

MINING, MINERALS AND SUSTAINABLE DEVELOPMENT

MMSD Southern Africa

RESEARCH TOPIC 6

**BASELINE SURVEY OF THE MINING AND
MINERALS SECTOR**

Final report

by

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1. INTRODUCTION

The baseline survey, numbered is no. 6 of six research topics studied in the southern African regional analysis (MMSD-SA) for the Mining, Minerals and Sustainable Development (MMSD) project. The six topics are:

- RT1. Small-scale mining
- RT2. HIV/AIDS and mining
- RT3. Mining and society
- RT4. Mining, the environment and sustainable development
- RT5. Managing mineral wealth
- RT6. Baseline survey.

The present study (RT6) aims to survey the interactions between mining and the total environment in southern Africa. By this we mean not only the ecological environment but also the social, labour, economic, industrial and political environments as well as that of the world mining industry. The report is directed at an understanding of where the industry is situated at present. It attempts to identify the major issues that various stakeholders have raised, the approaches they have taken and the impacts identified to date rather than to analyze or evaluate these impacts or to discuss the future direction of the industry.

One view of what the baseline survey should be is a synthesis of the other five research topics. The planning of the overall MMSD-SA project did not allow for this approach as all six topics were to be studied simultaneously. Nevertheless, the baseline survey has been executed with this approach in mind, covering aspects considered relevant to these other topics.

The coverage of the baseline survey is defined by the Terms of Reference specified by the MMSD-SA Working Group, as follows:

Characterize the nature and extent of the mining and minerals sector in Southern Africa, including but not limited to the following:

- Mining, Minerals and Sustainable Development
 - Regional interpretation of sustainable development.
- Industry Description
 - size, major minerals, contribution to national income and foreign exchange earnings, structure and stages of production and transformation
 - brief history of mining in the region, its interactions with communities, labour, local economies and the environment
 - trends in environmental, social and economic impacts of the sector
 - role of small scale and artisanal mining in the region
 - supply chain issues
 - land access and use issues in the region
- Drivers of Change
 - industry changes including supply/demand considerations, changing corporate profiles, technologies and structures
 - legislation and policy changes
 - stakeholder pressures and concerns in the region
 - regional initiatives and activities
 - impact of globalization on the sector and on the challenges of sustainable development.

Related additional aspects have been covered or mentioned where appropriate.

The RT6 report is not a baseline assessment in the sense of what is usually understood by the use of this term. That is, it does not measure quantitative variables as a basis for the evaluation of changes by a physical study. The changes normally studied this way would be those brought about by a defined operation occurring after the initial measurement. An example of such a baseline assessment is the measurement of the chemical concentration of a specific pollutant in a defined water source. This measurement would be done before a specified change

in operating practice of, for example, an industrial plant. The purpose of the measurement would be to determine whether the change brought about a reduction in that concentration. The present RT6 survey covers too wide a range of subjects and parameters to allow this type of quantification, at least with presently available techniques. The Australian MMSD baseline project (Hancock, 2001) proposes an application of Life Cycle Assessment for this purpose, but its methodology is not yet available.

Therefore the RT6 report is more a survey of the present situation in the aspects listed. It can still act as a baseline assessment in qualitative terms, to identify changes that may occur over time. However, without the quantitative measurements it will be difficult to assess whether changes have occurred, and to what extent.

For the purpose of this report, the southern African region is defined as the 14 member states of SADC, the Southern African Development Community. The 14 are Angola, Botswana, the Democratic Republic of Congo, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe. The island states of Mauritius and Seychelles are not members of SADC's mining sector and are not significantly affected by mining, so they are not mentioned often in this report. Malagasy is in the southern Africa region, but is not a member of SADC. It does not have a major mining industry and data on minerals and mining for that country are not readily available. Therefore Malagasy is not covered in this report.

