate mineral and mineral-based products marketing arrangements;

- To promote and develop Tanzania as the gemstone centre of Africa; and
- To alleviate poverty especially for artisanal and small-scale miners.

Specific provisions within legislation include:

- Environmental protection measures exist for the disposal of tailings and waste in the form of regulations.
- The standards are available in the new Mining Act (1998) and require any project to have a detailed Environmental Impact Statement (EIS).

Marketing Arrangements

Local trading of mineral products mined by small-scale miners in Tanzania is divided into three main categories, namely small brokers, mineral brokers and dealers.

Small brokers operate by linking market services, from miners to mineral brokers or dealers. The number of such brokers varies from 1,000 to 5,000 depending on type and volume of the mineral commodity produced, season of production and quality of stones produced.

Mineral brokers (traders, miners) of whom the number changes according to the volume and quality of the mineral commodity. In 1996 alone it is estimated that there were 700 illegal brokers in the country. The main task of a broker is to buy mineral commodities in mine sites and sell them to city official dealers or mineral smugglers. Starting in March 1996 the government recognized and legalized the activities of mineral brokers when most claim holders in gemstone mines acquired brokers licences. For example, many of Merelani Tanzanite Mines in northern Tanzania are involved in mineral trading as one way of recovering (through buying) gemstones stolen from the claim by the workers.

Mineral dealers are licensed and unlicensed operators dealing with gold and gemstone in mine centres. The number changes from year to year, see Table 6, because the involvement of illegal brokers and unlicensed dealers reduce the volume of market commodities. This third group of mineral trading contributes most to the government revenues.

Table 6 Number of licensed mineral dealers from 1990 to 1999

Year	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**4/1996**
Gemstone	-	56	105	128	127	145	63
Gold		7	6	9	23	23	12
Lapidary		4	7	10	11	12	20
Brokers	*Not recognized by government until 1996*						86

Year	*1996*	*1997*	*1998*	*1999*
Gemstone	85	103	205	144
Gold	-	-	25	5

Source: Ministry of Energy and Minerals

A World Bank-funded study conducted in Tanzania 1995–6 indicated that about 60 per cent of gemstones and 70–85 per cent of gold produced by small-scale miners were smuggled out of the country.

In general, gemstone buyers use different approaches in order to get the commodity as cheaply as possible. Two of the strategies used include: booking production by credit finance to the miners; and offering incentives to the miners that enhance the business relationship. The price paid per stone also varies depending on the number of middlemen involved in the business. Example, a cat's-eye, round-shaped rough alexandrite weighing 2.00 to 3.50 grams in 1996, was sold by a miner at the site (Tunduru, Tanzania) for 500,000 to 800,000 Tanzanian shillings (TShs) to a small broker. The broker sold the same stone to secondary broker residing at Tunduru town for TShs0.5 to 1.5 million. A dealer in Dar es Salaam paid TShs3.0 to 3.5 million, and in turn sold it on to an exporter or foreigner buyer for TShs 4 to 4.6 million.

Marketing of salt, gypsum, sand and aggregates, dimension stones, lime and coal is a problem for the miners. This is because the products are in bulk, and the cost of transport is very high. As result, miners have not yet been able to establish proper market outlets. Instead, most of them wait at production sites for customers in need to visit them. If a customer does not know the production site, it will be difficult to market the product.

Despite economic changes during 1987, mineral smuggling in the country has continued for the following reasons:

- better financial conditions for trade in foreign countries because of fluctuating exchange rates;
- tax avoidance;
- excessive bureaucracy in acquiring export licences for mineral commodities;
- better prices in different foreign markets.

The changes made by the government in the new Mining Act of 1998 law and its legislation favour a better environment that will reduce mineral smuggling in the country.

Sustainable Development Issues

Since the government introduced policies aimed at liberalizing the economy in 1990, the growth of the mining industry, or solely small-scale mining, has grown by 51 and 24 per cent in 1991 and 1992, respectively. In 1992 about 76 per cent of all mineral export earnings came from gold mining by artisanal miners. In the years 1990–94 the Bank of Tanzania purchased 13.84 tonnes of gold from small-scale miners. Other development issues are discussed below.

In the past decade, the small-scale mining sub-sector has managed to meet the following national economic challenges:
a significant rise in the contribution of the mineral sector in the national economy and increase the gross domestic product (GDP);

- an increase in the country's foreign exchange earnings;

- an increased government revenues; and
- created gainful and secure employment in the mineral sector and provided alternative sources of income particularly for rural people.

Other major milestones have been passed by artisanal miners. One is new discoveries of large deposits in the country. Examples include the small-scale mining activities in the Kahama area which has led to discovery of large ore bodies like the Kahama Mining Corp's Bulyanhulu Mine, which is one of the biggest gold deposits in East Africa, now under development.

Foreign companies have entered into agreement with small-scale miners after re-licensing agreements. Examples include Tembo Mine located in the Geita district in which a foreign company has entered into an agreement with a small-scale miner to participate fully in mining, ore processing and marketing of products.

Other companies have provided equipment and working capital as in case of tanzanite mining in Arusha region, where small-scale miners are required to pay back the equipment and working capital after mining and selling the gemstones.
Most of gold-mining centres in the Lake Victoria goldfields practise health and environmentally friendly mining methods. These methods include: use of retorts during vaporization of mercury/gold amalgam to recover gold; use of special amalgamation ponds of which process water does not contaminate domestic or ground water; and the use of protective gear: gloves, masks, ear plugs, helmets and boots.

Technical Assistance to the Sub-sector

Basically small-scale mining in Tanzania has received little or no technical assistance. The extension service providers from government lack facilities to reach miners in remote areas. There have been few NGOs, which assisted the miners technically by provision of tools, equipment and training. Such institutions include:

- Pride Africa: financial assistance.
- Meremeta Ltd: the 1998 creation of a Tanzanian state-based/private joint venture in a branch where there had earlier been no state activity. It will buy gold from artisanal miners, initially in Geita district and later in the other main artisanal gold-producing areas. An advertisement in *Business Times* announcing its foundation described it as owned 50/50 by the government of Tanzania and Triennex (South Africa). For some reason the advertisement appeared under the name of the Ministry of Defence. Meremeta has supplied working equipment and machines to miners in exchange for purchasing gold from miners.
- Southern African Network for training and Research on the Environment (SANTREN): has supplied training on alternative technologies and environmental protection.
- USAID: the Equity and Growth through Economic Research (EAGER) project, funded by USAID, has been in place for six years. The final year of activity was 2000. The project was implemented by a large number of organizations. In Tanzania, the Ministry

of Energy and Minerals alleviated prosecutorial pressure on miners because an EAGER study showed that taxes lead to smuggling activities. Taxes were all but eliminated because the same research shows the enormous size of the small-scale mining sector.

- University of Dar es Salaam: provides training and technical services;
- Ministry of Energy and Minerals: provides both extension services and demonstration plants in specific areas of the mining regions, which can be hired by miners.

Interaction Between Large- and Small-scale Mining

The working relationship between artisanal mining and large-scale mining in Tanzania is very good in gold-mining areas, but there have been some reported clashes in gemstone areas, like the Merelani Tanzanite Mines, where there are land or claim disputes caused by political and economical intervention in the area.

There are critical factors for the successful cooperation between small-scale gold miners and large-scale gold mining companies. One is that the country has been politically very safe and stable as compared to neighbouring countries. This is essential to sustained development especially in the development of mineral resources. The government has also enabled a stable fiscal, legal and regulatory environment. The new legal and regulatory framework focuses on streamlining licences with guaranteed security of tenure, stability of fiscal regime, freedom of commercial operation, right to trade in mineral rights, access to foreign exchange at market rates. Finally, the geology of the country assures both small- and large-scale mining companies further mineral resource discoveries.

There are major international mining and service providing companies present to assist both big and small mining companies investing in the country. Currently, six major projects are underway which represent $870 million of direct capital investment. International financial institutions are well established in the country.

Some of the observed positive social factors between communities, small- and large-scale mining companies include the following examples. Large-scale mining projects, like Ashanti Mining Company, Golden Prode Mine, Kahama Mining Co, are creating direct and indirect employment for people. One of the major driving factors for indigenous people to move into artisanal mining has been lack of employment. Companies have implemented community development programes where they have their operations. Some major projects can be observed in gold-mining areas south of Lake Victoria, these include roads, water supply, schools and health centres. Large mining companies are assisting small-scale miners through technical assistance and improving infrastructure.

Economically, it can be seen that government is collecting revenue from the mining industry as well as benefitting from the increased growth of secondary industries, which employ unlucky small-scale miners.

Government and large-scale mining companies in Tanzania recognize positive contributions of artisanal and small-scale mining sub-sector to the economy. Some of these positive contributions include:

- Discovery of mineral occurrences; small-scale mining activities has led to discovery of large ore bodies. Economical mineral production, especially those of marginal reserves and located in remote areas.
- Employment creation for rural people (500,000–600,000 are engaged directly or indirectly.
- Income generation.

Other interactions include foreign companies that enter into agreements with small-scale miners after converting their licences. Some examples include Tembo Mine located in Geita district in which a foreign company has entered into an agreement with a small-scale miner to participate fully in mining, ore processing and marketing of the products. Other companies provide equipment and working capital, as in case of tanzanite mining in Arusha where the small-scale miner is required to pay back the equipment and working capital after mining and selling the gemstones.

Clashes that have been observed include the 1998 case when a large mining company called Trustan Mining and Trading Company blamed the government for the indefinite suspension of operations after the nearby small-scale mines were flooded. The company claimed that they have the necessary preventive gear for their workers.

Change in Laws

Like every other sector of the economy in Tanzania, mining has been subjected to economic reforms and restructuring undertaken by the government from the mid-1980s through the 1990s, which have marked a clear shift in favour of private sector development and market-oriented economic management instead of government ownership.

Following the 1990 policy reforms artisanal miners were encouraged to peg their claims, and organize miners' cooperatives and societies. As a result, there was a sharp increase of 'legal' artisanal mining operations. Although most miners were operating without licences, there has been a sharp increase in licensing for small-scale mining operations.

The present government is an active promoter and strong supporter of investment in Tanzania's mineral sector. The government's role is to provide clear policy guidelines, stimulate private investment and provide support for investors. A series of substantial political and economic reforms have been implemented over the last ten years, including the Mineral Policy of Tanzania 1997, the Mineral Act 1998 and Fiscal Package 1998. Under these changes, the 1998 Mining Act and 1999 Regulations govern all mineral exploration development and mining activities.

The provisions of the act have contributed significantly to investor confidence, particularly in terms of security of tenure of mineral licences and transparency and predictability of the way in which the mining legislation operates. The overall fiscal regime governing mining investment in Tanzania is favourable, such that both major and small-scale mining individuals and companies are investing in the country. For example, Tanzania has been the major focus of Africa's gold exploration and development over the past five years. As a result, the mining industry in Tanzania grew 27 per cent in 1999, a big increase on 1998's

17 per cent increase. Up to 15 per cent of total African exploration expenditure has been spent in Tanzania, believed to have the continent's largest gold reserves after South Africa. Diamonds, gold, nickel and gemstones also play key roles in Tanzania's growing mineral industry, but nearly all major developments have been seen in the gold sector.

The Mineral Policy of Tanzania in 1997 was to attract and enable the private sector to take the lead in exploration, mine development, mineral purification and marketing. The role of the government focuses on regulating, promoting and facilitating private investment. It also acts as service provider in the case of extension services for artisanal mining. In general, the public roles consist of:

- Policy formulation to accommodate the overall and sectoral government policy framework.
- Advising on legislation, regulation and fiscal matters related to the sector. Revenue collection through royalties, annual rents, prospecting rights and licences.
- Monitoring mining activities.
- Collection and maintenance of geo-technical data for promotional purposes.
- Provision of extension services to small-scale miners, administering and inspecting mining activities, and carrying out research on minerals.
- The mineral policy objectives are to:
- Stimulate exploration and mining activities.
- Regulate and improve artisanal mining.
- Ensure that wealth generated from mining supports sustainable economic and social development. Minimize or eliminate adverse social and environmental impact of mining activities.
- Promote and facilitate mineral and mineral based products' marketing arrangements;
- Alleviate poverty especially for artisan and small-scale miners;
- Promote and develop Tanzania as the gemstone centre of Africa
- The objectives of the policy with regard to small-scale mining activities are to:
- Promote small-scale mining and encourage investment.
- Assist in the identification of small-scale ore deposits and making them accessible.
- Provide education and training services on marketing and finance skills.
- Encourage and emphasize the transformation of artisanal miners into formal small-scale miners in such a way as not to deprive them of livelihoods.

The new Mining Act 1998 replaces the old Mining Act of 1979 with the aim of reducing bureaucracy in its implementation. The new Act modified some codes such that it guarantees progression from one license to another, depending on the work undertaken. The reconnaissance and prospecting licenses are emerged into a mining license. In addition,

the new legal and regulatory framework focuses on streamlining of licencing procedures and ensuring safe and environmental management practices.

The new act assures the following: security of tenure; stability of fiscal regime; right to trade in mineral rights; and access to foreign exchange at market rates.

Specific features in the new Mining Act 1998 include: right to trade in mineral rights; simplification and consolidation of past statutes on mining and mineral trading; improved security of tenure through removal of most past ministerial discretionary powers and introducing a mining advisory committee responsible of advising the Minister on decisions to make; enhanced clarity and transparency; fair, streamlined and non-discriminatory licensing procedure, and environmental management.

The mining Act of Tanzania is aimed to deter information hoarding on new discoveries, freezing of exploration acreage for speculative purposes, transfer pricing and tax evasion. The fiscal incentives provided to exploration and mining activities include the following among others: exemption of import duty and value-added tax (VAT) on equipment and essential materials up to the anniversary of start of production, thereafter a 5 per cent seal applies; depreciation allowances of 100 per cent; repatriation of capital and profit directly related to mining; and non-mandatory government participation.

Administration of the Mining Act 1998 is by the minister responsible for Mineral Affairs and Commissioner of Mineral Resources. Under the act, mineral rights concern large- and small-scale operations.

Again, there are prospecting rights and mining claims for small-scale operations by Tanzanian citizens, companies or cooperatives. These rights are available only in designated areas for prescribed minerals. Prospecting rights are granted for a period of 12 months and are renewable. The holder can peg a claim and register with the commissioner. The claim holder can prospect and mine this claim. It is valid for one year and renewed as long as mining operations continue. Claim holders must pay royalties and submit returns. Non-compliance leads to cancellation of rights. Claim preparation and annual fees are TSh5,000 and TSh6,000 per annum, respectively.

There is no state obligation to participate in mining ventures nor any requirement for local equity. The minister may transfer a mineral right upon application and approval.

Specific provisions for small-scale mining were introduced in the Mining Act of 1998 under Division D to support artisanal and small-scale mining. The provisions are aimed at:

- Curbing illegal mining and trading or smuggling of mineral products such as gold, diamond, coloured stones especially tanzanite in the black market.
- Addressing environmental effects of mining.
- Assisting small-scale miners to operate in a more organized manner.
- Providing technical support to small-scale mining.

- Generating more employment opportunities.
- Promoting viable small-scale mining activities.
- The Mining Act states primarily that small-scale mining licences are exclusively for Tanzanians only or companies owned by Tanzanians. But a primary small-scale mining licence can easily be converted into a mining licence in case a small-scale miner wants to involve foreign investors in its small-scale mining operations.

In conclusion, the government has withdrawn from doing business. The tax system has been simplified and strengthened, public spending reorganized, inflation lowered and the exchange rate stabilized. Individuals can move the capital freely in and out of the country. All aspects of economy have been liberalized to create a market oriented and private sector investment more friendly.

Organizational Structure of Small-scale Mining

The organization structure of small-scale mining varies according to: the legality of the working area; driving forces like credit mechanisms and technologies applied; presence of mine rush areas; and ability and efficiency of government institutions to service the sub-sector.

Prospecting rights (PR) are issued to individuals, partnerships, cooperatives or companies. Claim titles are also registered on the basis of the above categories, but the monthly claim return forms are written on the assumption that artisanal mining operations are conducted using a formal enterprise system. Informal product sharing system is the most widely used system, both in mine rush areas and in most registered claims in Tanzania.

The study conducted by Tan Discovery Minerals Ltd in 1996 shows that the present mining groups can also be classified on the basis of skills and legality of mine operation as: mine rush gangs; special service gangs/operators; formal/informal mine claim organizations and village/association organizational structures. It should also be noted that these types of operational organizations usually depend on each other, so that it is common to see specialized gangs and mine gangs operating in informal mine claim organizations. Any effort to transform the artisanal miners must take into account the existence of these organization structures.

Financial Availability to Small-scale Miners

Among the Mineral Policy of 1997 objectives was to draw strategies for improving small-scale miners' access to credit. One of the achievements is a sectoral aim to encourage and facilitate easy transfer of mineral properties and provide security to the creditors. The government emphasize the improvement of small-scale miners' access to credit and mainstreaming small-scale mining loans by formal financial institutions. The strategies drawn up by the government include:

- Supporting the formation of formal enterprise groups such as miners associations with commercial companies.

- Formalizing traditional funding systems by promoting the following: hire-cum-purchase system, forward sales, mutual group savings schemes.
- Encouraging financial institutions to formulate affordable credit schemes to the miners as well as establishment of mobile banking systems.
- Promoting the use of third-party guarantees to enable other institutions to assist miners to get loans.
- Facilitating the creation of mineral property markets to enable discoverers to sell their properties to developers at competitive prices.
- Encourage NGOs to establish miners' cooperative banks and informal financial institutions such as rotating savings and credit associations.
- Encouraging miners to increase their income through value-added activities.
- Arranging mining trust fund to finance simple mining equipment.
- Conducting awareness-raising programmes to promote savings culture.

Strategies Used by Various Players in Managing Small-scale Mining

The government of Tanzania is committed to support the small-scale mining sub-sector by facilitating the transformation of the present artisanal mining activities into more organized and modernized small-scale mining groups. It also promotes mineral marketing, which encourages transparent business transactions and discourages smuggling. Government strategies and initiatives include:

- Transforming and upgrading artisanal mining into more organized and modernized mining.
- Facilitating the availability of appropriate and affordable mining tools and equipment.
- Promoting partnerships between local small-scale miners and large-scale mining companies and facilitate technology transfer and optimize mineral resources exploitation.
- Provision of supportive extension services in mining, mineral processing and marketing.
- Streamlining and simplifying the licensing of artisanal miners and mineral dealers.
- Preparing, disseminating and enforcing a code of conduct in mining and mineral processing.
- Promoting market arrangements, which are responsive to the requirements of the artisanal and small-scale mining sub-sector.

Southern African Network for Training and Research on the Environment (SANTREN) has conducted series of training to artisanal and small-scale gold miners in the Lake Victoria goldfields on the following subjects:

- National training workshop on Women in Mining and Environmental Protection. Among topics covered include mining and environment; women and mining;

technological advancement in small-scale mining; financial problems facing small-scale women miners.

- Workshop on Community Education for Artisanal and Small-Scale Gold Miners on the Health Hazards of Mercury. Topics covered included attendance at a workshop: mercury and environment; hazards of mercury — rising awareness of mercury poisoning in mining community.
- Workshop on Application of EnTA to amalgamation technologies. Technical Workshop on Environmental Technology Assessment (EnTA), featuring Amalgamation Technologies in Artisanal and Small-Scale Gold Mining Industry.

Results of training programmes are very positive. Some of the achievements include: miners used to wash and amalgamate gold ores in river beds, which pollute water bodies; after training and mine visits, miners use special ponds for amalgamation process; most of gold miners use retort systems during burning of amalgam to produce gold instead of open air burning of gold; some miners have changed the processing methods after successful running of EnTA programme. Instead of intensive amalgamation process, miners use gravitational methods to recover coarse gold prior to amalgamation.

Other achievements include: foreign companies (e.g. South African Company (Triennex) through an enterprise known as Meremeta Ltd) buying gold from small-scale miners with an arrangement of assisting them in the mining and processing gold ore by providing appropriate and modern mining and processing equipment to the miners. Both government and NGOs have prepared training manuals for small-scale mining in which all the essential procedures are elaborated as provided by the law. Some of the manuals are translated into the local language, Swahili so that the miners can understand them better.

Guiding the Transition to Sustainable Development

The government of Tanzania recognizes the positive contribution of the artisanal and small-scale mining sub-sector to the economy which includes the discovery of mineral occurrences, mineral production and the creation of employment and income in rural communities. In view of this, the government is committed to supporting the small-scale mining subsector by facilitating the transformation of present artisanal mining activities into more organized and modernized small-scale mining units, and by promoting modes of mineral marketing which encourage transparent business transactions and discourage smuggling. Among successful strategies taken includes a change in legal and regulatory framework. Tanzania has introduced Tanzania Mining Policy 1999. Under this policy, the role of the government will be to stimulate and guide private mining investment by administering, regulating and facilitating the growth of the sector through a well-organized and institutional framework. A cornerstone will be implementing successful strategies taken by government to improve small-scale miners' access to credit include:

- Transforming and upgrading artisanal mining into organized and modernized mining.
- Facilitating the availability of appropriate and affordable mining tools and equipment as well as encouraging their manufacture and supply. Most mining communities can access mining equipment within the region by existing service providers.

- Promoting partnerships between local small-scale miners and large-scale investors to facilitate technology transfer and optimize mineral resources exploitation e.g. TANSCAN and Anglo-American exploration companies have been active in collaborating with the artisanal and small-scale miners. Large exploration and mining companies have assisted small miners with drilling equipment, water pumps, training.
- Providing supportive extension services in mining, mineral processing and marketing.
- Streamlining and simplifying the licensing of artisanal miners and mineral dealers.
- Preparing, disseminating and enforcing a code of conduct among those active in mining and mineral processing.
- Promoting marketing arrangements, which are responsive to the requirements of the artisanal and small-scale mining sub-sector.

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South Africa

Overview of the Sector

Small-scale mining is fairly widespread in South Africa and has grown substantially in the last ten years. It is generally accepted to be a poverty-driven activity and may be seasonal in nature or a way to supplement other economic activities such as subsistence agriculture. There are, however, a substantial number of small-scale miners who do nothing else and this is their sole means of earning a livelihood. Some are driven by absolute poverty, such as rural women in KwaZulu Natal who mine kaolin at great personal risk to themselves, to be sold to intermediaries at below market value or to communities to be used as cosmetics or medicine. Some small-scale miners hope to find riches, such as the small-scale diamond miners in Kimberley. In this case there is a parallel market (read illegal) for diamonds. The Northern Cape government estimates that it is losing millions per annum through these illegal sales. In some cases artisanal miners are used as fronts for money-laundering and other criminal activity. Yet a third category have organized themselves in a semi-formal business fashion and grown substantial operations that sustain whole communities. One such example are the brick makers in Osizweni in Kwa Zulu Natal who have been mining clay and making bricks for over two decades, and in the process economically sustained a whole community. However, as such activity used to be seen by the authorities as illegal, no environmental or health and safety requirements were followed with the result that the area is an environmental disaster and a great risk to the miners and their communities.

Figure 1 and Tables 1–3 indicate the extent of the small-scale mining sector in South Africa, revenue generated and mineral commodity mined.

Table 1 indicates the size and revenue generated of typical small-scale mines. These figures refer to the formalized operations (with registered permits) and do not include the informal or illegal ones. There are many informal diggers in the country who are generating far less revenue than is indicated, and have fewer assets than those presented in the table.

Table 2 shows the ratio of revenue generated per employee (equivalent to production) for mines categorized by numbers of employees. An interesting point to note is that mines with up to 50 employees are as productive as mines with up to 200 employees which indicates that at least in the formalized sector, small-scale mining can be productive.

Table 3 illustrates employment distribution by commodity as well as presenting a gender breakdown. These statistics are for the total industry including small-scale mining. Clearly men play a far more significant role in the mining industry although there are significant numbers of women engaged in small-scale mining.

Figure 1 indicates number of mines in each province by size. Small-scale miners are most concentrated in rank order: Western Cape, Free State, Northern Cape, North West Province and Kwa Zulu Natal.

Table 1 Classification of mining and quarrying operations

Category	Micro	Very small	Small	Medium
No of employees	*<5*	<20	<50	<200
Assets (property excluded)	<R100,000	<R1.8m	<R4.5m	<R18m
Annual revenue	<R150,000	<R3.0m	<R7.5m	<R30m

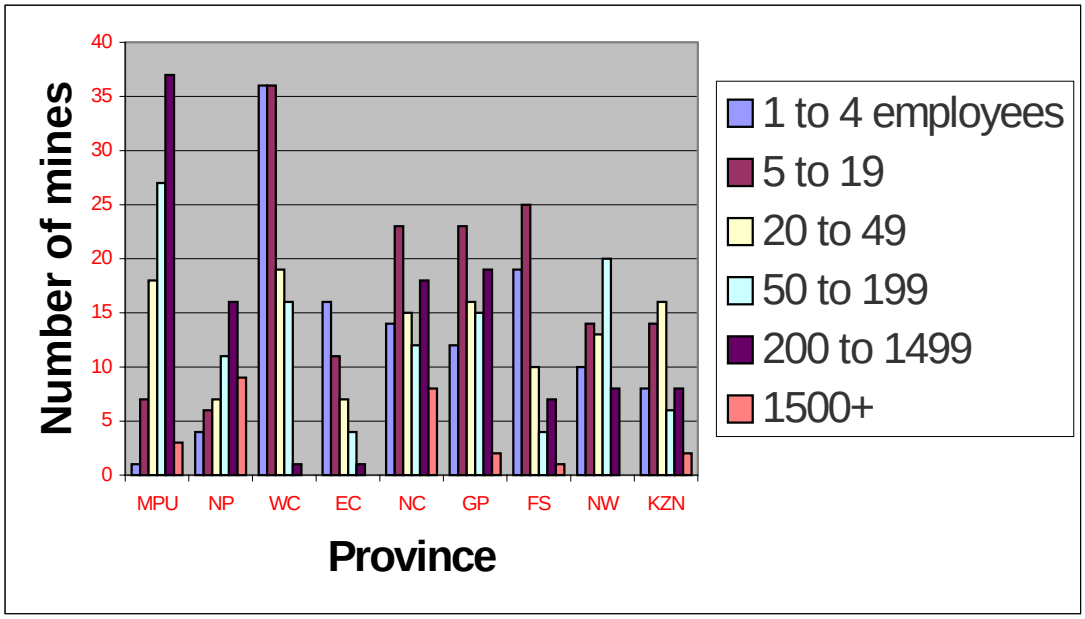
Table 2 Employment and revenue by mine size

No of employees per mine	Contribution to total industry employment (%)	Contribution to total industry revenue (%)	Ratio of total industry revenue to employment
1 to 49	1.1	2.5	2.3
50 to 199	1.4	3.2	2.3
200 to 1,499	8.2	22.1	2.7
1,500+	89.1	72.2	0.8

Table 3 Employee distribution in each mine size by mineral commodity (%)

Mineral Commodity	1 to 4	5 to 10	20 to 49	50 to 199	100+
Precious Metals	0	0	0	0.1	99.90
Coal	0	0.02	0.1	0.5	99.38
Base and other metals	0.02	0.1	0.3	3.5	96.08
Precious Stones	0.1	1.4	1.6	6.0	90.90
Hard rock quarrying	0.1	3.3	9.9	20.5	66.20
Soft rock quarrying	3.2	16.1	24.6	29.0	27.10
Industrial minerals	0.1	1.7	6.6	37.6	54.00

Figure 1 Number of mines in each province by mine size



Mining Methods

Most small-scale mining operations in South Africa can be described as artisanal relying on little more than pick-and-shovel methods. In some cases, such as diamond panning in the Northern Cape Province, simple technologies are used, however, the efficiencies of these systems are highly dubious. A study undertaken on pan optimization for the Northern Cape small-scale miners revealed that most were recovering little over 50 to 60 per cent of the potential carats per ton. Other mining methods are equally unsophisticated. In the Mpumalanga region, for example, small-scale miners searching for gold have sunk underground shafts without ventilation or prop support. They consequently mine under extremely dangerous conditions with the resulting accidents and loss of life. Other examples of simple technology is the mining of kaolin in Kwa Zulu Natal by a group of women small-scale miners. Once again technology is restricted to pick-and-shovel operations with miners digging into the overhanging rock often risking the collapse of the tunnels with resultant loss of life.

It can be concluded than that the level of technology deployed by the miners is low and that a substantial amount of work is required to raise them to profitable, properly managed business ventures. Where technology is used it is usually outdated with either adapted machinery (such as pumps and screens) or very old equipment. Miners also practise very unsafe mineral-extraction methods. For example, mercury is commonly used in gold extraction. Mintek have developed a gold extractor, which uses household chemicals (chlorine based) and is very cheap to manufacture. They have offered to train small-scale miners to use the method.

Value Addition

South African small-scale mining operations allow for purification opportunities. An example will illustrate this. As already noted, in Nwdedwe Kwa Zulu Natal, a group of

women small-scale miners have been mining kaolin from the mountain side to be used for medicine and pottery. Apart from the highly dangerous nature of the exercise, the mined material is sold to the local community for little profit. The NSC and Eskom (the electricity supplier) in a bid to assist the miners have developed a business plan to legalize and regulate the operation. Eskom will provide a site and the NSC will assist in the technical aspect (such as drilling and ore body assessment). Eskom do not wish to purchase the material but they will assist in marketing. Presently, the organization is involved in a porcelain plant near Durban harbour (they are supplying the power). This will be an ideal vehicle to market the material and the project has the potential to expand into the export market.

The Existence of Small-scale Mining Associations

A number of small-scale mining associations exist in South Africa. They are particularly prolific in the Northern Cape Province. In Kimberley, for example, there were three associations: African United Small-scale Miners, Rainbow and Nation building. They amalgamated into the Small-scale Miners Forum. The Forum managed to raise funding from the KWAGGA programme at the MEPC (Canadian funded) and from De Beers to set up offices and an administrative structure. They have managed to negotiate a number of projects for their members including a manganese project and a diamond dump-re-processing project in Kimberley.

Similar (although not as well developed) associations exist in other parts of the country, for example the Namaqualand Small-scale Miners Association. There is also a move to coordinate associations at a national level. The Small-scale and Junior Mining Interim Committee (representing most of the small-scale mining groups in the country) is presently negotiating with the Chamber of Mines on possible membership.

Financing Available

In 1998 the South African government launched the Small-scale Mining Development Framework intended to stimulate and develop the sector. The National Steering Committee of Service Providers to the Small-scale Mining Sector (NSC) was started to provide technical, managerial and financial support for small-scale mining projects. The financial assistance comes from two departments from trade and industry: Khula (who provide loans) and Ntsika (who provide services in kind such as training and capacity building) and the Industrial Development Corporation which provides commercial bank loans. The process for getting funding for small-scale mining is the following: pilot projects are identified and a business plan prepared based on technical input and managerial process. The business plan is then submitted to IDC for evaluation. If approved, IDC usually grants 90 per cent of the loan and the project (usually in the form of a cooperative or CC) is responsible for raising the remaining 10 per cent. Currently the NSC has negotiated a number of such agreements with small-scale mining legal entities.

Review of the Legislative Arrangements

The South African Draft Development Bill was released for public comment at the end 2000. The MEPC hosted two community workshops on the bill and submitted the finding to government for consideration. The draft bill is a radical departure from previous bills

particularly with respect to the ownership of mineral rights. There are several key aspects of the bill which affect the small-scale mining sector.

The bill intends reverting all mineral rights to the state (which brings South Africa into line with the majority of mineral-producing economies). Small-scale miners are concerned with a number of aspects of this in particular: clarification on how the bill will deal with compensation for mineral rights under the existing regime; clarify the position of land claimants which is subject to new or existing mineral lease or mine developments; and clarify the position of traditional communities regarding land and mineral rights.

The lack of any clear policy or guidelines for the small-scale mining sector is notable. Small-scale miners expressed the need for: access to finance; availability of geological data; the creation of 'one-stop shops' to make application procedures easier; the proposal was mooted that a 'mineral bank' similar to the land bank be set up to assist in the raising of finance; existing institutions such as the NSC, and government agencies such as Ntsika and Khula were seen as being too slow in delivery.

The bill proposes the setting up of a ministerial advisory board to advise the minister on all aspects of the bill. The small-scale miners felt that the board should have some teeth, namely that the minister could not unreasonably overlook its recommendations.

Big business took exception to the wide powers granted to the minister particularly with the granting of permits and mining licences. Small-scale miners feel that although the system is designed to assist them (by bringing on board the previously disadvantaged), it may not work as intended and become too cumbersome. They too would like to see more checks and balances.

The South African Regulatory Environment

Environmental legislation is governed by the National Environmental Management Act of 1998, the Mining and Minerals Act of 1991, EIA guidelines of 1997 the Environmental Conservation Act of 1986 and the Aide Memoir requirements of 1992.

Most of these regulations are unintelligible to small and artisanal miners, who rarely adhere to the standard guidelines nor do they engage in any rehabilitation programmes. Since the drafting of the new legislation, however, all small-scale mining operations applying for prospecting or mining permits are forced to pay a deposit for rehabilitation. Many of them find this burdensome which leads to non-registration or simply mining illegally. Similarly the requirements of the EIA assessments are quite beyond the capacity of the small-scale miners who have neither the resources nor capacity to carry out such an assessment. The DME in Kimberley has developed simplified EIA requirements, which are applied to 'artisanal' miners — defined as non-mechanized operations.

The key pieces of legislation governing labour relations in mining are: the LRA of 1995; The Basic Conditions of Employment Act of 1997; the Employment Equity Act of 1998; and the Skills Development Act of 1998. In each case only small parts of the legislation apply to small-scale and artisanal mining. For example, under the LRA collective bargaining

is only appropriate if a union is active in the sector. Also the Employment Equity Act would only be applicable to mines employing over 50 people. Most small-scale mining caters to designated groups anyway. The Basic Conditions of Employment Act is applicable in a number of areas (such as conditions of service, hours of work, leave entitlements), however, this piece of legislation is being revised particularly as it pertains to small businesses.

Health and Safety is governed by the Mine Health and Safety Act of 1996. Much of these regulations do not apply to small-scale miners. For example, a central feature of the act is the inclusion of Safety Committees made up of management and union representatives whose function it is to regulate safety issues on mines and advise on policy and other issues. The section pertaining to small-scale mining is: 'Every mine with more than 20 employees must have a health and safety representative for each shift at each designated working place at the mine.' At present this is not occurring in small-scale mining at all. The reason may be capacity and training issues as well as knowledge of the act.

The Skills Development Act of 1998 sets out the framework for developing a coordinated approach to skills development in the country. The act was promulgated in order to improve productivity in the workplace, promote self-employment, encourage employers to use the workplace as an active learning environment and to provide opportunities for new entrants to the labour market to gain work experience. The act will be achieved by setting up a National Skills Authority, imposing a skills development levy on employers, setting up a National Skills Fund developing Labour Centres and setting up a Skills Development Planning Unit. The act will be enforced in Mining through the Mining Qualifications Authority, which will be responsible for accrediting qualifications in the sector.

With respect to small-scale mining, the National Steering Committee of Service Providers to the Small-scale Mining Sector (NSC) is in the process of developing a course for small-scale miners which it is hoped will be accredited through the National Qualifications Framework.

South Africa has general environmental laws. Environmental Conservation Act (1989) established the Council for the Environment. The Council has developed guidance for environmental impact assessment (EIA). EIAs are required for all major mining and water projects. Other existing acts that address environment are: the Environmental Laws Rationalisation Act (1997); and the National Environmental Management Act (NEMA) No 107 (1998).

Sectoral environmental legislation includes: National Water Act (1998); Water Services Act (1997); Atmospheric Pollution Prevention Act (1965); Occupational Health and Safety Act (1993); National Health Act (1995); and the Nuclear Energy Act (1999).

Mining and Environmental Policy and Law

The following mining laws deal primarily with administrative matters and do not specially address environmental concerns: the Minerals Act (1991); the Mines and Works Act (1956) addresses worker safety and includes rehabilitation requirements; and the Mineral and Energy Laws Amendment Act (1994).

Specific provisions within legislation include: mineral lease agreements and standard contract requirements; mining and prospecting authorization; environmental management plans (EMPs); monitoring and EMP performance assessment; rehabilitation programmes; pollution control requirements; closure of mines and exoneration certificates; financial provisions for closure; regulations on waste disposal/stormwater control/rehabilitation; radioactive licensing; mandatory Codes of Practice on safety and health risks; effluent discharge permits; river diversion permits; and requirements for the eradication of invader species.

Existing policies include: White paper – Environmental Management Policy; White paper – Minerals and Mining Policy; Mine closure policy; Policy on Financial provision for rehabilitation; White paper on Integrated Pollution and waste Management; and National Water Resource Policy

Technical Support

Technical support is largely through the NSC. It comes in a few forms. The Council for Geosciences, one of the participants on the NSC, conducts all geological surveys for identified pilot projects. This becomes incorporated into the overall business plans. Similarly the Council for Scientific and Industrial Research (CSIR) through its Miningtek branch develop the mine plans and the technology to be deployed on the small-scale mine pilot projects. Organizational development, training and marketing aspect are handled by MEPC, Ntsika and the Industrial Development Corporation. Although the different aspects of technical support are handled by different organizations, a team approach is adopted with respect to developing the final business plan and particularly with the implementation of the project once the necessary funding has been raised.

Relationship between Large and Small-scale Mining Companies

An interesting development in South Africa over the past few years has been the involvement of large mining companies with small-scale miners. A few examples surfice. In the Kimberley region of the Northern Cape, Samancor the company mining manganese entered into a mineral lease agreement with the Small-scale Miners Forum, over manganese deposits in the Postmusburg area. These deposits were owned by Samancor who were prepared to hand them over without charge to the small-scale miners in exchange for an ore supply agreement with Samancor. Technical support came through the NSC. Samancor made available one of their operational managers to help steer the project forward and assist the small-scale miners each step of the way.

In a similar vein De Beers have entered into a joint venture arrangement with small-scale mining groups over the mining of diamond dumps. The first project, called Dumpco, involved granting the mineral rights to some of the old dumps in Kimberly. Ex-De Beers mineworkers (re-trenchees) formed a trust and now run the operation themselves. As with Samancor, there is an ore supply agreement and the recovered diamonds are sold to De Beers. The operation is run through an elected management with participative working practices. De Beers made available a loan to buy a processing plant, which is repaid at low interest. The mine process uses a combination of technology and manual labour to

maximize the labour component. While there have been problems in implementation as well as labour problems, the project does serve as a model for the South African context.

Land Issues

With small-scale mining the issue of land access is directly tied up with access to minerals. One of the biggest constraints facing the sector has been the inability to access minerals and to have the technical expertise to assess the reserves. As new deposits have been scarce, the known deposits have given rise to conflict among groups trying to access them. A few examples illustrate the point.

In Barkley West in the Northern Cape Province the African United Small-scale Miners Association (AUSMA) succeeded in securing a site for diamond mining and raised capital for machinery. The site was clearly demarcated and adjoined an environmentally sensitive area which had valuable archaeological diggings and been declared a world heritage site. In addition, the Northen Cape Government had raised monies to employ an archaeologist who was busy surveying the site. The membership of AUSMA grew, as did the numbers working the site. A splinter group, African Rainbow Minerals, began mining on the adjacent heritage site. The Department of Minerals and Energy threatened to cancel AUSMA's mining permit unless they controlled their membership and an ugly conflict developed between AUSMA and African Rainbow Minerals, which threatened to spill over into violence. A mediation process was set in place and eventually after a lengthy process, alternative mining sites were found for both groups. The original AUSMA site was given up and a junior company acquired the mining title and commenced operations. Requirements for issuing the permit was that rehabilitation would commence prior to mining and that a proper EIA would be conducted. This case illustrates is how easily unregulated mining can lead to social conflict which will eventually lead to land misuse and consequent degradation.

Environmental Impact Assessment (EIA)

Small-scale miners find it almost impossible to adhere to EIA requirements that accompany permit applications and which form part of the new legislative requirements. In cases where small-scale miners receive state assistance in the form of the NSC, these requirements are adhered to and agreements reached between the project and the department of Minerals and Energy. In many cases the department has, in the case of artisanal miners, waived the requirements and simply charged a deposit for post-mining rehabilitation. The reality is, however, that such deposits are far too low to conduct post- mining rehabilitation and the problem therefore remains.

Sustainability

Sustainable development is the buzzword of the 1990s and encompasses not only mining but also many other activities as well. Thus sustainability in mining would mean the transition from mining to other activities that could replace it once the ore body is depleted. With respect to small-scale mining it often means the ripple effect into other economic activities: or how does small-scale mining stimulate other related forms of economic activity? The reality in South Africa is that because the sector is so underdeveloped it has

not really generated any secondary activities. For a ripple effect to occur, some formalization of the sector is required. For example, if throughput is increased by the introduction of technology this can gear the sector up for a number of secondary economic activities: machinery has to be purchased and serviced; the production system will require to be supplied with various materials; access roads may have to be built. An example of this is the case of the Samancor/Small-scale Miners Forum joint venture on manganese mining in Postmasburg in the Northern Cape. Once the business plan had been finalized, a number of infrastructure requirements emerged: a access road had to be built to the site (which neeeded labour from the local community); during the feasibility stage, sampling was carried out by the local community; the rail link had to be extended and upgraded; once the project reaches fruition a shaft will need to be sunk with more technology and equipment being applied.

Developing Small-scale Mining in South Africa

Over the past few years many lessons have been learnt with respect to developing the sector.

Avoid unrealistic claims as to what the sector can achieve. Small-scale mining in South Africa is linked to the black economic empowerment arena, therefore it has received prominence in the post-1994 period. Most artisanal miners are black and historically have been prevented from running their own operations. Small-scale mining has also been seen as a means of alleviating rural poverty, which is a particular focus of government given the huge discrepancy in wealth in South Africa. However, these claims need a great degree of circumspection. Experience on the NSC reveals that a lot of resources are needed to regulate and to develop the sector and that the 'return on effort' is not that significant.

Care is required in selecting projects to support. Experience on the NSC has shown that much time is wasted on projects with little chance of success, or else the promoters are 'chancers' looking for state handouts. The way to resolve this is to screen all applicants for assistance at regional level. The local Department of Minerals and Energy then assesses the application in terms of: whether the promoters have formed a legal entity; whether a permit exists; whether mining has occurred previously; any information on the ore deposit; environmental considerations. Once these facts have been established, and the project deemed viable, a formal application is sent to the NSC for evaluation. Only then are field visits conducted by the various service providers in order to make a recommendation.