The danger was recognized from the start of the project that South African data and views would dominate the report to the detriment of the other countries of the region. It must be accepted that information is much more readily available on this country than for the others. The time constraints on the project have made it difficult to seek information on some topics from these other countries, so that the report is, inevitably, biased towards the South African situation. Nevertheless, the report has

been written with the whole region in mind. The author has obtained a great deal of information on the whole region in previous projects, as well as further and more recent information, especially from SADC-MCU (SADC Mining Co-ordinating Unit). Therefore, though the bias is present, it is not considered overwhelming.

Reference

Hancock, P., 2001. Mining Minerals and Sustainable Development (Australia). Baseline assessment scope of work. Personal communication from B. Sheehy, May 8.

2. REGIONAL INTERPRETATION OF SUSTAINABLE DEVELOPMENT

- an overview of the priority topics on the region's sustainable development agenda.

The Working Group (a group of three people directing the MMSD-SA project) compiled a document to describe this interpretation following a workshop in March 2001 (MMSD-SA, 2001) and has updated the document from the comments subsequently received. The document provides a working definition of sustainable development in the region.

The current version of the document (MMSD-SA, 2001a) notes that the economies of most Southern African countries either depend on the mining and minerals industry, or are strengthened by the industry's downstream activities. The entire sector has recognized the critical role mining plays in the region, and the opportunity this presents to act as a catalyst in the region's transition towards sustainable development. The MMSD project has been initiated to identify how the mining and minerals sector can contribute to the global transition towards sustainable development. The intention is to place the mining and minerals sector (including all the significant stakeholders) in Southern Africa within the context of the Southern African Development Community's (SADC) goals for sustainable development, to:

- accelerate economic growth with greater equity and self-reliance;
- improve the health, income and living conditions of the poor majority;

- ensure equitable and sustainable use of the environment and natural resources for the benefit of present and future generations.

The above working definition describes the process in terms of three interactive systems for sustainable development:

- Promoting economic equity and stability
- Enhancing social benefit, and
- Maintaining the natural resource base.

The process is then depicted as three interlocking circles, one each for the social system, the economic system and the natural system, indicating that each of the three systems must be considered in setting goals for sustainable development.

One apparent weakness of this definition is that it appears to apply world wide rather than being specific to Southern Africa. The issues are universal, but the balance between them and the priorities are likely to vary between regions. In this region, for example, the social and economic aspects dominate, both of them in terms of the overwhelming need to alleviate poverty.

No government in the region or elsewhere can afford to ignore issues of the natural environment. Environmental degradation intensifies poverty, as is described in the section on social issues (3.3) in this baseline survey. However, poverty also causes environmental degradation, and this reason is undoubtedly worse in southern Africa and other developing countries than it is in the industrialized world. Further input (MMSD-SA, 2001a) to the “Locating” document by various interested parties will, presumably, focus on a southern African interpretation of these issues. O’Riordan et.al. (2000) have examined the problems of sustainability in the South African context.

References

MMSD-SA, 2001. Locating the mining and minerals sector within the southern African vision for sustainable development. Workshop on Sustainable Development, Stellenbosch in March 2001.

MMSD-SA, 2001a. <http://www.mining.wits.ac.za>.

O'Riordan, T., Preston-Whyte, R., Hamann, R., and Mangule, M, 2000. The transition to sustainability: a South African perspective. *The South African Geographical Journal*, 82(2), pp.1-10.

3. INDUSTRY DESCRIPTION

3.1 The mining industry in Southern Africa

In this region mining contributes significantly to economic activities, fixed investment, employment opportunities, infrastructure, secondary industries, gross capital formation and foreign exchange earnings (Chamber of Mines, 1999). For mining development to take place a country has to have the mineral resources needed but economic factors also play an important role. The industry considers that the investment climate in terms of government policy, laws and regulations must be appropriate to the encouragement of private sector mining activity. It believes that these factors have improved in the region. However, it also believes that political stability and the lack of a positive track record on policy, together with external factors such as declining commodity prices, competition from other mining regions and global financial crises, have resulted in relatively slow progress in developing the mining industry in certain SADC countries.