Develop a business plan which is appropriate for the miners. This is best illustrated in the case of the Ozizweni brick-making project in Kwa Zulu Natal. The background is the following, the community at Ozizweni in Kwa Zulu Natal have been making bricks for the past 20 years. Clay and coal is mined within the village and fired in primitive kilns built with the bricks. The brick-making has sustained the village for this period of time, however, the whole area is an environmental and health and safety disaster. Buildings have collapsed into the diggings and there have been a number of fatalities because of collapsed hangings.

The mining is mainly done by women and children in an informal way: each digger pays a small rent for a site and sells his or her bricks independently of the surrounding community. Once the project had been identified as a NSC one, a process was set in

motion. The miners formed a trust which was registered and an alternative site was identified by the department. The trust entered into an agreement with the DME for a prospecting permit and also into an agreement with the NSC to develop a business plan. The plan was produced by five of the service providers: Council for Geosciences assessed the ore body; Mintek evaluated the processing techniques; CSIR worked on the mine plan; IDC commissioned a marketing study; and MEPC looked at the organizational structure and training needs. The service providers worked in a team and met regularly to review progress. Originally it was decided to replicate the mine methods (pick and shovel) on the new site, however, with safe and legal methods. Half way through the project CSIR called a meeting and said that the throughput would be so small that the miners would not be able to sustain the operation.

It was then decided to introduce basic technology at a cost of about R1 million. A meeting was held with the trust and they agreed that this was the route to follow. The business plan was then finalized and the plan was taken to the IDC for financing. IDC agreed to fund provided a joint venture partner could be found to raise 10 per cent of the monies as well as assist in project management. A local brick company was identified and they agreed to provide an on-site project manager as well as the remaining funding. All documentation is now in place, and the project is ready for commissioning in October 2001.

There is lobbying for separate regulatory requirements for small-scale miners. South Africa's mining legislation has 'levelled up' to that of international best practice. This has put it beyond the capabilities of small-scale miners. The result is that most small-scale miners ignore the requirements completely with resultant risks to health and safety, environmental degradation, poor labour relations practices (such as use of child labour). An international study on regulations in the sector conducted by the Intermediate Technology Development Group in the UK, which examined 18 countries, concluded the following: all 18 countries recognized the sector; most of the issues to do with small-scale mining but excluding labour relations are addressed by the legislation; the current trend in policymaking is to encourage integration of the sector into the mainstream; large proportions of small-scale miners operate outside of the formal regulatory environment; small-scale mining is generally seen as a national industry and should remain a national initiative and the motive in some countries to control it rather than develop it.

Consult with the miners themselves. Experience gained on the NSC is that the consultation process must begin at the onset. Not only does this ensure buying in but it also acts as a capacity-building exercise. Small-scale miners are party to the decisions taken on all aspects of developing a business plan.

Zambia

Introduction

Mining has been the economic and social backbone of Zambia since the first major phase of large-scale exploitation of the lead and zinc deposits at Kabwe (formerly Broken Hill) in Central Province and Copperbelt's copper and cobalt deposits begun in the early 1930s. It accounts for about 80 per cent of export earnings, about 13 per cent of the GDP and about 15 per cent of total formal employment. For instance, in 1997, the mining sector contributed US$822 million (78.3 per cent) to the total export earnings of $1,050 million. Of this, $798 million was realized from sales of copper and cobalt. The balance of mining sector earnings come from sales of gold, silver and selenium, mostly by-products of copper mining and from emerald sales. These mining activities have been carried out mainly on a large scale following the advent of multi-national corporations.

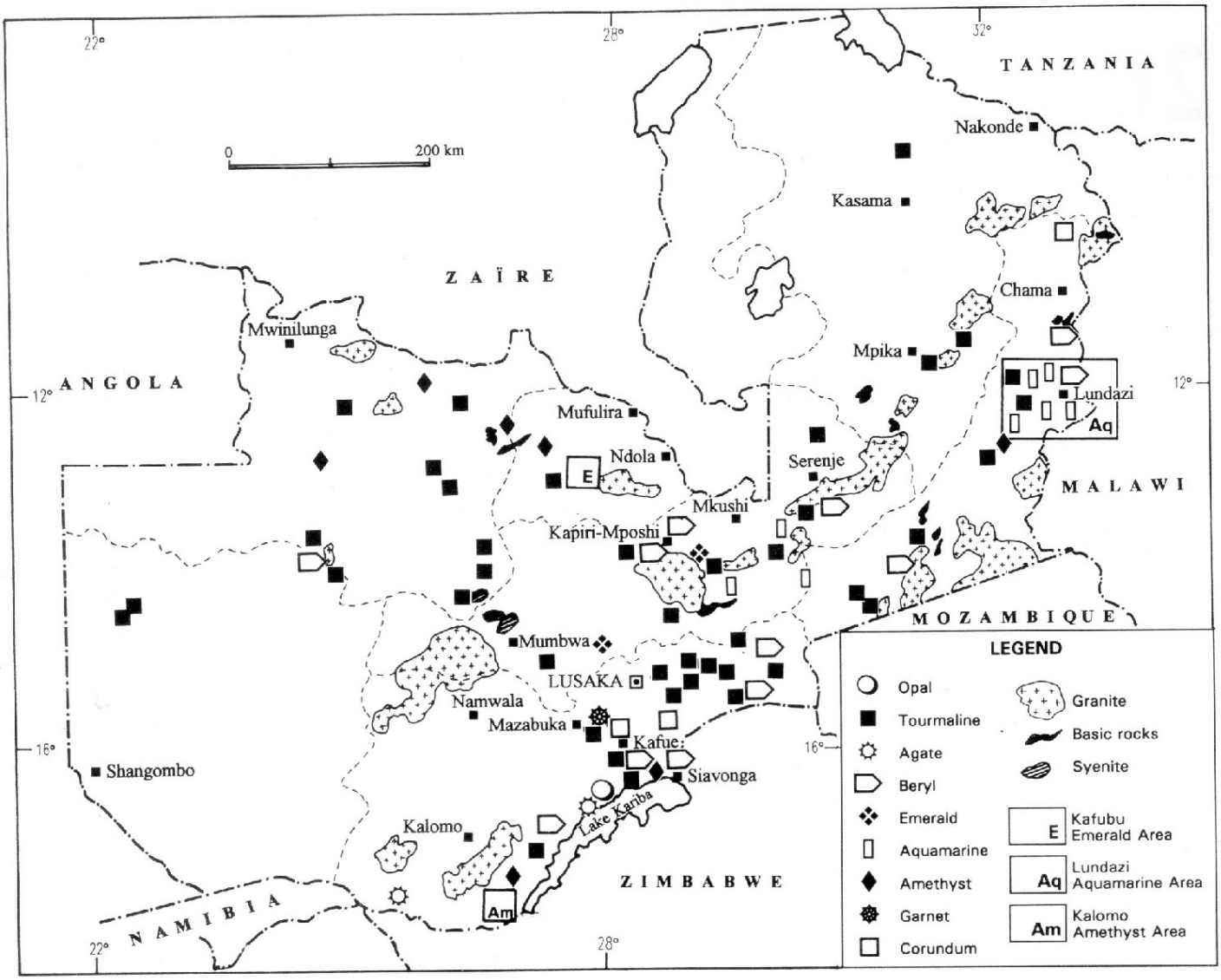
Apart from these large deposits, Zambia is endowed with a variety of high-quality gemstones notably emerald, aquamarine and amethyst. Emeralds are said to be among the world's best. It has been estimated that gemstones alone contribute about 25 per cent of mineral production in Zambia (Taupitz, 1991).

The mining community in Zambia has been divided into large- and small-scale operations according to investment capacities and capabilities. This classification has been adopted in the mining legislation and is used to classify mining rights.

General Characteristics of Small-scale Mining

Small-scale mining includes operations carried out under prospecting permits, small-scale, artisans mining rights and gemstone licences. It is specified in mining legislation and defined according to the area of mining rights and requirements of mine safety legislation. These systems have been used in Peru and are in line with a UN survey of small-scale mining in 1972 reported by Berger (1982).

This sector is dominated by the mining of gemstone namely emeralds, amethysts, aquamarines, beryls and garnets. Gemstones are mainly produced in rural areas from three mineral provinces: emeralds from Ndola Rural (or Kafubu) area, aquamarines from the Lundazi, Nyimba area and amethysts from Siavonga, Kariba area. Other localities are insignificant by comparison to these three. The distribution of gemstone occurrences in Zambia is shown on the map below.



Gemstone occurrences in Zambia

The gemstones of highest quality are emeralds, aquamarines and amethysts. Emeralds are estimated to account for approximately 20 per cent of the world production and are the most important contributor to the gemstone industry and the Zambian economy. Aquamarines and amethysts play less significant roles. Other minerals mined in significant amounts include garnet, topaz, agate and opal.

Surface mining takes the form of pits excavated by illegal miners who scavenge on already-developed mines by transporting material suspected to be containing emerald in sacks to places where washing and recovery can be done mainly at night and in streams.

Underground mining takes the form of narrow tunnels following the mineralized vein. These excavations are hazardous in that they lack ground support, are poorly ventilated and badly lit. Deaths have been reported due to caving. As the activity is illegal, it is also clandestine.

Emeralds are mined in the Ndola rural restricted area situated about 70km south of Kalulushi town in Copperbelt Province. The emerald mineralized area covers approximately 1,200km^2 , within which there are several gemstone licence holders.

Mining activities date back to 1931 when the Miku emerald deposit was discovered. Since then, the area has been a scene of unlicensed mining activities until 1984 when licensing of the operations started following the declaration of the area as a protected area. By 1990, the area had been divided into more than 200 plots of about one square kilometre each (Masialeti, 1999). To date these operations have become so extensive that mining excavations and huge waste dumps have become the most common sights. However, illegal mining activities still continue, making it even more difficult to control the operations.

Systematic exploration of the Ndola rural restricted area using modern techniques such as radiometric surveys and soil geochemistry offers considerable potential for the discovery of additional deposits of high-quality gemstones (Tembo et al, 2000). Local communities without any formal knowledge in the mineral sciences have done most of the discoveries so far. This suggests that with systematic prospecting, more discoveries are possible.

Small companies, in form of syndicates, cooperatives and individuals dominate the gemstone industry. In emerald mining, the government however, has a significant presence through its 55 per cent ownership in Kagem, the largest emerald mining company. Mining practices in rural Ndola are conducted at three different levels (Tembo et al, 2000). Essentially there are three basic types.

The smallest and simplest operation is characterized by the use of simple tools and absence of a formal enterprise. These operations are normally conducted as a spontaneous activity without legal title to the property worked. Artisanal mining in Ndola emerald mining area is predominantly perpetuated by illegal miners (see Figure 2). A number of such workings have been reported within Kagem Mines Ltd, Kamakanga and elsewhere.

A traditional small-scale mining operation comprises registered and licensed non-mechanized or semi-mechanized mining operations run by society members or entrepreneurs with the use of hired labour and with a basic management structure. Most mines in rural Ndola are of this description.

Illegal miners rounded-up at by paramilitary police

Traditional non-mechanized mining operation in rural Ndola

These mines lack financial resources as well as appropriate management and technical skills. The mining operations are done haphazardly such that overburden is dumped in the direction of the ongoing excavation. In a bid to minimize costs, benching is usually inadequate resulting in high walls that are dangerous.

The advanced small-scale mining operations are legally constituted, highly mechanized and undertake reasonable geological investigations and mine planning prior to beginning. These mines are highly productive. Kagem Mines Ltd, Kuber Minerals Ltd, Grizzly Mining Ltd, Sandawana Mine, Division of African Minerals Ltd and Chavuma Mine are examples of such operations.

Advanced small-scale mining in rural Ndola

Typical pit in Lundazi mining area

Current mining operations in Ndola rural do not exceed a depth of 60m, making surface mining methods more appropriate. Lack of reliable information on geology, hydro-geological conditions as well as physical and mechanical properties of surrounding country rocks make optimal mine design difficult. Blasting is used where the overlying overburden is hard and difficult to remove by excavators. Controlled blasting techniques with low powder factors are desirable to reduce damage to emeralds.

In the Kalomo and Lundazi areas, mining operations are much shallower and less extensive. Operations from other areas are of similar nature utilising mainly simple tools and techniques. In Lusaka, women and children with some youth are actively engaged in manual crushing of marble. Although this activity is illegal and efforts by the ministry of mines to stop the practice have yielded no results, there are no studies done, to assess the potential for pneumoconiosis.

Mwenechanya (2000) estimates that, out of every 30 to 40 registered gemstone operators, two (5–7 per cent) were large-scale mechanized mines and the number of unregistered mining operations range from 200 to several thousand. In rural Ndola Tembo et al, (2000) estimate that out of 400 licences, only 20 (5 per cent) were active.

Because of rain, mining in the wet season has proved to be very difficult so activity is concentrated in the dry season. In the Kalomo mining area, for instance, mine workers tend to concentrate on farming during the rainy season because it is the main source of livelihood.

Economic and Technical Impacts

Small-scale mining operations are mainly for gemstones. Emeralds account for about 80 per cent of national gemstone production in value, while amethyst comprises the largest output by volume (Mwenechanya, 2000). Emeralds from Zambia have been estimated to account for about 20 per cent of world production. It was reported by Mpande (1982) that emeralds could fetch prices as high as $3,000 per carat. However, Sikatali and Mambwe (1994**)** estimated that the amount of cut emeralds in 1989 and 1991 were worth $17.8 million and $22 million, respectively. This translates into prices of $387 and $629 per carat. Table 1 shows the production of gemstones from 1980 to 1992.

It can be seen from the table that amethysts account for highest proportion (97 per cent) of production by weight with beryls as the second highest with 3 per cent. These are followed by emeralds (0.58 per cent), aquamarines (0.57 per cent) and finally tourmalines with 0.45 per cent. Figures for the past decade are not very different from the ones above. The updated number of people involved, the range of mineral mined and production figures per mineral are available from the Ministry of Mines and Minerals Development.

Table 1 Sales of gemstones in the period 1980–1992 (in kilograms)

Year	Emerald	Aqua-marine	Amethyst	Beryl	Tourma-line	Total
1980	-	-	3,360.00	-	-	3,360.00
1981	-	-	45,222.00	-	-	45,222.00
1982	22.92	-	23,476.00	-	-	23,498.92
1983	17.37	-	33,799.00	43.94	452.06	34,312.37
1984	22.94	743.00	34,827.00	305.89	440.06	36,338.89
1985	114.75	2.98	19,612.00	432.18	12.42	20,174.33
1986	413.09	0.38	6,913.00	722.92	-	8,049.37
1987	0.99	63.03	3,981.00	1,130.27	-	5,175.29
1988	1.04	56.14	4,791.00	1,343.31	-	6,191.49
1989	0.35	86.98	6,275.00	879.93	-	7,242.26
1990	0.68	166.05	15,129.00	1,632.55	1.18	16,929.46
1991	618.04	-	139.96	-	-	758.00
1992	-	65.44	512.27	-	33.68	611.39
Total	1,212.17	*1,184.00*	198,037.23	6,490.99	939.40	208,863.75

Source: Industrial Minerals in Developing Countries, edited by Mathers S.J. and Notholt A.J.D.

Emeralds are mainly produced from the Kafubu area of Copperbelt Province. Other areas of potential emerald deposits include Lundazi, Rufunsa, Mazabuka-Choma, Kapirimposhi and Kaoma. Amethysts are mainly found in the Choma, Kariba area of Southern Province. Other areas of potential amethyst deposits include Lundazi, Solwezi and Mumbwa. Aquamarines are is mainly found in the Lundazi area of Eastern Province.

The distribution of other minerals of less significance includes tourmaline from Lundazi, Rufunsa, Mazabuka-Choma and Kaoma. Garnets are found in Mazabuka, Lundazi, Isoka and Nyimba. Based on the premise that the labour force for a typical simple mining operation numbers 15 (Kambaila et al, 1991), and that the 397 mining rights have been issued following the enactment of the Mines and Minerals Act of 1995 (Sweta, 2000), about an extra 6,000 persons became involved in small-scale mining between 1996 and late 1999. However, accurate information is available from the Ministry of Mines and Minerals Development.

Mineral Production Process

The mineral production process refers to the stages involved in finding and exploiting a mineral deposit as well as transforming it into a saleable form. It therefore includes prospecting, exploration, mining and mineral processing. These stages were used in the previous Mining and Minerals Act of 1976 to classify the mining rights. However, in the current setting, the gemstone licence covers prospecting, exploration, mining and mineral-processing activities. The operations are relatively simple in terms of technology and scale but with spontaneous production of the mineral such that it is difficult to make a clear distinction of the stages. Besides, all the above operations could be performed in the pit for gem-quality emerald.

The pegging of Miku mine in 1962 set the in motion exploration for emeralds in rural Ndola. Illegal miners who used the occurrence of surface outcrops of beryl-bearing or quartz tourmaline veins made most of the early discoveries. Emeralds were recovered from gravel above the water table through shallow pitting and trenching. The first systematic exploration in Ndola was done in the late 1960s following the pegging of Miku in 1962. Initially, trenching was carried out at Miku to ascertain the nature of mineralization and for sampling purposes. Subsequently a programme of geological mapping, geophysical and geochemical investigation was initiated and completed with satisfactory results. Geological and geophysical maps from the investigations clearly distinguished the lithological units and particularly the occurrence of the talc magnetite schist and quartzites (Tembo et al, 2000).

There was a significant influx of illegal miners in the 1970s following the Miku discovery. The area was randomly excavated with little understanding of the geology or controls on the mineralization. From the 1970s to date, prospecting methods have predominantly been geological (pitting and trenching) and geophysical employing magnetics and gravity methods. Geochemical exploration has not been actively used.

Currently exploration methods used by small-scale miners could be described as unsystematic, mainly using random pitting and trenching guided by the occurrence of surface outcrops of quartz tourmaline veins. However, small-scale miners understand the local stratigraphy and they have designated the lithologies using local names. They have ideas on where to find the emeralds through experience although their understanding of the controls on mineralization is inadequate.

Unsystematic exploration has been attributed to insufficient funds, lack of geological information, lack of management and technical skills. The provision of adequate information on deposit potential and identification of mineable targets must be considered

an essential precondition for successful exploration of the emerald deposits. A systematic approach to exploration is the only way to avoid wasting time and money, as is the case with most mines at present.

Legal mining activities start with prospecting and exploration prior to beginning work as the existing licensing regime stipulates in the Mining Act. After obtaining a licence, the holder will proceed with the setting up of a camp which may be a village comprising grass-thatched mud houses or a modern camp with masonry or brick houses.

Typical prospecting and exploration activity include pitting and in some cases trenching, to assess the geological setting for possible pockets or veins of the mineral sought. These excavations are made indiscriminately and are rarely more than 5m deep with high walls terraced every 1.5m. Some exploration drilling has been reported at Kuber Mines (Mukonka, 1996).

A modern mining camp in Ndola

Small-scale miners do very little systematic exploration before and during mining operations. Even in the most mechanized mines, illegal miners located emerald mineralization in many of the pits being currently worked. Gophering is ongoing and the only method of exploration at most mines. In the early stages, operations tend to be labour-intensive using simple tools mainly steel picks, hammers, shovels and wheelbarrows to break the ground, handle and dispose of it (see photos). The excavated material (mainly topsoil) is dumped indiscriminantly around the pits and trenches. As operations progress, a variety of other tools are used in the work indicating the success of the location.

Some of the tools used in early stages of mineral production

Mining tools used at a Lundazi Mine

Mining equipment used at mechanized mine in Ndola

Services of a professional geologist are critical to direct the operation as mining operations involve expanding and deepening the existing exploration pits and trenches or excavating completely new pits without any mine plans.

The mining is based on surface chance finds and comprise irregular diggings following pocket channels or pig rooting in eluvials. Work is often done by illegal operators and better-organized digging using steel pick, hammer and chisel. The use of self-owned or hired earth-moving equipment, such as bulldozers, excavators and dump trucks is becoming more common as mines get established. This has resulted in mechanized operations such as those at mines like Kagem, Grizzly and Kuber in Ndola. Blasting is often employed as last resort where hard rocks are encountered in order to avoid fracturing of the emerald crystals.

Surface mining is predominant and the mining method can be classified as open-cast because quite often, waste is dumped in mined-out space and re-worked several times. Alongside these operations, illegal miners scavenging on already-developed mines have excavated pits. Illegal mining usually involves secretly transporting material from dumps or soft ground suspected of containing emerald in sacks to places where washing and recovery can be done mainly at night and in streams. The resulting pits are typically shallow in most areas but could be as deep as 70m at some mechanized mines such as Kagem. Even without much mechanization, relatively deep pits have been excavated with proper benching.

Shallow pit in Lundazi area

A pit well benched with simple tools in Ndola rural

Underground mining takes the form of narrow tunnels following the mineralised vein. These excavations are a safety hazard in that they lack ground support, poor ventilation and lighting. Deaths have been reported due to caving. Being illegal activities they are designed to be easily concealed.

Considerable groundwater is met in the course of these excavations. This water is pumped from the lowest point of the pit using petrol-driven or electric pumps to the surrounding area without any treatment. In Ndola, the water passes through the surrounding ground including the waste dumps before draining into Kafubu River or its tributaries.

Huge amounts of waste are generated especially where heavy-duty earth-moving equipment is used. This waste is normally dumped randomly around the pit without proper planning. This has resulted in huge pollution problems.

Waste dump at a mine in Ndola rural

Pumping of water in Ndola rural

Processing gemstones involves washing, sizing and colour grading followed by knocking, cobbing and chipping using tools like pincers, hammers, chisels and lenses to remove unwanted rock material (gangue). Typical processing involves chipping and sorting. Chipping involves the breaking of crystals into smaller marketable size, preferably along natural weak zones (fractures). Sorting involves the grading of the emerald according to size, colour and clarity following strict criteria.