The size of the industry in Southern Africa may be gauged by the mining output of the region, which for SADC in 1997 was US\$15.7 billion excluding Lesotho, Mauritius, Mozambique and Seychelles (Table 1). To the total mining output South Africa contributed 71%, Botswana 12%, Angola 4%, Democratic Republic of the Congo (DRC), Namibia and Zambia 3% each, Zimbabwe 2% and Malawi, Swaziland and Tanzania 1% together.

The mining output of \$15.7 billion constituted 8% of the regional GDP in 1997. The most mineral-dependent country was Botswana, for which mining contributed 34% to its GDP, followed by Namibia at 15% and Zambia at 11%. Angola (excluding oil), South Africa, DRC and Zimbabwe have moderate-sized mining industries in relation to their GDPs, at 4 to 8% each. South Africa and Zimbabwe, especially the former, have developed industrial sectors and the

share of mining is undervalued as it does not reflect the contribution of value-added products derived from mining.

Table 1: SADC countries: Mining outputs and GDPs

Country	GDP (US\$m)	Mining output * 1997 (US\$m)	Mining as % of total GDP *	
	1997		1997	1973
Angola	7 830	705	9	15
Botswana	5 713	1 942	34	10
DR Congo	11 730	469	4	29
Lesotho	1 054		<1	0.3
Malawi	1 721	52	3	0.1
Mauritius	4 596			
Mozambique	1 801		<1	0.2
Namibia	3 150	473	15	69
Seychelles	530			
South Africa	140 020	11 202	8	16
Swaziland	1 101	52	5	17
Tanzania	4 542	45	1	1
Zambia	3 913	419	11	41
Zimbabwe	7 848	314	4	9
SADC	195 549	15 673	8	16

* at current prices

Sources: Granville et. al., 2000 (for 1997); Van Rensburg, 1977 (for 1973)

Southern Africa contributed 4% to the 1973 world mining production of US\$159 billion (including oil) or 8% excluding oil (Van Rensburg, 1977). In 1997 the region's proportion was 3.7% excluding oil. The six mineral leading producers in 1973 were:

- USA 23%
- USSR 18%
- Canada 5%
- China 5%

- South Africa 3%
- Australia 2%

No data are available for the value of world mining production in recent years.

Mining contributed 43% to the region's exports, with Botswana, DRC, Namibia and Zambia getting over 50% of their export earnings from mining. Angola earned 98% of its exports from minerals if oil is included, though without including oil, mining was a relatively small contributor to Angola's exports (Table 2).

Table 2. Contribution of mining to exports in SADC countries

Country	Total exports f.o.b. (US\$ m)	Mining exports US\$ million	Mining exports as % of total exports	Year
Angola (with oil)	4 198	4 117	98	1996
Angola (without oil)	4 198	80	2	1996
Botswana	2 100	1 663	79	1997
DR Congo	882	635	72	1994
Lesotho	119			1996
Malawi	566			1997
Mauritius	1 625			1997
Mozambique	169	0.5	0.3	1995
Namibia	1 359	792	58	1997
Seychelles	40			1997
South Africa	30 000	11 245	37	1997
Swaziland	896	21	2	1997
Tanzania	722	28	4	1997
Zambia	994	824	83	1995
Zimbabwe	2 440	566	23	1996
SADC	46 110	19 891	43	

Source: Granville et. al., 2000

When processed minerals and metals are included, the contribution to the minerals sector increased from 8% of the region's GDP to some 10% and its contribution to foreign exchange earnings from 43% to some 60% (Granville et. al., 2000).

Major minerals

In terms of a number of criteria mentioned below, the following are the minerals of major importance in southern Africa:

- Chromium
- Coal
- Cobalt
- Copper
- Diamonds
- Gold
- Iron
- Manganese
- Nickel
- Phosphates
- Platinum-group metals (PGMs)
- Semi-precious stones, and
- Titanium.

The criteria considered (Granville et. al., 2000) were reserves and grades, distribution of reserves between countries of the region, availability of technology and infrastructure, competitive global advantage, and economic impact.

The above minerals include some for which southern Africa has a considerable share of the world market: these include chromium, cobalt, diamonds, gold, manganese, platinum-group metals and titanium.

Southern Africa is the main producing region of five major minerals: chromium, cobalt, diamonds, gold and platinum-group metals, and is one of three major producing regions for semi-precious stones. Latin America is the largest producer of copper, east Asia of iron ore and north America of phosphate rock. Table 3 lists the southern African region's proportion of world production for most of the significant minerals (as well as two major metals) together with the countries which contribute to each.

Reserves, resources and grades

Southern Africa is one of the world's regions most richly endowed with minerals, and the economies of most of the states in the region are dependent on mining to a significant extent. There are extensive data for mineral reserves and resources in the region but they suffer from lack of information and standardization on their degree of assurance, that is, to what extent the reserves or resources are delineated. Grades are difficult to judge because they often vary over a wide range between deposits; only for a minority of deposits are they even sufficiently defined.

Table 3. Proportion of southern Africa in world mineral production

Mineral	%, 1998	>5%	Other regional producers
Alumino-silicates [@]	59	SA	
Asbestos **	na	Zimbabwe, SA, Swaziland	
Chromite	51	SA	Zimbabwe
Coal	7	SA	Zimbabwe, Botswana, Swaziland, Zambia, Tanzania, Malawi,
Cobalt	42	Zambia, DRC	Botswana, SA, Zimbabwe
Copper	4		Zambia, SA, Botswana, Namibia, Zimbabwe, DRC
Diamonds	46	DRC, Botswana, SA	Angola*, Namibia, Tanzania, Swaziland, Zimbabwe, Lesotho [#]
Ferrochrome	49	SA, Zimbabwe	
Gold	19	SA	Zimbabwe, Namibia, Tanzania, Botswana
Iron ore	3		SA, Zimbabwe
Manganese	18	SA	Namibia, Botswana, Zambia
Nickel	7		SA, Botswana, Zimbabwe
Phosphate rock	2	SA	
Platinum-group metals	49	SA	Zimbabwe
Semi-precious stones	n.a.	Tanzania, Zambia	SA, Malawi, Botswana
Steel	1		SA, Zimbabwe, DRC
Titanium	20	SA	
Vanadium	61	SA	
Vermiculite	45	SA	
Zinc	2		Namibia, SA

[@] andalusite, kyanite, sillimanite

* not including smuggled diamonds

[#] artisanal

** not available

Sources: BGS, 2000; USGS, 2000; Minerals Bureau, 2000; Granville et. al., 2000; SADC, 2001.

For eight minerals, Africa south of the equator has more than 45% of the world's reserves, as shown in Table 4.

Table 4. Proportion of southern Africa in world reserves

Mineral	Region%	% of reserves in individual countries
Chromite	95	South Africa 83, Zimbabwe 10
PGMs	86	South Africa
Diamonds	83	DR Congo 48, Botswana 10, South Africa 10, Angola 9, Namibia 5 Tanzania 1
Vanadium	64	South Africa
Vermiculite	60	South Africa
Manganese	53	South Africa 48
Gold	50	South Africa 49, Zimbabwe 1
Fluorspar	46	South Africa

Source: Van Rensburg, 1977

Resources of *aluminium* are large in Malawi, DRC, Angola, Mozambique and Zimbabwe but the amount that is reasonably assured and has known and sufficient grade (chiefly in Mozambique) is insufficient to supply a world-scale alumina plant (Granville et. al., 2000).

Resources of *antimony* are listed only for South Africa but undefined deposits or occurrences are mentioned also for Namibia, Zimbabwe and Mozambique.

South Africa and Zimbabwe have extensive good quality deposits of *chromite* and DRC produces that mineral. Undefined low-grade deposits or occurrences exist in Angola, Mozambique, Botswana, Tanzania and Namibia.