Display of Amethyst awaiting sorting in Kalomo

Mining regulations dictate that a holder of a mining right should apply for an abandonment certificate prior to partial or complete closure of a mine. This is to enable the regulatory body (Mines Safety Department) assess whether the land affected by mining operation is properly rehabilitated, levelled, re-grassed, reforested or contoured, as well as to ensure that all dangerous excavations are properly sealed or fenced off. Unfortunately, most operations are abandoned carelessly and pits and other mining excavations are left in dangerous state.

Marketing Arrangements

Small-scale mining produces gemstones whose main buyers are outside the country and continent such as Israel, India and of late some South Africa. Alongside legal channels are

illegal dealers who are mostly agents who buy and eventually sell to the global markets in Europe and Asia. Further, the current Mining Act liberalized the buying and selling of gemstones to Zambian nationals. By February, 2000, 415 gemstones sales certificates had been issued (Sweta, 2000). A brief history of gemstone marketing is summarized in Table 2 below.

Table 2 Gemstone marketing arrangements

Marketing system	General features	Weaknesses of system
Reserved Minerals Corporation Ltd (RMC) up to 1988	Was sole agent authorized by government. Sold rough emerald by auction Sold other gemstones at pre-determined price on ad hoc basis	Prone to collusive action in auction by people responsible for preparation and valuation of the emeralds , inviting bidders Buyers did not come regularly to buy the other gemstones
Zambia Emerald Industries Limited (ZEIL)	Was established to cut , facet and polish emeralds in Zambia following an agreement with a Brazilian company (ERB) Aim to add value to Zambian emeralds Policy was passed banning the export of uncut or rough emeralds	Occasionally, ZEIL rejected emeralds considered to be of low grade Complaints of undervaluing of the emeralds was common Delays in payments were also common ZEIL was not accountable to the ministry and this was a big concern to the government
Kariba Amethyst Marketing Limited (KAM)	Was formed following an agreement with ZEIL to market amethyst exclusively	Similar to ZEIL
Current	Formation of gemstone board Liberalizing the setting up of lapidaries Liberalizing the sale of gemstones	Update on the performance of the system not yet available.

Experience from all three strategies has shown that frustrations and apathy by small-scale miners have characterized these systems because they felt their products were undervalued. Miners preferred to sell their best stones on the black market to smugglers and only low-grade stones were sold to the marketing agents. In the gemstone industry, the operations are clandestine and the miners, buyers, government and other stakeholders do not trust each other.

Legislative Arrangements

The principal legislation in the mining industry is the Mines and Minerals Act. This act is passed to regulate the law relating to mines and minerals, to provide for granting of, renewal and termination of mining rights and any matters connected or incidental to them. It was first promulgated in 1976 and repealed in 1995. Subsidiary legislation applicable to small-scale mining include the Mining regulations of 1971 and the Beacons regulation.

After the state declared rural Ndola a restricted area in the mid-1970s and demarcated the area into plots in accordance with the Beacons regulation. The Mines and Minerals Act No. 32 of 1976 required periodic operational and geologic reports of their areas from all licence holders. As a result, the miners became aware of the law and became slightly more systematic in their approach to prospecting and mining.

Types of licences under the 1976 act were prospecting licence, exploration licence, mining licence and building and industrial minerals licence. These mining rights are in line with the conventional stages in mining namely prospecting, exploration and finally mining. Unfortunately, on the ground, prospective mining rights holders were much more interested in fulfilling the licensing requirement without regard to the purpose of the stage. For example, a professional geologist is normally hired towards the expiry of the exploration licence to pick up samples and ultimately produce a geological report acceptable when applying for a mining licence.

In the Mines and Minerals Act of 1995, the mining community in Zambia has been divided into large- and small-scale mining operations according to investment capacities and capabilities. Three types of licences namely prospecting licence, retention licence, and Large-scale mining licence are available to the large-scale operator.

A prospecting permit is issued for areas of 10km^2 and for terms of two years non-renewable. A small-scale mining licence is issued for areas not exceeding 400 hectares (4,000km^2) and for a term of ten years renewable. The Artisan Mining Rights which gives the right to local people to mine on an artisanal basis an area not exceeding five hectares (50km^2) for a period of two years non-renewable. However, the gemstone licences is issued for an area not exceeding 400 hectares (4,000km^2) for a period of not more than 10 years to carry out operations from prospecting to mining. The minerals covered under this licence include amethyst, diamond, aquamarine, beryl, corundum, emerald, garnet, ruby, sapphire, topaz, tourmaline and other mineral substances used in the manufacture of jewellery. By February 2000, the ministry had processed a total of 665 licences and permits, of which 198 were for large-scale prospecting and 375 (57 per cent) are for gemstones and 22 (3 per cent) prospecting permits (Sweta, 2000).

About 300 Artisan Mining Rights have been issued since 1998 with the majority of the licences being for river sand, mostly found in river beds. Therefore, approximately 1,500 hectares (15km^2) of land is covered by the Artisan Mining rights throughout Zambia. About 3,615km^2 of Zambia has been covered by combined Artisan and Gemstone Mining Rights to date. The total area covered by mining rights mining is approximately 379,922km^2 — or just over 50 per cent of the country (752,614km^2).

The provinces with extensive prospecting activity coverage are Northwestern, Central and parts of Western. Prospecting activities in Northern, Luapula and Eastern provinces are sparse, with only about 10 per cent of all prospecting coverage. Under the Environmental Protection and Pollution Control (Environmental Impact Assessment (EIA)) Regulations 1997. Projects involving mining of gemstones require submission of project briefs.

Of particular relevance to small-scale mining is Part IX of Mining Regulations 1971 which addresses the issue of ventilation and air pollution arising from dust, fumes and other toxic gases. It provides for the determination of concentration of these pollutants in ambient air, sets air-quality standards and taking of measures to minimize or prevent generation of air pollutants from drilling and other activity likely to release or evolve dust, toxic gases or fumes.

Hazards from dangerous surface excavations such as large cracks, subsidence and pits, protection of surface features such as infrastructure or water rights fall under Part VI. Part VII covers protection in working areas. It is also a requirement that all mining right holders submit monthly production and labour returns.

The general strategy for implementation of this legislation is some form of permitting and licensing followed by statutory reporting. From the foregoing, it is clear that in terms of scope, the legislation is adequate but it lacks guidance, which the small operator requires. However, the monitoring aspect still remains unresolved due to lack of capacity by both the regulators and the regulated.

The Environmental Protection and Pollution Control Act (1990) established the Environmental Council of Zambia. The act outlines the general requirements, including permit requirements, for activities that may pollute or otherwise harm the environment. The act authorizes the council to require an EIA where it deems appropriate. The council is at an advanced stage of EIA policy preparation.

Mining and Environmental Policy and Law

Some comments on mining and environmental protection include:

- The Mines and Minerals Act 1995 does not contain any environmental requirements other than references to compliance with the Water Act and in limited circumstances, with other sectoral environmental legislation. The act, however, gives the Ministry responsible for Mines and Minerals the power to require the abatement of nuisances.
- The Mining Regulations 1971 regulate water use by mines, drainage of underground areas and flood prevention; discharge of effluent; and occupational health and safety.
- The Mining (Dumps) Regulations 1995 regulate both new and existing dumps, including pollution management and rehabilitation, record-keeping and reporting requirements.
- The Local Administration (Trade Effluent) Regulations 1985 enable local governments to regulate effluent discharges from the mines. Both the Kabwe and Copperbelt local authorities have made reports to the Environmental Council of Zambia based on these regulations.

General provisions regarding subsidence, spontaneous combustion and protection at surface excavations. Some issues concerned with legislation include: mine dumps regulations; water standards; handling of hazardous material; licences to discharge effluent; financial provision/environmental protection fund; emission standards.

Institutional Framework

The Ministry of Mines and Minerals Development was recently restructured and is divided into three departments namely Geological Survey, Mines Development and Mines Safety. The functions of these departments are summarized below.

The primary roles of the Geological Survey are to provide geological, geophysical and geochemical data on a country-wide basis, to act as a national repository for all information relating to the geology of Zambia, and provide support and advisory services to the public. Many other technical services are offered there.

The Mines Development Department is responsible for issuing of all mining rights in Zambia, and onward monitoring of the mining, prospecting and any mineral exploitation activities, in accordance with the Mines and Minerals Act of 1995. The department also issues Gemstone Sales Certificates and undertakes surveying and mapping activities such as demarcation of mining right plots, placement of the mining rights beacons and volumetric surveys of mining pits.

Apart from monitoring the copper-mining industries in the Copperbelt, the department is closely involved with small-scale miners, the majority of whom are mining precious and semi-precious gemstones and building materials such as sand and dimension stones.

To carry out and achieve its mandatory obligations, the Mines Development Department has recently been subdivided into regional bureaux located in strategically selected districts near the major mining areas.

The main coordination and operation office is situated in Lusaka. It also monitors mining operations in central and parts of Western and Southern provinces of Zambia. The other bureaux are located in Kitwe, Chipata, Livingstone and Mkushi to monitor operations within the Copperbelt and Northwestern provinces, Eastern and parts of Northern provinces, Southern and parts of Western provinces and the Northern, Luapula and parts of Central provinces, respectively. Surveyors who mainly demarcate the mining rights are employed at most of these bureaux.

The Mines Safety Department is a statutory department which is responsible for formulating and enforcing occupational health and safety standards at mines and explosives factories in order to ensure that operations are carried out in the safest, healthiest and most efficient manner possible. The department also is responsible for protecting the environment and controlling pollution in the areas where prospecting, exploration and mining operations are being carried out.

Despite the well-conceived structure of the ministry, implementation still suffers from inadequate manpower to implement the various pieces of legislation and to realize the objectives of the various departments. However, some significant progress has been made in mining practices especially licensing. The main bottleneck is that because of the clandestine nature of gemstone mining.

Environmental Impact

Environmental considerations in small-scale mining have received attention mainly at regional (SADC) level. As a result, these considerations are rather general considering the variations in what is classified as small-scale mining, the type of minerals and their associated technology for mining and processing in the region. Although there have been

no research and studies undertaken in Zambia, the scope for potential environmental impacts arising from small-scale mining operations in Zambia have been identified in several reports. In these reports, methods including review of existing literature, personal visits to the area and interviews with individuals associated with mining activities in the area, have been used to identify the potential impacts in the absence of monitoring data.

In July to August 1990, Wolff and Holloway carried out field visits to roughly 50 small-scale mines and projects in Zimbabwe and Zambia with the aim of carrying out visual assessment of the extent of environmental pollution arising from such operations. Some impacts assessed included air pollution from fumes, gases and dust; soil contamination from hazardous effluents; water (surface and ground) pollution from effluents to water ways from mines, plants and dumps; destruction of vegetation and wildlife habitat due to subsidence; deforestation, fumes and direct health hazards.

Mambwe in 1993, based findings on field visits to the area which highlighted some of the potential environmental impacts as: scarring of the earth's surface due to stripping of the overburden; disturbance of fauna and flora adjacent to the pits adjacent to national parks; deforestation because of mining operations and drying of streams and dambos due to excessive evaporation from cleared lands; siltation of streams draining areas of rapid soil erosion and leachate from waste dumps;

Banda in 1995, has reported concern about small-scale mining as follows:

- Land use conflicts arising from operations close to dwellings and farmlands as well as disposal of mine waste on land intended for other uses. In Lusaka, disruption of research activities by dust emitted from Chilanga cement, air and noise pollution from United quarries along Great East road and indiscriminate quarrying for laterite and stone aggregates were some of the conflicts highlighted.
- Siltation of rivers by leachate and runoff from waste dumps
- Degradation of land due to waste dumps occupying land that could be used for other purposes such as agriculture.

Scope for EIA and EnTA

The mineral production process for small-scale mining has been described above. This section will identify the main potential environmental issues arising from this process. The factors affecting the nature and extent of environmental impact is dependent on the size of operations, geographical and location factors mining method and mineral characteristics. Individual small mines taken together have had a huge impact on the areas where they are found. The mining areas range from the naturally uninhabited forests of Ndola to the mountainous areas of Kalomo through generally flat landscapes in Lundazi. Although these areas are sparsely populated, the influx of illegal miners tends to increase the population. Further, the open-cast or open-pit mining methods used in these areas are associated with indiscriminant dumping and pumping with no after-mining rehabilitation.

Therefore the main environmental issues to be considered in the Zambian small-scale mines include siltation of rivers by leachate and run-off from waste dumps and ground water pumped from mining pits. Other large areas of concern are unsafe abandoned mine excavations due to non-existence of rehabilitation practices; degradation of land because of mining and dumping operations, especially those that use heavy earth-moving equipment.

The current technology used by small-scale miners suffers from lack of geological and other technical information to ensure proper mine planning including equipment selection. In most cases, equipment ordered or used in operations is either too big or too small. There is a need to visit operations to establish a system of selecting the appropriate equipment. Pumps, which are critical to operations, are also not selected appropriately. The technology used in small-scale mining may be appropriate but not where they are applied. However, controlled blasting techniques with low powder factors are desirable to reduce damage to emerald crystals

Waste disposal is an essential part of open-cast mining. In most of the gemstone mines waste is only disposed of for convenience so that the miner can get access to the veins. This has led to re-working of material. Where heavy equipment is used, huge mounds of waste is generated and dumped at designated places. These dumps are formed as material is dumped by some rear dump trucks. This has caused some concern because first, these dumps occupy a lot of space; and second, run-off and leachate from such dumps eventually finds its way into rivers and cause siltation.

Social Impact

The health and safety of workers is paramount for any mining enterprise. Regulations have therefore been brought in to promote these, as well as to protect against child labour. It prohibits children below the age of 16 and women from working underground.

Mining practices in small-scale mining operations have at times led to fatal accidents. Several authors have reported the main causes of these accidents. In a study of 50 small mines in Zimbabwe and Zambia by Holloway and Wolff (1990), unprotected excavations in terms of unfenced shafts, trenches and pits were a concern to the safety of humans and animals.

Kambaila and Kangamba (1991) have highlighted the main safety points in Zambian emerald mines as abandoned excavations, lack of protective clothing and unsuitable sanitary conveniences. This work was based on statutory inspection visits to the area.

Further, Masialeti (1994) has highlighted the main sources of safety hazards in gemstone mines as the pit highwall mining excavations and lack of protective clothing. These hazards were also based on five years of inspection visits to the areas. Table 3 shows people killed in Zambian mines during the period 1984–90.

Hazards posed by highwalls in Kalomo mining area

Hazards posed by highwalls and pumping of water in Ndola rural mining area

Safety hazard posed by mining excavations in Kalomo mining area

Dangerous excavation in Ndola Rural mines

Table 3 People killed in Zambian Mines (1984–1990)

Year	Total number of persons killed			Cause for small mines accident(s)
	Small mines	Large mines	Country total	
1984	-	20	21	-
1985	-	38	38	-
1986	-	24	24	-
1987	5 (Pirala –1) Norodom – 1)	27	32	Fall of ground from pit highwall
1988	-	24	24	-
1989	1	30	31	Hit by rocks from blasting
1990	1	29	30	Drowning in pit
1991	-	22	22	-
1992	1	29	29	Fall of ground from pit highwall
1993	1	23	24	Drowning in pit
1994	-	29	29	-
1995	-	17	17	-

Note: Classification of small-scale mining based on Mines and Minerals Act, 1995

Hazards Posed by Highwalls in Kalomo Mining Area

Accidents have been attributed to undercutting and steep highwalls, which have led to slope failures. Further, accumulation of water in pits has in some cases led to some miners drowning especially in Ndola rural where mining is almost impossible without pumping water.

Significant numbers of women have been actively involved in mining as owners and workers. As a result, women have formed associations to spearhead their mining activities. Women and children crushing marble for sale is a common feature along Lusaka roads. These crushed stones serve as a source of livelihood and are used in construction. On the positive side, these operations continue to create employment opportunities especially in the rural areas and consequently increased economic power of successful mine owners. For instance, makeshift market have sprouted in these areas to provide the basic needs.

accumulation of water in an active pit in Ndola rural.

Health and safety problems can be attributed to structural (legal, legislative and regulatory) administrative, institutional and organizational deficiencies. Legislation has tended to focus on conditions of granting mining rights, duration, surface area covered and description of marketing area without clear guidelines for the operations. Furthermore, it has been found that no institutions have been set up to deal specifically with the problems of small-scale mining operations. Even where they exist, the capacity is lacking mainly because of lack of resources. Insufficient scientific knowledge and the absence of research on appropriate mining methods continue to perpetuate poor mining practices. For instance, pits, trenches and other excavations are left open for future production.

Centre for buying and selling of essential commodities in Kalomo Mining area

Measures taken so far to minimize some of the negative social impacts include setting up specialist institutions, review legislation, conducting safety-awareness campaigns and workshops.

Discussion

Small-scale mining including artisanal mining is a widespread and complex sector, prevalent in Zambia and among rural communities. The social frameworks for small-scale mining communities are typically very unstable. The unregulated nature of Small-scale mining coupled with the large number of illegal miners in this activity results in lawlessness. The coping adaptive strategies of artisanal mining communities to deal with poverty are therefore, severely constrained.

More recently, however, there has been a growing realization that overlooking small-scale mining essentially ignores people living in poverty who earn a living through it. Poverty eradication, participation, privatization and sectional interlining are some of the strategies for promoting small-scale mining. It is necessary to understand the relationship between small-scale mining and poverty before any action can be taken to implement effective small-scale mining community development strategies. This may be done by examining the key economic, social, technical and environmental factors, which are commonly found in poor small-scale mining communities followed by strategy for improving the livelihoods of these communities. Finally, the role of key stakeholders in the implementation of this strategy can then be spelled out.

Throughout the three main gemstone mining provinces in Zambia, small-scale mining has become the principal livelihood. The data on the number of women engaged in Small-scale mining are not available. By its nature gemstone mining does not encourage child labour.

Because of the often transient and illegal nature of small-scale mining, data on the numbers of people engaged in it are far from comprehensive. It is nevertheless useful as an indication of the scale and importance of this activity. In 1992, the World Bank estimated the number of people involved in gemstone mining was estimated to be 30,000. Every month, mining right holders are obliged to report the number of people involved in their mining operations to the Ministry of Mines and Minerals Development, but such information is not available. It is known that gemstone mining in Zambia contributes about 25 per cent of total mineral production.

Considering the series of natural disasters such as drought that the country has experienced and the ensuing crop failures, as well as the low prices of agricultural products and falling mineral prices, small-scale mining seems a viable alternative for survival. Emerald mining in Zambia is estimated to be potentially worth $200 million, although the nation realizes only about $20 million.

This cycle is made worse by policy failures, which resulted in the development of illegal and informal small-scale mining and the disempowerment of miners. The small-scale miners have little access to appropriate credit mechanisms orientated to the specific requirements of small-scale mining communities. Lack of collateral and higher interest

rates make borrowing from the commercial banks highly unattractive. Besides, formal banks view gemstone mining as a high risky venture and the hire charges by existing equipment hire companies are too high.

Even when miners have some savings, a lack of productive investment opportunities often results in income from mining being spent on alcohol, and other things not related to mining.

The strategy improving the livelihoods of small-scale mining communities involves developing alternative livelihood opportunities and formalizing the artisanal mining sector. Small-scale mining encompasses social, environmental and economic issues and therefore, any strategy to improve the livelihoods of small-scale mining communities must necessarily be cross-sectoral. Small-scale mining has developed in its own economic and political enclave, decoupled from the rest of the economy by its specific requirements and nature. The latter means that any strategy must also facilitate the development of links between the mining community and stakeholders at the meso and macro levels. The sustainable livelihood approach is preferred to traditional participatory development initiatives because the latter tend to remain isolated from broader economic processes, while traditional anti-poverty programmes pay little attention to the manner in which (or where) communities live, the resources (assets) used for pursuing livelihoods, or the human and financial costs associated with the implementation of a national programme through a centralized bureaucracy.

Sustainable livelihoods (SL) offers both a conceptual and programming framework for poverty reduction in a sustainable manner. Conceptually, livelihoods connote the means, activities, entitlements and assets by which people make a living. Assets, in this particular context, are defined as not only natural/biological (namely, land with gold/ precious stones, water, common-property resources, flora, fauna), but also social (i.e., community, family, social networks, participation, empowerment, human (namely, knowledge creation by skills) and physical (namely, roads, markets, clinics, schools, bridges).

The SL approach, by using both participatory and policy (cross-sectoral) tools, highlights the links between livelihood systems at the micro level and the macro policies, which affect mining community livelihoods. Understanding such processes offers constructive advice to partner governments on how current policies and programmes can be re-oriented to better serve the interests, needs and capacities of mining communities. This is done through meso-level links, which operate through institutions such as local government, NGOs and CSOs.

As used by UNDP, Sustainable Livelihood Methodology consists of a five-step process described briefly below. The strategy should begin with a participatory assessment of the risks, assets, entitlements and indigenous knowledge base found in the mining community. One can ensure community participation by focusing on the assets, strengths and livelihoods of the community. Identification of alternative livelihood opportunities such as micro enterprises auxiliary to the mining activity such as vending and small stores catering to miners)in agriculture. Formalization of artisanal mining in order to transform it from being an illegal, unregulated activity using inappropriate technologies to one that is legal, regulated and supported through access to appropriate technologies, government services

and capital. The formalization process involves detailed examination of a series of key areas, namely regulation, technology, financial, social and the environment. Issues in regulation involve legalizing the operations, which the Zambian government has already done under its mining and minerals Act of 1995. The regulatory action still suffers from lack of collection and dissemination of information on technology and methods and on possible deposits in areas suitable for small-scale mining and measures to improve health and safety conditions.