There are sufficiently large reserves of steam *coal* to supply a power station in Angola, Botswana, DRC, Malawi, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe. However, they are listed as

identified or recoverable only in Botswana and South Africa, though Malawi, Mozambique, Swaziland, Zambia and Tanzania also produce coal. Coking coal is reported only in Mozambique, Zimbabwe and South Africa.

Extensive reserves of *cobalt* having good grades are found in the copperbelt of DRC and Zambia, which are major producing countries. Smaller but useful reserves occur as a by-product of copper, nickel or PGMs in Zimbabwe, Botswana and South Africa. Occurrences or small low-grade reserves exist in Swaziland and Tanzania.

There are large, identified *copper* reserves of good or acceptable grades, with continuous production, in DRC and Zambia and a significant amount in South Africa. There are intermediate reserves or resources and/or continuous production in Botswana (as a by-product of nickel), Zimbabwe and Namibia. Intermittent production or dormant deposits or deposits with low potential exist in Angola, Tanzania and Mozambique. Deposits of copper in Swaziland have been reported but reserve figures are not available (De Kun, 1987).

Major diamond reserves or resources occur in Angola, DRC, Botswana, Lesotho, South Africa and Namibia, with smaller quantities in Tanzania, Zimbabwe, Swaziland and Mozambique. Much is of gem quality, and ore grades are good to adequate.

Southern Africa is a major world region for deposits and production of *gemstones*. The region has many of the major stones except high-quality rubies and sapphires.

Significant reserves or resources of *gold* are widespread in the region, in South Africa, Zimbabwe, Tanzania, DRC, Mozambique, Namibia, Botswana, Swaziland and Zambia, but the degree of assurance is generally low.

Large *iron* reserves exist in South Africa, DRC, Angola, Mozambique, Zambia, Tanzania, Swaziland and Zimbabwe, with many of the deposits having good or adequate grade. There are also significant reserves in Malawi, DRC and Botswana.

Sizable *lead* reserves are listed in DRC and South Africa, with significant reserves in Namibia and Zambia. Occurrences are mentioned in Zimbabwe, Swaziland, Tanzania and Angola.

Limestone, dolomite and *calcite* deposits are found in most of the countries of the world, including in southern Africa, but their qualities are not well described.

South Africa and Tanzania have significant land-based reserves of *magnesium*, but only in South Africa is enough information on quality available to indicate the potential for reduction to the metal. All the coastal states have access to sea-water magnesium.

Only South Africa has good-quality reserves of *manganese* sufficient to sustain world-scale production of ferromanganese. These are considered to be the world's largest manganese deposits.

Large or significant *nickel* reserves, generally of the sulphides, occur in Botswana, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe. Grades are marginal or low by world standards, but the element is recovered in Botswana, Zimbabwe and (as a by-product of PGMs) in South Africa.

Phosphate reserves are widespread in the region, being large in South Africa, Mozambique and (low-grade) in Zambia. Reserves are significant in Angola, Malawi, Seychelles, Tanzania and Zimbabwe.

South Africa and Zimbabwe have a very high proportion of the world's *PGM* reserves. Deposits of the elements also occur in DRC, Tanzania, Botswana, Zambia and Angola. Grades are adequate.

Silica reserves in various forms are widespread, with many being quartzitic, which is relevant for the production of silicon metal, ferrosilicon and glass. The deposits in Zimbabwe, Mozambique, Botswana and Tanzania are large, but only those in Angola, Mozambique and South Africa are of high grade.

Silver is reported in Zambia, Tanzania, South Africa, DRC and Namibia, mainly as a by-product of gold and copper.

Large on-shore reserves of *soda ash* or *salt* exist in Botswana, Namibia and Mozambique. Angola, Mauritius, Mozambique, South Africa and Namibia produce salt from sea water or coastal brines. Only salt produced in Namibia or Botswana is sufficiently pure for the production of chlorine.