Technology

The poverty trap in which many artisanal miners find themselves means that technologies and techniques used are inefficient and relatively unproductive. The marginalized nature of this sector means that small-scale miners have little access either to institutions that provide training, or to technology appropriate to mining, let alone the credit to capitalize on such access. A second problem is in the prospecting for mineral deposits. Although artisanal miners tend to lack the skills and tools to prospect for suitable deposits, for prospecting activities, governments, mining companies and multilateral development agencies have a clear comparative advantage over small mining communities in this.

Most artisanal miners work with precious metals. They have are two main technology requirements. The first is water pumps for pumping water from workings or to use for purification; and the second is screening technology for separating out coarse particles from gravel prior to washing. Although the lack of access to credit for investment in technology is a major obstacle for many miners, in cases where miners are making money is may get squandered on prostitution, alcohol and gambling. In order to encourage formal financial institutions to lend to miners, appropriate financial mechanisms must be orientated towards the specific requirements of artisanal mining for example, credit assistance which accepts mineral rights as collateral.

Finally, governments could give artisanal miners exemption from taxation, this would not constitute a large sacrifice for governments (especially given the problems and costs associated with collecting taxes small dispersed communities) and would increase the acceptance of regulation among artisanal miners.

Environmental destruction is the single most visible aspect of small-scale mining. Problems include acid soil erosion and river silting. The use of chlorine as a means of purifying water is a common practice in Zambia. Because of poor information about geology, waste disposal has become erratic, in some cases leaving the mining operator to handle waste several times. Further, the use of heavy duty earth moving equipment means huge amounts of waste have been generated, lying in huge mounds. It is high time miners, governments and local communities became aware of the environmental situation and encourage efforts to improve it.

Campaigns in form of shows were done last year in rural Ndola, Kalomo, Lundazi and the Serenje-Mkushi area, but they have had little impact so far. Safety statistics indicate that fatal accidents do occur in small-scale mines, but few are reported. Again, this is because of the clandestine nature of small-scale mining. Some statistics are available from the Ministry of Mines, although they do not represent a true picture. Sampling and analysis of ore mined

by youth and women in Lusaka need to be done to establish the potential for silicosis. It is important for government to improve the mining inspectorate concerned with safety and health conditions.

The mining community, NGOs and the private sector working directly with the community must part of the strategy and play their roles to achieve sustainability of the sector.

Conclusions and Recommendations

The information about the small-scale mining sector in Zambia is well known. What now needs to be done is to collect all the necessary literature together. The reported statistics on labour and production are available from the Ministry of Mines and Minerals Development. These figures will give an indication of the numbers involved. A success rate of about 5 per cent demonstrates that much more needs to be done. Financial resources, inadequate technical skills, lack of access to credible markets are some of the reasons for this situation. Success in this sector will depend on mechanization.

The mining methods used are quite appropriate but lack of reliable information on geology, hydro-geological conditions as well as physical and mechanical properties of the surrounding rocks make optimal mine design difficult. Blasting is used where the overlying overburden is hard and difficult to remove using excavators. Controlled blasting techniques with low powder factors are desirable to reduce damage to emerald crystals.

Exploration methods used by small-scale miners are unsystematic mainly using random pitting and trenching guided by the occurrence of surface outcrops of quartz tourmaline veins. Yet these small-scale miners understand the local stratigraphy and they have designated the lithologies local names. They have ideas on where to find the emeralds through experience although their understanding of the laws on mineralization is limited.

Unsystematic exploration has been attributed to insufficient funds, lack of geological information, lack of management and technical skills. The provision of adequate information on deposit potential and identification of mineable targets must be considered an essential precondition for successful exploration of the emerald deposits. A systematic approach to exploration is the only way to avoid wasting time and money, as is the case with most mines at present.

Systematic exploration of the rural Ndola restricted area using modern techniques such as radiometric surveys and soil geochemistry offers considerable potential for the discovery of additional deposits of high-quality gemstones. Again, activity in the sector is clandestine and the miners, buyers, government and other stakeholders do not trust each other.

With reliable information on geology, hydro-geological conditions as well as physical and mechanical properties of surrounding country rocks is the key to the mineral production process. When sufficient information becomes available, reliable optimal mine design will become easy and unit mining operations such as waste disposal can also be optimized. Further updated information needs to be collected from the ministry to get a clear picture.

The information includes statistics on labour and production, technical assistance programmes as well as legislation being reviewed.

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Zimbabwe

FIGURE 2.1: ZIMBABWE HISTORICAL INFORMATION

- **TOTAL AREA 390 580sq km (15 080sq miles)**
- **GEOGRAPHICAL EXTENT**
  - **N - S. AXIS OF 720km**
  - **E - W. AXIS OF 830km**
- **POPULATION 13.5 MILLION**
  - **51% FEMALE**
  - **3.2% GROWTH RATE**
  - **75% IN RURAL AREAS**
  - **25% IN TOWNS AND CITIES**
- **ZIMBABWEANS ARE ESSENTIALLY A RURAL PEOPLE (SRB)**
  - **54.3% COMMUNAL**
  - **20.0% COMMERCIAL FARMS, STATE LANDS**
- **ZIMBABWE OF TODAY WAS SHAPED BY THE TENURE SYSTEM WHICH STARTED IN 1890 WHEN THE BSAC AWARDED**
  - **1 210 ha. AND**
  - **15 GOLD CLAIMS TO THE FIRST SETTLERS**
  - **2 430ha. EACH FOR FIGHTING THE NDEBELES & SHONAS**
- **BRITISH GOVERNMENT REQUESTED THAT SPECIAL LAND BE RESERVED FOR BLACKS**
  - **NATIVE RESERVES (KURUZEVHA)**
  - **TRIBAL TRUST LANDS (T.T.L.s)**
  - **COMMUNAL LANDS**
- **LAND TENURE SYSTEM IS THE SOURCE OF ENVIRONMENTAL PROBLEMS AND LAND MANAGEMENT - GOOD OR BAD**
- **75% OF COMMUNAL LANDS ARE IN NATURAL REGIONS 4 AND 5 (THE WORST AGRICULTURAL LAND)**

(SOURCE:- Svotwa and Mtetwa 1997)

Zimbabwe is the southern-most country in tropical Africa, with a north–south axis of 720km and an east–west axis of 830km, covering a total surface area of about 390,000km^2 (see map). Its most striking geological feature is the Great Dyke, a massive volcanic extrusion extending NE/SW over 500km, with an average width of 10km. The dyke is richly endowed with a host of minerals such as chrome and platinum group metals.

Although traditional small-scale and artisanal mining can be traced back to the 13th century as evidenced by the Portuguese- Monomotapa gold trade era, modern mining in Zimbabwe started at the turn of the 20th century. This new mining era started with the re-examination of some more than 4,000 old mine workings by the British South Africa Company (BSAC) and it led to the establishment of a number of important gold mines[Viewing, 1984]. The mines, aided by agricultural activities, formed the centers of commercial activities and eventually developed into permanent communities with basic infrastructure such as clean water, communication, health, education and ultimately local government. The development and growth of at least 80% of the present infrastructure, cities and towns in Zimbabwe are closely linked mining and agricultural activities.

The mining sector in Zimbabwe is arguably one of the most diverse and developed in the SADC region, with a variety of over 40 different minerals under production. The sector has played an important role in the economic development of Zimbabwe, and Viewing [1984], acknowledges that there is hardly any town and city in Zimbabwe that does not owe its origin to mining.

The sector has strong forward and backward linkages into both the agricultural and manufacturing sectors where it acts as provider of raw materials to these sectors and as a consumer of end products from the same sectors. Therefore, its successful development, or lack of it, has significant ripple effects on these sectors.

The sector accounted for an average 5% of Gross Domestic Produce (GDP) up to 1994 (Table 2.1). However, in the last six years the sector's contribution has declined significantly to levels as low as 1.5%, raising serious concerns about 5% of total formal national employment (CSO, 1998), and about 40% of total merchandise export earnings (excluding foreign currency earnings from tourism, airport departure taxes, rail and road transmit fees and consultancy). The country exports about 90% of its mineral production, mostly in semi-processed form (SFYNDP, 1991). The most important minerals include gold asbestos, nickel, chrome, coal and platinum (Table 2.2) Gold remains the mainstay of the sector, accounting for about 40% of the total mineral output by value and is the country's second single foreign exchange earner after tobacco. The gold sector is also believed to employ about 50% of the total formal mining labour force.

TABLE : Mining's Contribution to GDP

Year	Total GDP at market prices (nominal Z$ million)	Mining's Contribution to GDP (Nominal Z$ million)	Mining's Contribution to GDP (%)
1972	1419	76	5.4

1973	1553	104	6.7
1974	1861	136	7.3
1975	1998	131	6.6
1976	2166	152	7.0
1977	2198	149	6.8
1978	2359	156	6.6
1979	2822	226	8.0
1980	3441	285	8.3
1981	4433	252	5.7
1982	5197	217	4.2
1983	6306	393	6.2
1984	6404	320	5.0
1985	9097	336	3.7
1986	10361	446	4.3
1987	11200	336	3.0
1988	14109	680	4.8
1989	17509	602	3.4
1990	21494	845	3.9
1991	29623	1184	4.0
1992	34392	1552	4.5
1993	42481	1625	3.8
1994	56159	2531	4.5
1995	61763	1142	1.8
1996	84767	1317	1.6
1997	99737	1384	1.4

Sources: Central Statistical Office, National Income and Expenditure Report, 1990

Central Statistical Office, National Accounts 1985–1997, July 1998

TABLE: Mineral Production in Zimbabwe (by volume) 1991–1995

	Unit	1991	1992	1993	1994	1995
Antimony	Tonnes	160	254	95	65	37
Asbestos	Tonnes	141697	150158	156881	151905	169487
Black Granite	Tonnes	79907	90694	40032	106605	121685
Chromite	Tonnes	563634	5222013	252033	516801	707433
Clay	Tonnes	100604	82956	113470	169097	169823
Coal	Tonnes	10890204	9715340	9901274	10101903	10281059
Cobalt	Tonnes	105	100	113	126	109
Copper	Tonnes	13811	9673	8187	9350	8045
Corrundum	Tonnes	1567	2873	5995	2616	2253
Diamonds			Carats		173588	204416
Emeralds	Kg	667	46	634	276	221
Feldspar	Tonnes	3820	2696	1553	1617	3920
Fireclay	Tonnes	23304	15954	9257	13997	12743
Gold	Kg	17820	18278	18565	20512	23959

Graphite	Tonnes	12903	12346	7142	7890	11381
Iron Ore	Tonnes	1136338	1179400	374493	5300	311352
Iron Pyrites	Tonnes	69851	66345	72588	71026	70772
Kaolin	Tonnes	65			462	57
Kyanite	Tonnes	2463	1990	875	567	875
Limestone	Tonnes	1427602	136924	1036129	1658160	1499101
Lithium	Tonnes	9186	12837	18064	25279	33498
Magnesite	Tonnes	23295	8973	6276	1588	5597
Mica	Tonnes	506	495	510	213	1040
Nickel	Tonnes	11313	10349	110967	13516	10864
Phosphate	Tonnes	116938	142322	153471	150560	154482
Quartz	Tonnes	142064	159468	95149	131157	172330
Silver	Kg	19380	16930	12004	10942	15640
Talc	Tonnes	1676	2203	1349	2049	2080
Tantalite	Tonnes	111	94	48	7	
Tin	Tonnes	796	716	657	82	
Vermiculite	Tonnes	742	4300	5032	8184	13742

Source: Ministry of Mines CGME Annual Reports

Table: Operating Mines in Zimbabwe

Mining Region	Gold	Base	No.	Total %
Harare	213	42	255	19.29
Bulawayo	206	9	215	16.26
Gweru	149	20	169	12.78
Masvingo	163	47	210	15.89
Kadoma	472	1	473	35.78
Totals	1,203	119	1,322	100

Source: Chamber of Mines (1998), *Mining in Zimbabwe 1997–8*

Structure of the Industry

The mining sector in Zimbabwe comprises a formal large scale subsector with more than 1300 operating mines (Table 2.3), the formal small-scale subsector with more than 20 000 registered mining claims of which about 10% or 2000 are in active production (Svotwa and Mtetwa, 1997), and the informal small-scale and artisanal operators who are primarily unregistered gold panners and diggers scattered along some of Zimbabwe's main rivers such as Mazowe, Angwa, Insiza, Tokwe and Runde.

There are about 300 000 miners in this category. More information on the structure as pertaining to the small-scale mining sector is given in section 3 of this document.

Small-scale Mining Characterization in Zimbabwe

Small-scale mining in Zimbabwe, like in many other developing countries throughout the world, means something different to different people. To thousands of poverty stricken and hungry people in both rural and urban areas, small-scale mining is the "God-given answer to their woes". To many people, particularly those involved in gold and semi-precious

minerals like emeralds and diamonds, small-scale mining represents the "fast track process to their earthly riches". And yet there are those, especially the so called "independent observers" who view small-scale mining with high contempt, accusing it as epitomizing the "greatest environmental disaster-in-the making".

There is one common thing with all these definitions, that is , they represent the deepseated polarization of society towards the sector. These perceptions need to be addressed if at all the sector must play its role in sustainable development. For the purposes of this study, the definition of the sector will be given in terms of two broad mining activities, namely the formal (legal) small-scale mining activities and the informal (illegal) small-scale mining activities. Subsequent discussions on the baseline information will follow this definition, and keep the two groups separate throughout.

Formal (legal) small-scale mining

Formal small-scale miners are those miners who have registered their mining claims with the Ministry of Mines and Energy (MME) in accordance with the provisions of the Mines and Minerals Act Chap. 21:05 (1996). The miners operate, or at least attempt to, within the confines of mines and minerals Act, together with other relevant statutory instruments such as the Mining (Management and Safety) Regulations, 1990. In this group the lowers, syndicates and co-operatives.

It is estimated that there are well over 20 000 registered small-scale mining claims in Zimbabwe. (Svotwa and Mtetwa, 1997). The smallest mining claim is one block of 10 ha in size. Of the 20 000 registered claims, it is estimated that about 10% or 2000 are in active production. Also, more than 1200 have been registered directly by women (Mugedeza 1995).

To translate this number of registered claims into operational mines and determine the numbers of miners involved is an extremely complex matter because of several reasons. Firstly, many people, particularly in gold, register mining claims for speculative and other purposes like having the legitimate cover for their parallel gold buying and selling activities. Secondly, several claims or blocks can be registered are worked at any one time mainly due to lack of resources. Due to lack of conclusive data on the sector, various studies have attempted to account for the total number of people involved in the formal small-scale mining sector. O. Maponga (1995) estimated the number of people employed in the small-scale formal mines to the 35 000, and Svotwa and Mtetwa (1997) using a mine-employment ratio of 1:13 estimated the figure at 20 000. More recent studies, Svotwa (1999) show that on average, a small-scale miner now employs between 20-30 workers. This would put the number of people involved in this sector at between 40 000 and 60 000.

Whatever the exact number of small-scale mines and workers, the majority (at least 80%) are known to operate in the gold mineral. Reasons for this include the fact that gold always has a ready market at both the Reserve Bank of Zimbabwe and on the parallel market. In addition gold mining operations of that nature have low capitalization of about US$10 000 for an average monthly production of about 50T.

Mining co-operatives

There are more than 3000 registered co-operatives in the country and only about 100 (equivalent to about 3%) are in mining, with a total membership of about 5000. The majority of the mining co-operatives are located along the Great Dyke where they are supplying chrome to Zimbabwe alloys and Zimasco who are the principal buyers and smelters of chrome in Zimbabwe.

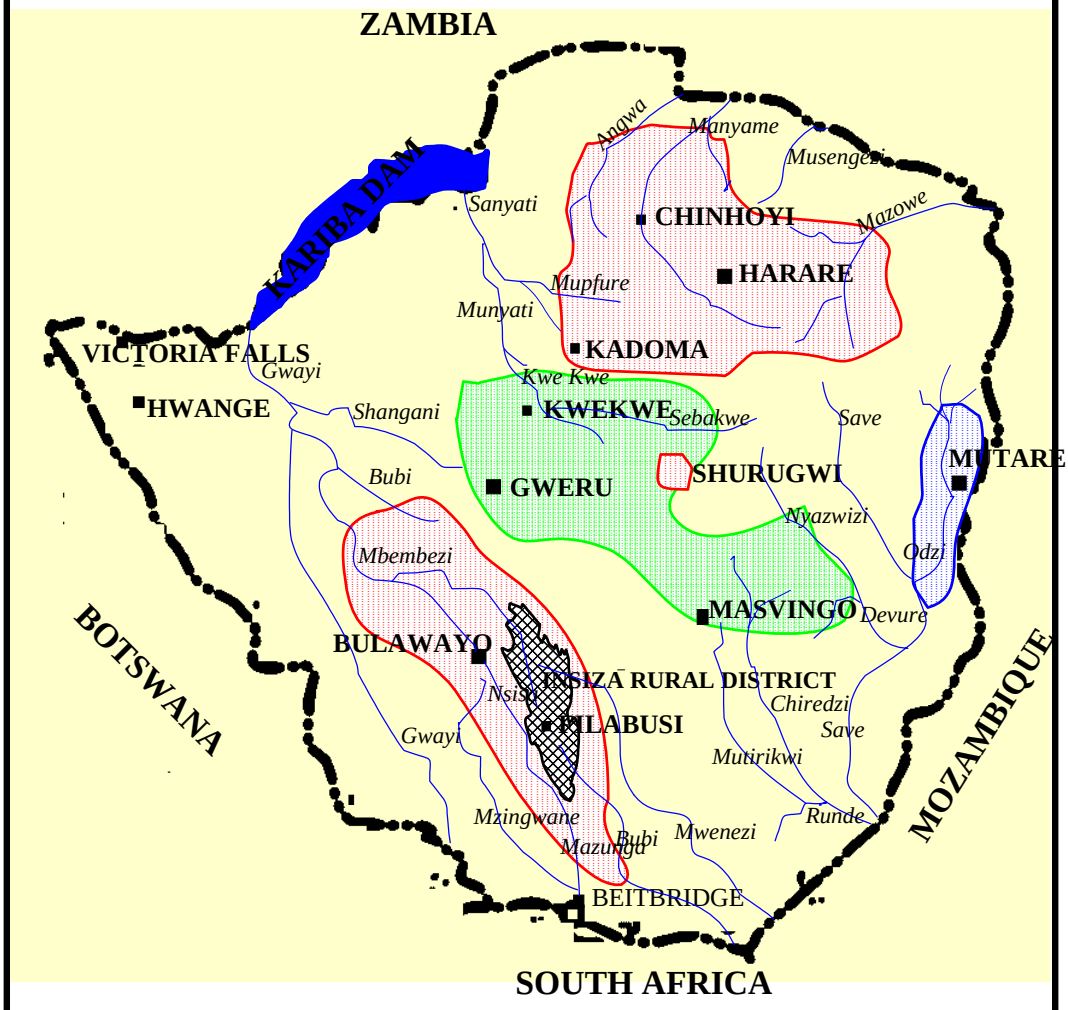
Great Dyke co-operatives constitute about 60% both in number and membership. Another 25% are located in and around Kamativi where they are mining tin. The remaining 15% are scattered around Zimbabwe where they are producing in varying quantities, minerals such as limestone, glitterstone, tantalite, mica and gold. The general performance of mining co-operatives has been poor when compared with co-operatives in other sectors such as agriculture and manufacturing. The reasons for this poor performance are many and varied, but the main one is that mining co-operatives are governed by two conflicting pieces of legislation, namely the "Mining (Management and Safety) Regulations and the Co-operatives Act. The legislation governing co-operatives requires that the leader of the co-op must be popularly, democratically and frequently elected. This leader is then equated to the mine manager in terms of section 4 of the Mining (Management and Safety) Regulations. However, the mining legislation does not require popularity in appointing a mine manager, but technical and managerial skills, which are usually non-existent in the democratically elected co-op managers.

Artisanal/informal miners

The informal small-scale or artisanal mining sector in Zimbabwe comprises primarily unregistered gold diggers and panners (men, women and children alike) scattered along some 5000km or so of Zimbabwe's main rivers. (Fig. 3.1) and (Tables 3.1 and 3.2). Shamu, Wolff et al, (1993) estimated that there were over 100 000 artisanal gold panners in Zimbabwe. Svotwa and Mtetwa (1997) put the figure at about 190 000. The ILO (Sectoral Activities Programme, 1999) estimated the number of small-scale and artisanal miners in Zimbabwe to be between 50 000 and 350 000. Svotwa et al (1999) attempted to estimate the number of gold panners in Zimbabwe by using panner densities derived from the number of gold panners physically counted per km of river course traversed during the UNIDO study (Table 3.2) and estimated the number to be between 200 000 and 250 000. The growth of the gold panning sector is graphically shown in (Fig. 3.2). The number of people deriving their livelihood from artisanal mining in Zimbabwe could well be over 2 million if account is taken of people who provide support services to panners (e.g. transport, food and other basic services) and also due to the fact that the average family size in Zimbabwe is about 5 people.