South Africa, Namibia and Zimbabwe have large reserves of pyrite (as a source of *sulphur* for the production of sulphuric acid) but the average grade of the Namibian reserves is low. Zambia also produces pyrite.

Large *tantalum* reserves exist in Mozambique and DRC. Namibia, Zambia and Zimbabwe also produce tantalum.

There are extensive reserves of *titanium* in South Africa, Mozambique, Tanzania and Zimbabwe, mostly in beach sands but also in hard rock deposits. Namibia also has significant but low-grade reserves.

Sufficient reserves of good-grade *vanadium* have been found only in South Africa. Tanzania has large reserves but the grades are marginal. Mozambique and Namibia have small reserves with low grades.

Only South Africa and Namibia have large enough *uranium* reserves to supply a calcining plant. Smaller reserves exist in Malawi, Zimbabwe, DRC and Botswana. Occurrences or undefined deposits are mentioned for Angola, Tanzania and Zambia.

Sizable *zinc* reserves of sufficient grade exist only in South Africa, DRC and Namibia.

There are large *zirconium* reserves of sufficient grade, mainly in beach sands, in South Africa, Mozambique and Namibia.

Employment and earnings

The total labour force in the SADC mining industry was listed as 2.0 million in 2000. This included 1.5 million in the informal mining sector in Tanzania (see Table 5). This table is an example of the uncertainty in figures published for the region, as employment figures published elsewhere differ from those given here. Thus, the number of people formally employed in the mining industry in Zambia and Zimbabwe were listed by Dreschler (2001) as 300 000 and 350 000 respectively, as compared to the figures of 25 000 and 48 000 listed in Table 5. Though comparison with the production output data in Table 1 indicates that the latter figures appear more likely to be correct, this comparison is not conclusive. Other areas where data appears to be inconsistent include the output data themselves, sales tonnages and values, imports and consumption, the number and identity of mines in operation, input information such as water, electricity, chemicals and reductant usage, and the equipment in operation.

Table 5. Employment in the region's mining industry

Country	Employment 2000
Angola	24 000
Botswana	12 961
DRC	n.a.
Lesotho	636
Malawi	3 700 (1999)
Mozambique	n.a.
Namibia	6 248
South Africa	412 000
Swaziland	n.a.
Tanzania	1 500 000
Zambia	25 000 (1999)
Zimbabwe	48 091 (1999)
TOTAL	2,0 million

Source: SADC, 2001

The number of employees in the mining industry in South Africa in 1999 represented 2.7% of the economically active population or some 9% of all workers in the non-agricultural formal sectors of the economy. A total of 341 000 mineworkers, or 43% of the industry's 1990 work force, lost their jobs over the ten years from 1990 to 1999. The multiplier effect, i.e. the number of people in formal or informal employment who depend on mining compared to those directly employed in the industry, is not easy to estimate, but a factor of 4 has been frequently used in South Africa. On this basis, mining still provides direct and indirect employment for some 1,5 million people in that country.

The average wage received by mine workers in South Africa in 1999 was R46 079 per annum or US\$628 per month (Minerals Bureau, 2000). The wage on gold mines increased from R2000 to R44 000 from 1980 to 2000 (COM, 2000). The most recently available data for the average monthly wage in the mining industry in other southern African countries was as follows (Table 6).