Figure 3.1:-MAP SHOWING GOLD PANNING IN

ZIMBABWE



INSIZA RURAL DISTRICT

MAJOR CITIES/TOWNS

PANNER DENSITY >100 PER KM OF RIVER COURSE

PANNER DENSITY 50 - 100 PER KM OF RIVER COURSE

PANNER DENSITY <50 PER KM OF RIVER COURSE

RIVERS

MMSD STUDY IN SADC REGION - ZIMBABWE

(Source: Svotwa & Mtetwa 1997)

Table: Panning Activities along Zimbabwe's Rivers

Sub-continental Indian Ocean River System	Main River System	Tributary System	Rivers under Panning	Length (km)
LIMPOPO	Shashe	Ingwize	Ingwize	20
		Sansukwe	Sansukwe	45
		Tuli	Malema	50
			Chavezi	75
			Tuli	140
			Shashe	215
	Bubi	Bubi	Jejet	20
			Mutzengwe	25
			Bubi	135
	Mzingwane	Mzingwane	Insiza	50
			Nyazani	15
			Mzingwane	140
SAVE	Runde	Mutirikwi	Mutirikwi	105
		Tokwe	Tokwe	75
			Mukosi	20
		Ngesi	Umchati	35
			Ngesi	30
			Runde	230
	Save	Devure	Nyanyadzi	75
			Mugezi	40
			Devure	95
			Nyatanda	5
			Umvumvumvu	35
			Odzi	120
			Save	335
ZAMBEZI	Rwenya	Nyangadzi	Nyanyadzi	80
		Inyangombe	Mwarazi	45
			Nyamkomani	20
			Inyangombe	75
		Inyamsizi	Nyamarume	15
			Inyamsizi	25
			Ruenya	65
	Mudzi	Mudzi	Nyamasanzura	40
			Mudzi	60
	Ruya	Ruya	Mupfuri	25
			Ruya	115
	Mazoe	Gwerera	Nyakadzi	20
			Gwerera	50
			Chiora	25
		Nyadire	Nyadire	85
		Nyagui	Nyagui	30
		Pote	Pote	20
		Tsamvi	Tsamvi	5
			Mazoe	220
	Kadzi	Kadzi	Kadzi	65
	Angwa	Angwa	Angwa	135
	Manyame	Manyame	Dande	60
			Manyame	90
	Sanyati	Mupfure	Washange	40
			Beri	30
			Mupfure	90
		Piriviri	Sungwi	50
			Biriviri	30
			Piriviri	30

		Munyati	Starkstroom	15
			Sebakwe	55
			Umsweswe	50
			Munyati	195
		Bvumvudzi	Bvumvudzi	70
		Kanyati	Kanyati	30
	Gwayi	Insuza	Insuza	80
		Lupane	Lupane	50
		Bubi	Bubi	50
		Shangani	Gweru	5
			Lukampa	15
			Shangani	140
			Gwayi	90
Total Panning Length				4615

Source: Wolff, 1993.

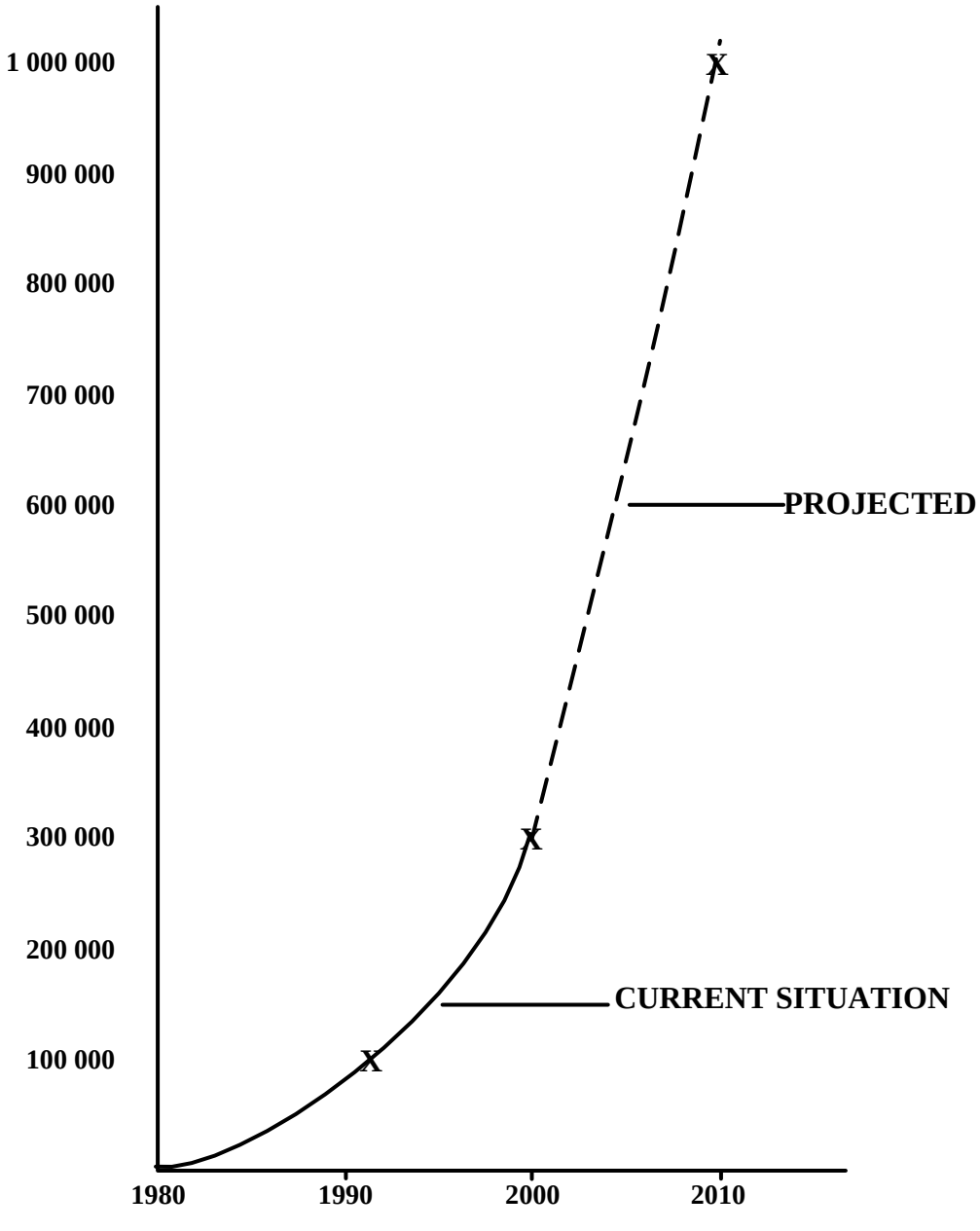
Table: Observed number of gold panners

RIVERS	NUMBER OF PANNERS OBSERVED					TOTAL	Av. No. Of Panners Per KM
	1ST km	2nd km	3rd km	4th km	5th km		
HARARE							
Mazowe	80	77	165	-	-	322	107
Ruenya	150	98	-	-	-	248	124
Odzi	156	168	88	-	-	412	137
Nyamsizi	400	300	300	-	-	1,000	330
Mupfurudzi	1,500	1,000	-	-	-	2500	1250
KADOMA							
Angwa	115	89	96	100	140	540	108
Mupfure	40	90	75	60	-	265	66
BULAWAYO							
Insiza	100	80	-	-	-	180	90
Mzingwane	130	90	128	-	-	348	116
MASVINGO							
Runde	70	40	-	-	-	110	55
GWERU							
Tebekwa	1,000	500	-	-	-	1,500	750

Source: Svotwa et al (1999)

Future of Small-scale Mining in Zimbabwe

Figure 3.2: GROWTH OF SMALL SCALE MINING IN ZIMBABWE



Source: Svotwa & Sibanda (2000)

It is now commonly accepted that small-scale and artisanal mining has enormous potential for absorbing greater numbers of people into productive employment in Zimbabwe. However, it is extremely difficult to quantify its commercial contribution to national economy for as long as the sector remains informal in its operations. There are indications, though that the sector can be made to operate in an environmentally friendly and socio-

economically sustainable way. An integrated problem-solving approach is needed to strengthen the sector. This approach implies strengthening the capacity of the sector to enable it deal with the economic, social and environmental issues that would lead to sustainable development.

Nature & Extent of Small-scale Mining in Zimbabwe

Seasonal mining activities which complement other activities

Zimbabweans are essentially and truly a rural people with nearly three quarters of the 13 million population living either in the communal lands (54.3% of the country's area) or on commercial farming and state land (20%). Even the urban businessperson, the academic, the professional civil servant and the politician alike all see their true home as being somewhere in the country, well away from the city lifestyle. This close link between urban and rural people makes Zimbabwe to be defined as an agricultural country. The zeal to farm has created immense environmental problems for urban authorities because of streamback cultivation activities and partly explains the political passion currently prevailing in Zimbabwe to solve the land re-distribution. It is therefore difficult to talk about full-time small-scale mining activities, no matter how successful they are in terms of sustaining economic production levels. When rain comes, everybody in Zimbabwe always finds time and space for agricultural activities.

What has tended to happen in recent years as a result of increasing poverty caused by effects of implementing the economic structural adjustment program)esap) and due to erratic rains, the miners are spending at least 60-70% of their time on mining.

Formal small-scale mining

In several studies carried out on the subsector in Zimbabwe, nearly all the miners cited harsh economic conditions resulting from retrenchment of workers from paid employment and high unemployment levels as the main reasons for going into mining. The situation had been further aggravated by poor agricultural yields due to erratic rainfall patterns. Small-scale mining, and gold mining in particular, is therefore seen as a panacea for survival in such harsh living conditions. For example, at least 80% of gold reef miners interview in Insiza District (Svotwa et al, (2000)) claimed they derived all their income from mining. This response is certainly true for most small-scale reef miners in the country. However, the same miners conceded that their wives or spouses performed farming activities.

In the Insiza study above, 64% of the miners indicated that they spend at least 3-4 months per year on farming (Table 4.1).

Duration of Farming Activity per Annum

Area	**Period of Farming**			
Area	None	3 months	4 months+	Total
Filabusi	13	36	5	54
Insiza	23	18	-	41
Fort Rixon	3	15	-	18
Total	39	69	5	113
%	35%	61%	4%	100%

Source: Svotwa et al, "Insiza Reef Mining Study, 2000".

It is pertinent to note that the seasonality of the formal small-scale mining sector is partly due, also, to be undercapitalisation and underfunding of the operations. Most of these operations are at best shallow open pits not exceeding 20-30m in depth. When the rains come, most of them get flooded, thereby hindering mining if water pumping cannot be done. If mining continues in the rainy season, it is albeit on a reduced scale because even the transportation of ore to the custom milling centers becomes problematic due to bad roads.

Of the 2000 – 3000 operating formal small-scale mines in Zimbabwe, it is very difficult to obtain definitive information about their operations and production statistics. The Ministry of Mines and Energy which is mandated to collect such data has failed to do so as it requires resources for its officers to travel round the Ministry, this is not done, and where figures have been declared they are far from telling the truth on the ground.

This study has therefore made an effort to show the contribution of the formal small-scale mining sector to the total mineral production in the country, in the last 10 years (Table 4.2). This information is derived from various sources such as the annual reports of the Chief Government Mining Engineer, research studies and experience of the author.

Table: Estimated Mineral Production Contribution by Ssm in Zimbabwe in Last 10 Years

Mineral		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Total in last 10 years	Estimated % from small-scale miners
Chromite	t	573 103	583 634	522 013	252 033	516 801	707 433	658 416	669 757	605 405	653 479	5 742074	40%
Clay	t	99 854	100 604	82 956	113 470	169 097	169 823	185 593	121 283	135 785	N/A	1 178465	20%
Emeralds	g	822 062	667 396	45 755	634 732	276 264	2208604	1079900	-	25 212	21 221	5 781146	100%
Gold	Kg	16 900	17 820	18 278	18 278	20 512	23 959	24 699	24 156	25 175	27 114	217 178	15%
Limestone	t	1251 618	1427602	1365924	1365924	1658160	1499101	1425373	1027375	1473236	1549632	13714150	10%
Mica	t	1301	506	495	495	213	1040	42	30	1309	N/A	5 506	100%
Tantalite	t	35	111	94	94	7	0	85	1	6	N/A	387	100%
Tin	t	808	796	716	716	82	-	-	-	-	N/A	3 059	10%
Vermiculite	t	-	742	4300	4300	8184	13 742	10 249	14 804	14 804	N/A	71 893	5%

The estimated contribution includes gold illegally bought panners and declared as production from mines.
Source: Adapted from Ministry of Mines Annual Reports.

Conclusion

In conclusion, it can be inferred that formal small-scale mining in Zimbabwe is still 100% a complementary activity. Even the very few professionals who have turned to the sector still find time and space for other activities such as farming, market trading and consultancy work. What is noticeable is that as more and more formal small-scale mines become better capitalized, the time spent on mining activities is gradually increasing.

Informal small-scale mining

The informal small-scale miners in Zimbabwe are predominantly gold diggers and panners. This sector is highly normadic (they hardly spend more than two years in one particular panning area). The only exception is when the panners are working on a huge tailings dump (as is the case in Bindura), or when the panners are working on rubble or reef material. Panners display a high mobility characteristic. This results in them not having permanent infrastructure such as houses, water and sanitation. Those who own land are few, and in most cases, this is far removed from the panning area. All the same, the panners still manager to grow farm/vegetable produce on small plots. However, panning has become a way of life in Zimbabwe, and these activities only stop when they perform peasant farming.

Activities which result from distress situations such as drought

The growth of the gold panning sector as demonstrated in Fig 3.2 above is historically linked to distress situations of the 1990s. The distress situations are given as:-

- The initial effects of the economic structural adjustment programme (esap) which was adopted by government in 1990. As many industries geared themselves for free market economy, they streamlined their operations and thousands of workers lost their jobs. In the mining sector, esap was supposed to bring and employment growth rate of 2.5%. Instead, employment grew by a negative 1.3% (Table 4.3). Many of the retrenched miners turned to artisanal gold mining.

- The severe egional drought caused by the effects of Elnino in 1992 and 1994 rainy seasons. In Zimbabwe, these effects were more pronounced in the Natural Regions IV and V where rainfall patterns are erratic.

The general economic depression in the country which started in late 80's. This depression led the government into changing from its socialist into market oriented policies as it adopted the World Bank/IMF ESAP programme in 1990. ESAP saw massive retrenchments of workers in all major economic sectors as the industries streamlined themselves for a free market economy. In the mining industry, employment grew by a negative 1.2% over the ESAP period 1990 (Table 4.3). Many of these retrenches turned to small-scale mining for them to continue to earn a living.

Table: Labour Statistics and Fatality Rate

Year	Labour	Deaths	Fatality Rate
1970	52518	49	0.93
1971	58584	57	0.97
1972	54605	467	8.55
1973	56739	51	0.90
1974	60672	52	0.86
1975	63316	55	0.87
1976	65161	72	1.10
1977	63850	57	0.89
1978	60362	57	0.94
1979	61154	61	1.00
1980	68793	47	0.68
1981	69038	34	0.49
1982	60372	52	0.86
1983	52206	35	0.67
1984	53711	35	0.65
1985	52941	43	0.81
1986	55231	43	0.78
1987	58464	34	0.58
1988	57660	33	0.57
1989	59986	36	0.60
1990	60198	39	0.65
1991	60275	55	0.91
1992	59471	56	0.94
1993	55342	24	0.43
1994	55212	34	0.62
1995	59007	75	1.27

Source: Ministry of Mines

- A generally sluggish world economy whose effects on the mining sector have been worsened by depressed metal prices. In Zimbabwe, the low metal prices, coupled with critical shortage of foreign currency for mining spares and other with more than 30 miners having closed down in the last 3 years.
- The closure of the mines have had many ripple effects upon downstream and other related support industries like transport and manufacturing. Employment opportunities have thus been very limited, and with more than 300 000 school leavers joining the job market every year, unemployment hovers above 30%, with no sign of improving. Consequently, very few people have bothered to look for employment and have turned to artisanal mining for survival.
- Poor agricultural yields due to severe regional droughts of 1985, 1992 and 1995. These droughts forced the least privileged part of the population, a majority of whom reside in the rural areas, to turn to the exploitation of minerals as a means of survival. To compound the problem, the rural areas are located in the most fragile regions 4 and 5 which are not very amenable to farming.

In conclusion, it can be inferred that virtually all small-scale gold mining activities as they are in Zimbabwe of today are a result of the distress situations as discussed above.

Activities which are the principal livelihood

The mining of chrome on the Great Dyke has seen dramatic structural changes in the last 10 years. More than 90% of the claims belong to the two mining giants, Zimbabwe Alloys and Zimbabwe Mining and Smelting (Zimasco) who both own smelting facilities. In the last ten years both Zimbabwe Alloys (Zimalloys) and Zimasco have literally stopped mining and relied on small-scale miners to supply their smelters with ore. This arrangement, called tribute mining has created a near full time dependency on mining, mostly from the mining co-operatives. This is the only sector which is deriving almost 100% of its livelihood from mining.

Number of women and children in the Sector

Of the more than 300 000 artisanal gold miners in Zimbabwe, at least 50% (i.e. more than 150 000) are believed to be women and children. The number of women in the 30 000 formal small-scale miners is much less, and estimated at about 10% or 3000. Of the 3000 women in the formal sector, about 70% feature mostly as mine owners or joint mine owners. The other 30% are usually engaged in the processing of gold (grinding using) pestle and mortar). In the informal sector, the women are involved in the gravity concentration of the gold bearing material using mostly wooden pans. They are also involved in the supply of water (where this is a problem) to the panners. This is where many children are also involved.

In a study carried out in the Insiza District of Matebeleland South Province, (Svotwa et al, 2000), it was shown that more women work as part-time employees than full-time ones. (Table 4.4). This table certainly reflects the general trend of women involvement in the formal small-scale mining sector in Zimbabwe.

Table: Number & Percentage of full time and part-time workers by gender and area

	Full Time			**Part Time**			**Total**		
Filabusi	Men	Women	Total	Men	Women	Total	Men	Women	Total
	No 204	1	205	79	13	92	283	14	297
	% 99	1	100	86	14	100	96	4%	100
Insiza	No 224	0	224	-	-	-	224	0	224
	% 100		100	-	-	-	100		100
Fort	No 120	9	129	7	3	10	127	12	139
Rixon	% 93	7	100	75	25	100	93	7	100
Total	**No 548**	**10**	**558**	**86**	**16**	**102**	**634**	**26**	**660**
	98%	2%	100%	84%	16%	100%	96%	4%	100%

Inventory over the last 10 years

The numbers of miners involved and the minerals miners have been adequately dealt within section 4 above, and in particular, Table 4.2 has attempted to show that contribution of the sector in the whole mining industry.

Mining

As more than 90% of the small-scale miners in Zimbabwe are involved in gold mining, most of the discussions in section 5 will refer to gold mining activities. The only other area which has been described is the chrome mining on the Great Dyke.

Zimbabwe is characterized by a large number of small to medium gold reef deposits that can be mined profitably by small companies, co-operatives, syndicates and individuals. As a result, more than 50 000 mining claims have been registered with the Ministry of Mines and Energy, but due to many other related problems, only about 2000 are in active operation.

Nearly all those mines in operation are characterized by low levels of mining technology and capitalization all symptonic in appalingly low production and productivity levels of 10T per month per mine and 0.2T per manshift respectively.

The mining cycle

A typical mining cycle in a large scale gold mine would involve the following important stages:

- Prospecting and exploration
- Prefeeasibility and feasibility studies
- Mine planning and mine designing
- Infrastructural development
- Production, processing and marketing
- Mine closure.

From the prospecting to the production stage, it can take anything up to 5 years or more especially if the mine is going to be an underground operation. In Zimbabwe it has been found out that the resources, the capacity nor the patience to wait that long. Consequently all the above stages of a proper mining cycle are virtually carried out as one stage. It is not uncommon to find that from the time a claim is registered with the Mining Commissioner to production it takes only one month.

Normally, registration of a mining claim is preceded by simple sampling and or hand panning to verify mineralisation. This is then further substantiated by opening up the outcropping reef. At that stage ernest mining starts on dip, following the reef until the operation becomes unattainable because of hoisting, waterpumping and or ventilation requirement problems. One thing is very clear though, and that is all miners are involved in minimum waste mining and movement.

Very few mines operated by small-scale miners as defined above do have proper mechanical hoists. They all invariably use windlasses. A windlass is a simple hand-pulley hoisting system, whose operational depth is limited mainly by the strength of the rope and the ability to bring the bucket at great depth.

In many cases, one is brought to surface in a bucket or hessian sack tied on to a rope and dragged upwards. In exceptional cases, ore is brought to surface using the human chain system. As the mine gets deeper, the operation becomes more difficult to manage and is usually abandoned at depth not exceeding 50m. A new shaft is then started from surface and follows a similar pattern. The resultant is a series of deep trenches, pits and gulleys along the strike.

Mineral processing

Once the ore is brought to surface, it is usually hand sorted to improve on the grade. The material is stockpiled until a reasonable tonnage (± 10T) is achieved whereupon it is transported to the nearest custom mill. In the meantime the best one is milled by pestle and mortar. The custom mills are either ballmills or stampmills.

At the end of the milling process, the ore goes through a gravity concentrator which is usually a james or shaking table. The concentrate is fed into an amalgam barrel where it is mixed with mercury. The gold-mercury amalgam is then free-retorted to recover the "yellow staff" which is the end product.

Artisanal miners

Artisanal gold miners (panners) simply mine by stripping the overburden material which ranges between 2 and 3 meters before they get to the mineralized zone at the bottom of the riverbed. The material is brought out for hand panning (gravity separation). Occasionally mercury is added into the pan to enhance the recovery. Gold panning is characterized by large mounds of sand punctuated by numerous pits along the riverbanks.

Waste disposal

As discussed in section 7.4.1.2. above, small-scale miners move and handle minimum amounts of waste. Whatever waste is mined, it is usually dumped close to the shaft and abandoned like that. The only major waste handling done by small-scale miners is on the Great Dyke where chrome mining requires that approximately 3T of waste must be removed to get 1T of chrome ore. This waste is clearly visible along the entire dyke where chrome is being mined.

Problems of small-scale miners

Despite the unprecedented numerical growth rate of the sector in post-independence Zimbabwe, small-scale mining remains a grey area in the mining industry. It remains underdeveloped, misunderstood and fraught with environmental problems. Several reasons that explain the sector's underdevelopment include limited access to credit finance, an inadequate institutional framework and restrictive marketing conditions.

- *Limited Access to Credit Finance*

The small-scale mining sector has received very little investment amounting to less than 1.0% of the total investment directed at the mining sector (*Svotwa and Mtetwa, 1997*). The Ministry of Mines created the Mining Industry Loan Fund (MILF) which is available to small-scale miners. The fund, which is administered by the Mining Affairs Board (MAB), amounts to around Z$2 million a year. This is just adequate to capitalise four mines at Z$500,000 each. Banks such as Zimbank, Barclays and the Commercial Bank of Zimbabwe and other financial institutions have offered loans to small-scale miners amounting to less than Z$300,000 per miner, mainly due to the miners' very little collateral. This is not enough to get a miner into production, contributing to a poor success rate in this sub-sector.

- *Inadequate Institutional Framework*

The principal institutions in the mining industry are; The Ministry of Mines, Environment and Tourism, which is the parent ministry dealing with mineral exploration, mining, processing and marketing; The Chamber of Mines, which is the representative body of the mining industry; The National Miners' Association (formerly The Small-scale Miners Association of Zimbabwe), which represents the views and aspirations of small-scale miners; the Zimbabwe Women's Trust, representing small-scale women miners; and the Associated Mine Workers of Zimbabwe (an arm of the Zimbabwe Congress of Trade Unions) which represents the interests of mining employees.

The existing institutional framework is inadequate to support the development of small-scale mining in Zimbabwe. For example, the location of Ministry of Mines offices throughout the country has been designed to reach the large mines, with the result that some formally registered small-scale mines can operate for years before an Inspector of Mines pays them a visit. Small-scale miners often do not know where to go in order to obtain the service and/or assistance they may require. The Chamber of Mines only represents mines affiliated to it and the affiliation conditions are restrictive to entry by the small-scale miners. The small-scale miners feel that the Chamber, in its present constitutional form does not and cannot represent their interests. The National Miners' Association, which claims to have a membership of about 5,000, does not adequately represent the broad membership because there are over 100,000 artisanal miners. The Associated Mine Workers of Zimbabwe (AMWZ) estimates that there are over 10,000 workers employed formally in small-scale mines throughout Zimbabwe, of whom 7,000 are members of the AMWZ (*Carr, Laurence and Svotwa, 1998*).

- *Restrictive Marketing Conditions*

For the large-scale mines, the gold market is well-structured and well developed. Domestic gold prices are primarily determined by two factors, the international price from the London bullion market and the Zimbabwe dollar exchange rate. Although this price fluctuated considerably in the 1995-1998 period, it has ranged between Z$150 and Z$300 per gramme. All the gold is declared to the Ministry of Mines and sold to the Reserve Bank.

The Gold Trade Act and the Mines and Minerals Act are restrictive, allowing only legally registered mine owners to sell gold to the Reserve Bank. The Reserve Bank, through its agent Fidelity Printers, only accepts gold deposits of 50g and above for logistical reasons. This requirement tends to discourage several small-scale miners (who produce smaller

amounts) from selling through the official channel. Even those miners who market their gold through Fidelity Printers have to contend with a time lag between deposition of bullion and payment (which is by crossed cheque). This time lag can be anything up to two weeks. Again, this system encourages small-scale miners to sell through the black market in situations where they are hard-pressed for cash. The majority of gold panners are usually operating illegally and cannot sell through the official channels since it is an offence under the present Gold Trade Act to be found in possession of gold unless one is a legal producer.

Environmental concerns of small-scale mining

The main policy affecting the mining industry in relation to the environment is contained in the Second Five Year National Development Plan (SFYNDP) for the period 1991 – 1995, which notes that unplanned gold panning is among the major problems that have led to serious environmental degradation. The SFYNDP also underscores the need to direct efforts at solving these environmental problems. There is no doubt that small-scale mining has contributed significantly to land degradation, deforestation, and health and safety problems. Small-scale miners are wasteful because of their high-grading practices. The miners are interested only in free gold; thus, any 'locked up gold' is lost as tailings. In addition, the miners shift from one place to the other once the high value ores are exhausted or once the extraction becomes impossible, without rehabilitating the mined out areas (*Maponga, 1995; Musingwini and Sibanda, 1999*). This practice causes physical environmental damage to rivers with consequent siltation of rivers, weirs and dams downstream. Some of the small-scale miners use mercury to recover the gold resulting in contamination of river systems thereby posing a danger of poisoning plant and animal life dependent on these river systems for survival.

- **LAND DEGRADATION**: - Small-scale and artisanal miners occupy and utilize approximately 0.005% of total land in use and they move about 10 million tonnes of rock material per year. At least 80% of the operations are open cast or shallow pits (less than 30m in depth) and are left behind in uncovered and unprotected trenches. The worst offenders are the chrome miners on the Great Dyke.

- **SOIL EROSION**: - Gold panners move an average of 8 million tonnes of material for panning per year, and this ends up in the streams and dams as silt. In addition, they destroy about 3 metres of river bank on either side of the river in cases where mineralisation continues beyond the banks. Some dams and weirs have been known to silt completely within five years.

- **GROUND AND SURFACE WATER**: - The main pollutants were found to be mercury, cyanide and to some extent human excrete, because of lack of good health and sanitation facilities.

- **MERCURY POLLUTION**: - Gold panners and small-scale miners use mercury fairly extensively during the gold recovery process. The usage of mercury is widespread, effective, simple and cheap, leading to as much as 2g per gram of gold recovered mainly in the belief that the more mercury one uses, the higher the recovery of gold. It is

estimated that of the more than 9 tonnes of mercury being imported into the country every year, small-scale gold miners utilize about 6 tonnes. About 50% of this mercury is lost on the amalgam plates, barrels and during retorting. Most members of a mining group are exposed to direct inhalation of mercury fumes at the retorting stage because they all want to see this most exciting part of the whole mining process that gives the "yellow metal". In a sample of miners examined for mercury poisoning in a study in Insiza Mining District (*ITDG, 1998*) it was found out that 60% of the population had general body weakness, 55% had symptoms of nausea, 50% had lost teeth, 45% had a history of respiratory distress and 40% had high salivation and tremors, 40% had high mercury levels in hair and 30% had high mercury levels in blood. These symptoms are associated with occupational mercury poisoning. This is not surprising, when considering how carelessly mercury is being handled by the miners in the sector.

- **CYANIDE POLLUTION**: - Very few small-scale miners are using cyanide for gold recovery as the process is more involving, requiring a high degree of technical input to maintain the right chemical balances that yield high gold recoveries. The other reason is that treatment of tailings by vat-leaching methods requires considerable capital investment and constant supply of tailings, both of which the small-scale miners cannot afford. The Ministry of Mines, Environment and Tourism, through its Mines Inspectorate is also very particular about use of cyanide, authorising each operation only after careful inspection of the health and safety measures in place. There are however, a few cases of cyanide pollution being reported (Figure 4.1).

- **DUST AND NOISE**: - Small-scale mining operations are labour intensive. Dust, fumes, noise and blasting vibrations which are a common feature in large scale mines are almost non-existent. On average, small-scale miners use about 5kg of explosives per blast. The dust and fumes generated by blasting are quickly diluted and dispersed as most operations are shallow workings. The study found out however, that the widespread use of pestle and mortar generates fine quartz dust, which is inhaled by those involved (mostly women) in the process (Figure 4.3). It can therefore be asserted that many of the miners exposed to this operation are likely to end up with pneumoconiosis diseases such as silicosis and tubercolosis.

- **HEALTH AND SAFETY**: - Very poor health and safety conditions exist in small-scale mines due to ignorance, lack of resources and skills. Over 20 people are killed in the sector every year, but because both the Mines Department and the Chamber of Mines do not recognize these as mine accidents or fatalities due to the illegal nature of the operations, nobody is interested in collecting and maintaining the data. Most of the accidents occur when the sidewalls and hangingwalls collapse due to undercutting worsened by lack of support.

- **VEGETATION DESTRUCTION**: - Gold panners are usually nomadic and whenever they discover a lucrative panning area, they construct makeshift homes out of pole and dagga, using local trees. In addition, almost 100% of their fuel needs comes from wood (Figure 4.2).

- **ECONOMIC BENEFITS**:- Gold panning and formal small scale mining are estimated to employ up to 350,000 people and provide livelihoods to more than 2 million people in Zimbabwe. This is an economic fact which cannot be ignored. In addition, the miners have the capacity to produce up to 10 tonnes of gold per year and at current prices, this approximates to Z$3.5 billion in revenue. Unfortunately, that gold and revenue goes unaccounted for, and the operations have no guaranteed sustainability in their present form.

Major Panning Areas in Zimbabwe

Panning production in Zimbabwe is confined mainly to the Greenstone belt (Figure 2.2). The gold areas are further indicated in Figure 2.3. In essence, the Greenstone belt also constitutes the main gold panning area. The most affected areas in terms of alluvial mining were found to be: -

- Mashonaland Central – Mazowe, Mudzi, Nyadire, Rwenya and Inyangombe rivers
- Mashonaland West – Angwa, Sanyati, Mupfure and Munyati Rivers
- Matebeleland North & South – Insiza, Mzingwane, Gwayi and Bubi Rivers
- Midlands – Shangani and Gweru rivers.
- Masvingo/Manicaland – Runde, Nyanyadzi, Odzi and Save Rivers.

In rivers like Mazowe and Angwa, as many as 300 panners were found on every kilometre of river course being panned. An attempt to show the gold panning spread is given in Figure 2.1.

Legal & Regulatory Framework

Mining Policies

There are over 18 pieces of legislation governing the management of natural resources and environmental protection, and administered by at least 7 different government ministries. As a result, environmental issues relating to mining in general, and to small-scale mining in particular, have been dealt with in several fragmented (and often conflicting) pieces of legislation. It is hoped that the upcoming Environmental Management Bill will resolve many of these problems arising from conflicting legislations.

The major policy regulating mining activities is the Mines and Minerals Act, Chapter 165 (1961) together with its subsequent amendments. This Act is administered by the Ministry

of Mines, Environment and Tourism and it overides all other Acts affecting mining, thereby making it the single most powerful Act vis-à-vis natural resources management. The Act however, covers only a limited range of environmental issues once a mining permit has been issued. The main criteria for issuing a permit are technical and financial competence. By ignoring specific issues on environment, the Act has left room for abuse, leading to indiscriminate dumping of waste material, erosion, siltation of dams, rivers and weirs and non-compliance with quittance requirements.

The Act is administered by an eleven member Mine Affairs Board (MAB) whose composition does not adequately represent the current state of small-scale mining in the country. In fact, it is the belief of small-scale miners that the MAB in its current form, where 50% of the Board members are chosen by the Chamber of Mines, can never represent the views of artisanal miners, let alone women miners.

Several regulations have been enacted in support of the Mines and Minerals Act. Most important of these include:

- **The Mining (Health and Sanitation) Regulations, 1977** which regulate for the provision of adequate health and sanitation facilities on a mine. This regulation is rarely applied on small-scale mines because these facilities are non-existent and there is no small-scale miner who has been legally charged for failure to provide the facilities to their employees.

- **The Mining (Management and Safety) Regulations, 1990** which seek to control health and safety in and about mining operations. The regulations cover management and responsibility in mines, surface protection, protection in working places, ventilation, gases and dust and examinations in several certificates of competency. They also cover certain ILO Conventions, including Convention No. 45, which prohibits women from working underground. Compliance with these regulations demands a certain level of technical competence on the part of mine management, and the availability of adequate resources to supply the safety clothing and equipment to employees. None of the current formal small-scale mines comply with at least 20% of the requirements of these regulations for the reasons cited above.

- **The Mining (Alluvial Gold) (Public Streams) Regulations, 1991** – which seek to control the small-scale gold panning activities in the country. The regulations empower local councils (RDCs) to issue permits, monitor and control gold panning in designated areas. The regulations also require that mining will take place only in the riverbed, and not closer than 3m to either bank. Undercutting is prohibited, as are excavations deeper than 1.5m. All mined out areas must be backfilled and the gold sold to the Reserve Bank or its agents.

- The regulations contain many positive aspects as they encourage RDCs to issue permits only to local residents, and to ensure that the natural environment is preserved. The implementation of these regulations has, however, been a difficult task. Out of a possible 30 RDCs who are affected heavily by gold panning activities, only 9 have

applied and obtained Special Grants that empower them to issue panning permits. The Councils feel that they do not have the technical capacity and resources to monitor activities of gold panners. In addition, that some of the environmental conditions (like not being allowed to mine deeper than 1.5m or closer than 3m to either bank) are not practicable because illegal panners still come and work on these areas. As a result, the regulations have failed to stem out the tide of illegal gold panning which has been on the increase since 1991.

Other relevant legislation

Environmental Management Bill (1998) is at an advanced stage of ratification by Parliament. Sectoral laws with relevance to mining include:

- Water Act (1998);
- Natural Resources Act (1996);
- Parks and Wildlife Act, (1998);
- Forestry Act (1996);
- Hazardous Substances and Articles Act (1972);
- Atmospheric Pollution Prevention Act (1971);
- Water (Effluent and Waste Water Standards) Regulations (1977) set effluent standards for discharges into water catchment areas;
- Explosives Act (1972);
- Communal Land Forest Produce Act (1998);
- Public Health Act (1996);

A National Conservation Strategy (NCS) exists although it has not been formally adopted by Parliament. The NCS has established a Interministerial Committee on Environment.
Zimbabwe's Second Five Year Development Plan (1991-95) provides that environmental impact assessment (EIA) should be undertaken for major development projects and an Environmental Impact Assessment Policy (1997) is in place and is operating on a voluntary basis until the adoption of the Environmental Management Bill as an Act of Parliament.

Mining and environmental policy and law

The Mines and Minerals Act (1996) is all powerful and designed to promote development of the mining sector with minimal restrictions. The Mining Affairs Board must consult with the Natural Resources Board before issuing a licence and should in principle ensure that any negative environmental impacts are mitigated and enough resources are budgeted for eventual reclamation and rehabilitation.

- Water Act places some considerable restrictions on powers of the Mines and Minerals Act in terms of the environment.
- Mining (Management and Safety) Regulations (1990) concern the management of toxic substances especially cyanide. These regulations appear to be applicable only to large-scale mines as they are not enforced in the use of mercury by small-scale miners.

- The Mining (Alluvial Gold) (Public Streams) Regulations (1991) were intended to stem the trend toward illegal gold panning and to capture potential losses of gold sales through the parallel market. There is also an explicit goal to protect rivers from siltation as well as other environmental ills.

Specific provisions concerning policies

Existing policies include:

- Environmental Impact Assessment Policy
- National Conservation Strategy

The compilation of an EIA is voluntary. The member state has well-defined guidelines for mining and exploitation activities. Environmental monitoring programme including mitigatory measures to reduce the impact on the environment is voluntary.

Policy Constraints

Although many mining and environment–related policies are in place in Zimbabwe, the mechanisms and resources to implement them are virtually non-existent. Major problems that were identified included the following: -

- Lack of capacity and resources within the mines department to deal with the hundreds of thousands of small-scale miners.
- Lack of adequate small-scale miner representation on the MAB.
- Lack of capacity and resources on the part of Rural District Councils (RDCs) to monitor and control gold panning activities, coupled with lack of perceived benefits from the activity.
- The proliferation of Exclusive Prospecting Orders (EPOs) which has seen virtually over 80% of Zimbabwe being covered by EPOs. This has left very little room for the small-scale miner to carry out prospecting activities. On the other hand, the EPO holders complain that the thousands of claims owned by the small-scale miners, many of which are located in the EPO areas, are hindering large scale prospecting activities.

It is therefore suggested that the Mines and Minerals Act, together with the regulations discussed earlier on, may need to be revised with a special focus on small-scale and artisanal mining.

Barriers to Cleaner Gold Production Technology

It is estimated that there are about 3.5 million small-scale and artisanal miners in Africa, and Zimbabwe's share of that population is put at about 350,000 (International Labour Organisation, Sectoral Activities Programme, *Social and Labour Issues in Mines*, Geneva, 1999, pp4-7). The sector could be providing livelihood up to 2 million people, and has the capacity to contribute more than Z$3 billion to GDP. However, these benefits may never be fully realised, let alone sustained for as long as small-scale mining is not formalised and given adequate support to sustain its proper activities. Any support programme for the sector cannot afford to ignore the poor health and safety conditions, the negative

environmental impacts and the potential barriers that inhibit the positive development of the sector.

Legal barriers

The 1991 Mining (Alluvial Gold) (Public Streams) Regulations are specific on leaving 3m of riverbank undisturbed, not undercutting, not mining deeper than 1.5m and backfilling all mined out areas. Since its enactment, there have been several attempts by equipment manufacturers to make gravity separation equipment that would be more appropriate to gold panning conditions. The "Bambazonke" machine was not very successful as its production was very low at about 500kg of throughput per day, which is what the miners are achieving without mechanical equipment. The GTZ/UZ Riverbed Mining Project in Insiza has achieved fairly high productivities of 4 tonnes per man-shift, but requires minimum ore grades of 0.25g/t to be commercially viable because of the capital investment which is between US$10,000 and US$15,000 per panning group of 20 people. With this technology of sluice boxes, it is possible to mine and rehabilitate even the river banks. However, leaving behind material less than 0.25g/t will bring back illegal panners in the near future. What is needed is low cost technology that will enable even grades lower than 0.1g/t to be panned economically because leaving behind patches of low grade material in the riverbed is not the ultimate solution. It is recommended that the legal restrictions in these regulations should be removed, and a combination of technologies such as sluicing and wind-sifting be researched into to achieve optimum gold recoveries.

The rehabilitation as mining proceeds needs to be addressed more positively. The panners must be educated in the benefits of proper rehabilitation, such as availability of water for their livestock and market gardening. But above all, there should be financial incentives for proper rehabilitation. The scheme, which is being tried by ZimAlloys on its chrome suppliers should be extended to the gold panners. In the ZimAlloys scheme, the company deducts Z$20 per tonne of chrome received from the supplier as "environmental rehabilitation charge". When the miner successfully rehabilitates the operation, he/she is then given back Z$35 per tonne bought from him/her. A quick evaluation of this arrangement has shown that it costs the miner about Z$25 per tonne mined out to rehabilitate the mine. The same job would cost ZimAlloys Z$50 per tonne mined. And so, by doing rehabilitation, the miner is gaining Z$10 per tonne, and ZimAlloys is saving Z$15 per tonne.

Health & safety barriers during production

The 20 to 30 deaths which occur annually in the small-scale mining sector are mainly due to rockfall, cave-inns and negligence due to greed. Because the miners want to get to the gold-bearing material at minimum cost, they want to remove minimum overburden or to do "minimum stripping". This invariably leads to undercutting with the inevitable collapse or caving of the hangingwall. Successful approaches to good mining methods will come with training and availability of capital resources to do either proper pre-stripping and stripping in opencast, or to do proper development in underground operations. Only increased productivities of 2.5kg of gold per small mining operation can afford to pay for the cost of good health and safety practices.

Health & safety issues during processing

After the ore has been blasted (mainly in reef mining) the material is usually hand sorted and hoisted to surface either in a bucket hauled by a manual windlass, or by a human chain arrangement (where the ore is passed on from one worker to the other). This material is then crushed by hand using 141b (6.4kg) hammers to reduce it to less than 150mm which is fed to a ball mill or to a stamp mill. If the mine does not have either of these, then workers are employed to grind the ore using pestle and mortar. This task is usually delegated to women, and as it is done dry, the women are exposed to high dust concentrations. In its simplest operation, the material is then usually panned for fine gold, after which mercury is added to form an amalgam, which is later retorted.

The final stage is called retorting when mercury is separated from gold through open air heating. This process is watched by all miners because they all want to see how much gold has been made. The inhalation of mercury is therefore something shared by nearly all gold miners. Attempts to encourage the use of closed retorts have not been successful in Zimbabwe because of the following reasons: -

- The retorts are expensive (Z$2,000) and miners do not see the justification because most of them require more heat energy to melt the amalgam.

- Miners believe that the use of aluminium foil (which they normally get free from cigarette packets) in an open pot adds to the lustre and quality (hence value) of the gold. The opposite is said to be true when a closed retort is used.

- Many miners do not believe mercury is harmful and one or two have "boasted of having swallowed a 250ml bottle of mercury and successfully ejected it through the normal excretion system".

- Mercury is a fairly cheap product (at least compared to the returns it gives) and is readily available from many illegal dealers who capitalise on its demand to buy gold. Many of the suppliers of mercury are businessman of Asian origin who then buy the gold through a third party.

It is believed that more than 6 tonnes of mercury is finding its way to the small-scale miners every year. Annually, this amount ultimately ends up in the soil and water system.