Table 6. Average earnings of mine-workers in southern African countries

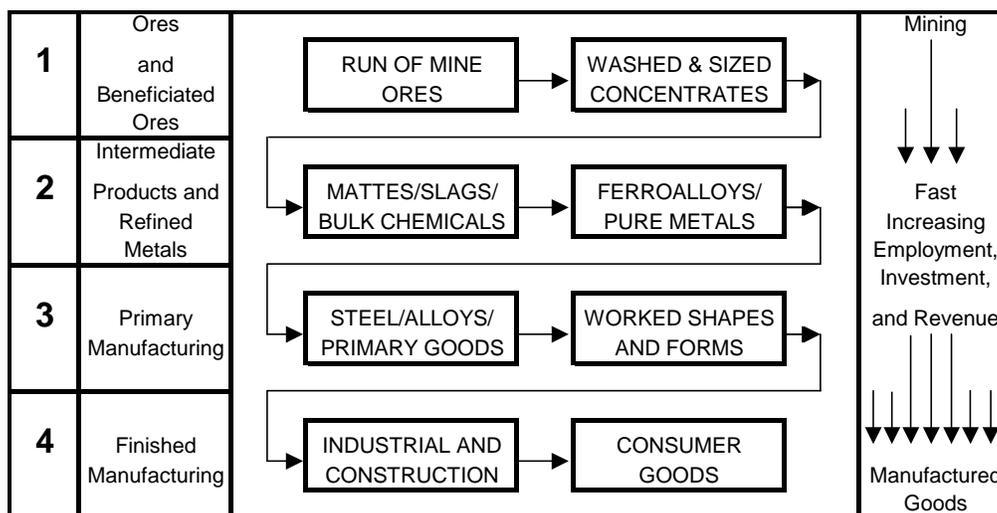
Country	US\$ per month	Year
Botswana	374	1992
Malawi	17	1989
Mauritius	302	1992
South Africa	514	1991
Swaziland	309	1989
Zimbabwe	179	1992

Source: Du Toit, 1995

Stages of production and transformation and major processing plants
 (Sources: Granville et. al., 2000 and references listed therein, Chamber of Mines of South Africa and SADC, 2001).

Successive stages of beneficiation can be classified according to the type of products obtained in each stage, as shown by Figure 1. Employment, investment and revenue all generally increase in the direction from mining to manufactured goods, though the increases do not always follow that direction uniformly.

Figure 1. Stages of beneficiation



Source: Chamber of Mines

The furthest stage of transformation achieved in each southern African country for a number of the major minerals is listed in Table 7.

Table 7. Stages of processing achieved in southern Africa

Mineral	Stage	Country
Chromium	Stainless steel	South Africa
Chromium	Ferroalloy	Zimbabwe
Cobalt	Manufactured product	South Africa
Cobalt	Metal	DRC, Zambia
Cobalt	Salt	Zimbabwe
Cobalt	Matte	Botswana
Copper	Manufactured product	South Africa, Zambia, Zimbabwe
Copper	Metal	DRC
Copper	Matte	Botswana, Namibia
Copper concentrate	Mozambique	
Diamonds	Rough	Angola, DRC, Lesotho, Swaziland, Zimbabwe
Diamonds	Cut	Botswana, Mauritius, Namibia, South Africa, Tanzania
Gold	Bullion	Botswana, DRC, Mozambique, Namibia, Tanzania, Zambia
Gold	Fabricated product	South Africa, Zimbabwe
Iron	Manufactured products	Angola, Botswana, DRC, Lesotho, Malawi, Mozambique, South Africa, Zambia, Zimbabwe
Platinum group metals	Concentrate	Zimbabwe
Platinum group metals	Manufactured product	South Africa

Mineral commodities that are mined in Angola of which the processing plants are on site include: diamond, cement, industrial minerals. The Siderurgica Nacional steel plant at Luanda is apparently still in operation, using steel scrap. Besides these and the modest processing of diamond, industrial minerals for ceramics, bricks, and dimension stone, no significant processing facilities are in operation in the country.

BCL Ltd at Selibi-Phikwe in *Botswana* produces copper-nickel-cobalt matte, which is refined at the Empress Mine in Zimbabwe and by Falconbridge in Norway. Debswana Co. and Tswapong Mining Co. operate diamond

concentration plants at their four mines, and diamond cutting and polishing is done by Teemane Manufacturing Co., Schachter and Namdar Co. and Diamond Manufacturing Botswana Ltd. Agate (Botswana) Ltd. Masa Precious Stones cut and polish semi-precious stones. Reliance Foundries (Pty) Ltd have a plant at Palapye and Botswana has a small plant producing gold bullion.