Support Programmes for Small-scale Miners

Government support

Government has historically supported the mining industry through various schemes as outlined in Table 3.2. However, its focus on small-scale mining was made in 1945 after the Second World War when it introduced the ex-Servicemen Scheme. With this scheme, returned soldiers were trained in mining at the Guinea Fowl School (later developed into what is now the Zimbabwe School of Mines). The government then gave them soft loans

to start up their own mining operations or to re-open mines closed during the war. This scheme was hailed a success with 221 men trained and 279 mines re-opened (*Viewing, 1984*). The only problem though with this scheme was that it was reserved for whites only. Therefore, before independence there were no indigenous black Zimbabweans who legally owned or operated a mine.

At independence the situation began to change. Although the Mines and Minerals Act was not reviewed immediately, the period 1981 – 1990 saw the emergence of formal small-scale black miners who focused mainly on mining gold and precious minerals. Government facilitated the registration of mining claims by these miners by charging a nominal registration fee of Z$20. This initiative by government was one way of absorbing those workers who were being retrenched as some whites (who feared and did not trust the new political order) closed down their operations and went to South Africa. In addition, the government introduced support schemes targetted to benefit the small-scale miners. The major schemes were: -

- **Plant Hire scheme**, which was administered by the Chief Government Mining Engineer. Under this scheme, small – scale miners had access to mining and metallurgical equipment as long as they could present a sound mining proposal. The plant hire charges were set at rates which enabled the miner to pay off the capital cost (plus 10% interest per annum), over a period of 1 to 3 years.

- **Loans to purchase mines** which were limited to Z$25,000 (nominal terms). This was exclusive of the cost of plant and machinery at the mine. Repayment was over five years with a fixed 9% interest rate per annum.

- **Loans to develop mines**, which were for shaft sinking, raising or developing a reef. This loan could be written off if the work failed to expose workable ore.

- **Loans to set up extractive plants** which included up to 6 months operating costs and were aimed at bringing the mine into profitable production.

- **Out of hand emergency loans** of up to Z$4,000 (nominal terms) which were given by the District Advisory (Mining) Board and repayable within one year.

Government's desire to see the development of a formal small-scale mining sector was further evidenced by its provision, through the ZMDC, of logistical and technical support to mining co-operatives. These support initiatives seemed quite successful, because by 1990 registered mining claims were estimated at 10,000 compared to about 1,000 in 1983. In addition, in 1990 government acknowledged that the contribution of this sub-sector to total gold production was about 10%.

Although several small-scale miners and co-operatives benefited from the above incentives and consequently set up formal mining operations, the majority of the claim holders did not really intend to operate formal mines. Instead, they were interested in having a legal front to avoid arrest by police, for possessing either gold or precious minerals. These sly miners bought gold from illegal panners who suddenly found that there was a ready market

for their produce. In order to maintain their claims and continue with their clandestine activities, these miners declared part of the gold as legal production to the Ministry of Mines. It is this gold that constitutes the greater part of the 10% mentioned above. The rest of the gold was sold to trans-border dealers. This scenario largely explains why there was little development in this sub-sector.

These services, particularly the technical extension services offered by the Mines, Geological Survey and Metallurgy departments have been virtually phased out mainly due to lack of resources as government cuts down on fiscal expenditure. Nearly all the departments are being commercialised, and miners are being asked to pay the true commercial value for the services.

NGOs & the private sector

The major NGO which has been working with the small-scale and artisanal miners is the Intermediate Technology Development Group (ITDG), which has provided a wide range of financial and technical support to the sector. Its major accomplishment was the establishment of the Shamva Mining Centre, which offers a range of services to small-scale miners in the Shamva area. ITDG was the only NGO working with this sector until mid-1990s, mainly because other NGOs did not want to identify themselves with the bad publicity associated with artisanal mining, especially with regards to environmental disregard. Since the UN-sponsored Harare Conference on Small/Medium scale mining in 1993, several key NGOs have come to the forefront to assist the sector. They include: -

- **EU Micro Projects** which has provided funding to several small-scale mining projects, including funds for the establishment of Shamva Mining Centre.

- **COMIC RELIEF** which provided capacity building funds for National Miners Association of Zimbabwe (NMAZ).

- **TDH (FRG**) which funded the establishment of the Shamva Mining School. The school has been training women miners to certificate of competency level.

- **GTZ** which has been funding the alluvial Riverbed Mining project initially in Insiza and now about to go national. This project is being executed by the UZ-Mining Engineering Department.

- **SNV** a Netherlands NGO which has committed itself to developing a vibrant small-scale and artisanal mining sector in the Insiza and Umzingwane rural districts of Matebeleland South. A project document to that effect has been developed and will be used to source resources for the activities.

- **AFSM (Austria)** which has been providing loan funds mainly to chrome mining co-operatives on the Great Dyke. The loan facility was extended to gold miners. (The programme is currently suspended)

In addition, organisations such as Hivos Foundation and World Vision have expressed open willingness to fund small-scale mining activities as long as there is a properly organised assistance programme. Other NGOs like the American Jewish World Volunteer Service, the Austrian HORIZON3000 and the British VSO are willing to provide human resources if there is a proper small-scale mining development programme.

In the private sector, large mining companies have offered to train small-scale miners in areas such as occupational health and safety through the Chamber of Mines. This opportunity however, has not been properly utilised because of the rift which divides the two sub-sectors of the industry. Many large mines have also facilitated the sale of explosives to small-scale miners, and in emergencies, often respond with rescue teams. Companies like Zimbabwe Alloys and Zimasco have been offering a total assistance package (training, finance and technical) to the miners who supply chrome to their smelters. In fact, Zimbabwe Alloys has stopped mining chrome completely, and now depends on small-scale miners to supply ore to their smelters.

Manufacturers of mining equipment have also been endeavouring to produce appropriate gold processing plants for small-scale miners. Some companies have begun to realise the commercial opportunities that exist in the sector. For example, IMF (Bulawayo), ABJ Engineering and Precision Grinders have all developed and manufactured mobile gold processing plants that are specifically designed for small-scale miners. An individual intreprenuer has also developed a wind-sifting, gravity gold separator that does not require water and is promising to be an exciting development for gold panning. It is capable of treating up to 20 tonnes in an 8 hour shift and can achieve 90% recovery of free gold.

Despite this growing positive trend, the impact in terms of environmental alleviation has been minimal. There are three major reasons for the lack of meaningful impact: -

The NGOs and other institutions that have been putting resources into the sector have been doing so piecemeal and without co-ordinating their activities.

Most activities which have been directed at the sector have focussed on alleviating environmental problems associated with the sector with little regard being given to the root cause of the problem (poverty).

There is very little evidence that both the public and the gold panners themselves really understand and are aware of the issues and problems involved in gold panning. There is therefore, a need to embark on a massive educational campaign to enlighten both the public and gold panners about the environmental issues and the consequences of ignoring them.

Rural District Councils (RDCs)

Under the **Mining (Alluvial Gold) (Public Streams) Regulations, 1991**, the Rural District Councils are empowered to issue permits and to monitor and control gold panning in designated areas. Permits can be issued to anyone – registered co-operative society or partnership, providing they are over the age of 18 years, are of good character and are permanent residents of the council area. People employed by the permit holder must also

be residents in the area. The last two conditions were meant to benefit the local community from the exploitation of mineral resources in their area. Similarly, the local councils are meant to benefit from gold panning through increased employment opportunities, increased council revenue base from permit holders and other spin-off activities that normally follow successful mining.

However, up to now there are only 9 RDCs that have applied for and been given Special Grants, out of a possible 30 with intense gold panning activities. The RDCs claim they have no resources and expertise to control and monitor gold panning in their areas. To date, the only local authority that has made significant strides in this area is the Insiza Rural District Council. A commitment by the council through the provision of a mining budget and human resources, coupled with an active NGO community such ITDG, SNV, UZ/GTZ and EU Micro Projects, have all helped towards the development of a vibrant small-scale and artisanal mining sector. Perhaps, more resources should be channelled to Insiza district so that it becomes a role model in the development of small-scale and artisanal mining.

Economic Role of Women

Nowhere have Zimbabwe's women been more invisible than in the mining sector. Of the more than 60,000 people employed by the large scale mining sector, only a handful women hold meaningful technical and managerial positions, particularly in production. Not even one women holds a mine manager's position. For many years, mining was considered the domain of men because people thought that women were not strong enough to do the work associated with mining.

Recently however, the number of women venturing into mining both at the formal and informal (panning) levels has been increasing, with indications that women constitute at least 50% of the panning community. Although most have gone into mining as a way of countering the harsh economic effects of ESAP and the recent spate of droughts in the country, there are quite a good number of women who now see mining as a sector with good economic prospects and are therefore determined to make a career of it. These women are disadvantaged as small-scale miners, not only because the industry is dominated by large mining companies, but also because very few women have ever been employed by these companies, and so they do not have skills and expertise on the complex mining and processing activities.

The needs of women small-scale miners

In Zimbabwe more than 1,000 registered mining claims are owned by women, and the numbers are increasingly steadily as more women turn to mining as a means of sustaining their livelihoods and those of their dependants. Major factors which have driven most women into this field include among others: -

- The ease with which a claim can be registered under the investor friendly shift in government policy particularly in the mining sector.

- The perceived high potential to become self-sustaining through gold mining and "official" trade in the metal made possible by acquisition of a claim.

- Intense competition with men for the few jobs available on the formal labour market with limited scope for growth.

- Land pressure which has had the effect of crowding out women who have traditionally lacked land inheritance opportunities under customary arrangements.

- Reduced confidence in relying on agricultural activities which in recent years have been severely crippled by recurrent droughts.

- The urge to demonstrate that all forms of economic activity are gender neutral including mining.

While the above factors have in large measure attracted a lot of women miners into the small-scale mining sector it must be emphasised that these developments have taken place within the existing harsh environment characterised by its marginalisation over time by both government and private institutions. The net effect has not only been to increase the numbers of people facing similar problems in small-scale mining but also introduced new players with different expectations.

In general, the problems afflicting the small-scale mining sector would appear to be common to both men and women miners. However, close analysis has revealed that women miners are more disadvantaged than their male counterparts in a number of respects. Studies carried out by the SADC Gender Programme in 1994 covering Zambia, Tanzania and Zimbabwe also confirm this tendency. In addition workshops held in Zimbabwe both at the local and regional levels in 1997, highlighted the special needs of women miners as follows: -

- *Lack of technical and management skills*

Traditionally mining has been dominated by men in the region and very few women, if any, have had access to official training in skills related to mining nor been employed in mining situations which would otherwise have exposed them to on-the-job skills acquisition.

- *Lack of access to credit facilities*

Women in business in general have had to face problems raising the necessary collateral security required by financial institutions due to their subordinate role in family structures. Besides, it has been demonstrated that the majority of women miners start off so poor that they can not even raise the collateral in the first instance.

- *Bias, and stigmatisation*

This is evident both at the institutional and operational levels wherein women miners are not taken as serious players in the business. The SADC Gender Programme Report on Zimbabwe states that, "Mining is a male dominated area. Women have to struggle for

recognition as capable miners and entrepreneurs in their own right". "I had to involve my husband to get a male miner to agree to sell to my mine a small water pump", said one woman miner in Kadoma. Families and institutions, which include the government and banks, have created administrative and organisational barriers for women's advancement in business and mining in particular.

The study goes on to say, however, that "although not really visible and acknowledged, women involved in mining make a significant contribution to the survival of their families and those of other men and women they employ".

Women miners often find themselves having to divide their time between their mining activities and the other domestic and cultural duties thus rendering their attention to mining discontinuous and more risky in terms of support solicitations.

- *Lack of exposure to appropriate technology*

As a result of their late entry into the field women have not been adequately exposed to the various technological choices available to miners. Consequently "hit and miss" tactics are common with attendant high failure rates.

- Lack of exposure to markets

Unfamiliarity with the intricacies of the mineral commodity market place which in itself is male dominated has had a negative impact on the disposal value of women miners' products and therefore operational profitability. Women miners have not been able to diversify from the traditional precious and semi-precious minerals.

Recommendations

Women must be given hope and recognition for their isolated efforts, acknowledging that their endeavours are breakthroughs. This should include:-

- Gathering data on female participation in mining and a comparison of their roles. This data collection should be undertaken on a participatory basis and should involve operators in the sector, district mining staff, local government officials and others involved in artisanal mining. This will increase awareness of the problem at all levels of the sector. Gender oriented policy analysis and statistics compilation are mechanisms needed to promote the advancement of women;
- Publicizing information about the sector and the opportunities it can provide to women in particular;
- Image building through awareness campaigns, NGOs can play an important role in this, particularly at the grassroots level;
- Publicizing women's initiatives and achievements as small entrepreneurs in general and miners in particular;

- Helping to train women in technical areas through workgroups which would provide opportunities for women to meet, share experiences and learn from one another;
- Establishment of support associations;
- Creating special skills development programmes, in collaboration with gender and management training experts and with resource persons chosen from among successful women artisanal miners, who would provide women with management and personal effectiveness training.;
- Encouraging women to take risks by showing them success stories about women in the field;
- As a means of fulfilling the previous point, establishing successful demonstration mines with women operators;
- Training in managerial as well as technical skills to raise the self-confidence of women.

Conclusions & Recommendations

While it is now commonly accepted that small-scale and artisanal mining has enormous potential for absorbing greater numbers of people in productive employment in Zimbabwe, quantifying its commercial contribution to national economy is hard to define for as long as the sector remains informal. There are indications that the sector can be made to operate in an environmentally friendly and sustainable way. The process of strengthening the sector should use the integrated problem-solving approach so that all the issues affecting and inhibiting the development of the sector are given due attention. The issues can be tackled under four broad categories, namely policy and legislation; institutions; support programmes and research and development.

Policy & legislation

There are many existing policies that impact on mining and in particular, small-scale and artisanal mining in Zimbabwe. In fact, it is the conclusion of this study that the sector is over-legislated. What is needed is a review of these policies such that they become more responsive to the needs and aspirations of the sector. The main criticism to nearly all the existing policies and legislation is that they are difficult to implement. To that effect, the following should be done:-

- **Mines and Minerals Act** must be reviewed so that there is a whole section which deals with small-scale mining and its administration. The review should look a the issue of exclusive prospecting orders (EPOs) and the needs of women miners. The issue of environmental management should be dealt with more on the incentives, rather than stringent control side.
- **The Mining (Management and Safety) Regulations** should be revised so that there is provision for health and safety standards that are achievable in the sector. These standards should be on a sliding scale depending on the complexity of the mining operation.

- **The Mining (Alluvial Gold) (Public Streams) Regulations,** 1991 should be revised to remove the restrictive 3m on either bank, and the 1.5m mining depth. If any gold bearing material is left behind or is perceived to be left behind , it will be the source of future panning problems.
- **The ILO, Women (Underground Mining) Convention No. 45**, which Zimbabwe ratified must be reviewed. Although government has never enforced it, it may now choose to denounce it because this convention prohibits women from going to work underground.
- Government should develop a minerals investment policy document, which has sufficient investment attractions for the small-scale mining sector. Such a document should incorporate policies that are attractive to both the private sector and the donor community.
- **The Collective Bargaining Agreement, Mining Industry (General Conditions) 1990**, should be seriously reviewed so that the standard conditions of service and minimum wages should not be equated to those prevailing in the large scale mining sector.

Institutions

The existing institutional framework has so far proved inadequate to support the development of the sector into a vibrant economic activity. It is perhaps necessary to revisit the main institutions so that their new compositions and structures show a much better accommodation of the needs of small-scale miners, and in particular, the needs and interests of women miners.

- The Ministry of Mines, Environment and Tourism is the principal institution regulating and controlling the mining industry. This is done through the Mine Affairs Board (MAB) whose composition is heavily in favour of the medium to large scale mining operations. Merely increasing the MAB by one or two representatives from the small-scale mining sector may not adequately address the problems of representation. What might be more appropriate is a newly structured MAB with substantial membership from the small-scale mines that reflects the economic potential of the sector. The same should apply in the composition of the District Advisory Boards (DAB). Women participation in these two Boards should be substantially improved.
- The Chamber of Mines is the official mouth organ of the mining industry. In principle, the chamber accepts any legally operating mine as a member, large or small. However, because the Chamber draws its major funding from the large mining companies, it treats them with kid gloves, offering them special seats on the various Chamber organs. Consequently, the development and activities of the Chamber reflects the paramount interests of large companies. Until very recently, the Chamber was in the forefront in condemning small-scale and artisanal miners for their environmental impacts.
- There is need to revisit the Chamber's Charter so that all its organs fully represent the needs and aspirations of small-scale and artisanal miners, particularly women miners. The Chamber must also be encouraged to develop a new strategy on how to assist the small-scale mining sector other than mere training and sale of explosives.

- Associated Mine Workers Union (AMWZ) is a member of the ZCTU. Although AMWZ claims to have more than 7,000 members from the small-scale mining sector, they have no strategy to reach the hundreds of thousands of artisanal miners scattered throughout Zimbabwe. It is therefore suggested AMWZ be assisted in its endevours to represent all the mine workers in Zimbabwe.
- **National Miners Association of Zimbabwe (NMAZ)** – has always claimed to be the official mounth piece of all small-scale miners. With an estimated membership of less than 5,000, it is doubtful that the organisation has the mandate to talk on behalf of more than 300,000 miners. There is evidence of disgrantlement amongst members of NWAZ, and various splinter organisations have been formed, namely the Gold Producers Association of Matebeleland, the Explorers and Developers Association and the Zimbabwe Women Miners Association. The formation of the Zimbabwe women Mining Trust is a clear testimony of the failure by NMAZ to properly represent women miners. There is thus an urgent need for a re-organisation of NMAZ if the organisation is to be saved from total collapse.
- **Employers Confederation of Zimbabwe (EMCOZ)** – brings together all the employers in Zimbabwe. Although small-scale miners are employers in their own right, they have not associated themselves with the organisation. The recent interest shown by EMCOZ into the small-scale mining sector does not necessarily reflect the intention to make the miners good employers but rather EMCOZ has seen commercial opportunities in organising training for the sector. It is suggested that EMCOZ should revisit both its strategy and mandate to include artisanal mine employers.

Support programmes

If small-scale and artisanal mining is to be developed into a vibrant sector that is environmentally sound and sustainable, there is need to revisit the current support programmes which have proved grossly inadequate so far. In some cases, new ones may have to be introduced.

Ministry of Mines & Energy

The ministry has so far offered various loan schemes and technical support services through its departments of Geological Survey, Metallurgy and Mining Engineering. The loan scheme is grossly inadequate and should be reviewed upwards. The extension services have been grossly curtailed because of budget problems to a point where they are virtually non-existent. It is recommended that these services be relocated to the local authorities, (RDCs) where they will be run on a cost recovery basis but ensuring that the miners are adequately supported.

Training

Small-scale miners need training in the mining and processing of their minerals. This training should be linked to the establishment of mining services centres like Shamva Mining Centre, and at least one centre in each Province should also serve as a training centre for the miners. The provision of equipment for hire should be linked to these centres.

Finance

Whilst it is acknowledged that donor funds will be required to kick start the assistance programme, there should be serious considerations given towards the formation of a small-scale mining bank. An integrated management programme towards the strengthening and development of small-scale mining should be drawn and the costing done. Donors should then be enticed to fund the various elements of that plan. For example, GTZ and SNV are interested in funding gold panning activities; SIDA (Sweden) has shown interest in funding reef mining activities. If all the efforts of various donor agencies are properly co-ordinated, then sufficient resources can be raised for the programme.

Research & Development

- There is need to carry out research and development in several topics, including:-
- Cleaner gold production and processing methods.
- How to mainstream gender into mining.
- Workable funding schemes for small-scale mining.
- Production and marketing of industrial minerals.

Capacity Building Requirements for the Ministry of Mines & Energy

The Ministry of Mines, Environment and Tourism is the parent regulatory ministry on the mining industry. Its regulatory, controlling and supporting functions are provided to the industry through its 3 main departments, namely the Geological Survey; the Metallurgy and the Mining Engineering department. Proper investment in small-scale and artisanal mining has the potential to create at least 1 million jobs and more than 5,000 operating small mines. This magnitude of mining activities cannot be regulated and controlled by the Ministry in its present format. The Ministry's departments are already battling to cope with the activities of a handful of current operations mainly because of poor working conditions which have led to many people leaving the ministry. Secondly, the ministry has severe budgetary problems and seems more affected by cuts than other ministries. As a result, the inspector of mines annual vote is usually spent in only one month of travelling, leading to the grounding of the inspectors for the rest of the year except when there has been a fatal accident.

It is therefore unthinkable that a tenfold increase in the number of mining activities could be successfully regulated and controlled by the present departments in the ministry. The capacity building requirements of the ministry must therefore also acknowledge the need to restructure these departments. The following recommendations are therefore put forward.

- The Geological Survey and Metallurgy Departments should be fully commercialised, and concentrate on macro activities.
- The Mining Engineering Department should retain only the regulatory and control functions, but modified as follows:-
- Every Rural District Council that has small-scale mining activities should have a mining department manned by a mining engineer, a geologist and a surveyor. The mining engineer should be appointed sub-inspector for the district.

- The local authorities should be allowed to raise and retain revenue from the miners, and the revenue should be enough to cover the running of the mining department.
- The rural district offices should be computerised and linked to the main Geological Survey and Mining Engineering Departments for access to data.
- The main mines offices should collate data from the district offices and make follow up on trouble areas.

In conclusion, the capacity building programme for the Ministry would entail training personnel for the district offices and equipping the offices.

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