In the *DRC* most of the mineral processing facilities are dormant, inoperable or have reduced capacities. Copper production in 1997 was mainly electrowon and refined from tailings and cobalt production was mainly from recycled hydrates. Gecamines' operating copper mines in 1988 included Kolwezi, Luiswishi, Kasombo 2, Kabankolo and Kimbe. The rehabilitated Kasombo cobalt mine was in operation as well as was the Shituru hydrometallurgical cobalt plant. The smelter at Lubumbashi was under construction to produce cobalt from stockpiled converter slag. Avmin has processed high-grade cobalt concentrate from the DRC at its Chambishi refinery in Zambia.

Malawi Iron and Steel Co manufactures steel products in *Malawi* and Portland Cement Co. and Shayona Cement Corp. manufacture cement.

In *Mauritius*, steel reinforcing bars are made from imported ingot at three rolling mills, and there is a small diamond cutting factory.

Apart from the modest processing of industrial minerals for ceramics, bricks, tiles and dimension stone, no significant mineral processing facilities are available in Lesotho. Steel products are produced at Berea Steel Industries and Lesotho Steel Products Ltd.

Construction of the US\$1.3 billion Mozal primary aluminium smelter near Maputo in *Mozambique* is complete and a second plant at Mozal has been approved. A bauxite drying plant owned by Mina Alumina Lda exists at Penhalenga and is accessible from Zimbabwe. A bentonite beneficiation and milling plant and a

soda activation plant exists at the mine near Boane, south of Maputo. A graphite processing plant exists at the mine located at Ancuabe west of Pemba. Gemstones are cut and polished by Companhia de Desolvimento Minerio and Gemas Pedras Lapidadas de Mocambique. Steel products are produced by Forjadera SARL, Industriana Mocambicana de Aco, Companhia Siderurgica de Mocambique and Empresa Metalurgica de Mocambique.

In *Namibia*, the Tsumeb copper/lead concentrators and smelters have been sold and restarting of operations was being planned. Namdeb and Namibian Mineral Corp. operate diamond recovery and sorting plants and Namgem a cutting and polishing factory for diamonds and semi-precious stones. The construction of a new solvent extraction and electrowinning plant with a capacity of 150 000 tonnes per annum at the Skorpion zinc mine was approved and in another development Rossing Uranium commenced the construction of a pilot ore sorting plant as part of its yellowcake facility.

South Africa operates processing plants for most of the significant minerals that it produces as well as for some imported minerals or mineral products. It also runs fabrication operations for iron, steel, copper, aluminium, non-ferrous metals, gold, platinum and other metals and minerals.

Except for the processing of industrial minerals for local manufacture and use, few mineral processing facilities are available in *Swaziland*. Brick and talc production are the only mineral-based industries at present.

Tanzania has a small diamond-cutting factory and a steel plant based on electric furnaces.

Zambia operates copper and cobalt smelters and refineries at Nkana, Mufilira, Luanshya, Nchanga and Chambishi. Dunrobin Mining Ltd produces gold bullion and Precious Metals Plant in Ndola produces gold and silver from anode slimes

from the Nkana and Mufilira copper refineries. Nitrogen Chemicals of Zambia produces fertilizers near Kafue. Scaw Ltd operates iron and steel foundries.

Zimbabwe has a number of operating concentrators, smelters and refineries for copper. Rio Tinto Zimbabwe Ltd at the Empress Mine at Eiffel Flats refines nickel-copper matte from BCL in Botswana, and Alaska Copper Smelter and Refinery in Zimbabwe processes concentrates from South Africa and the Democratic Republic of Congo. There are plants manufacturing copper cable, extruding copper, drawing tubes and fabricating copper, brass and bronze. Gold bullion is produced at a number of mines in the country and Fidelity Gold Refinery has a plant near Harare. Zimbabwe Iron and Steel operates an integrated steel mill at Redcliff and there are several iron and steel fabrication plants and foundries in the country. Zimasco produces PGMs in copper-nickel concentrates at Mimosa Mine for treatment in South Africa but the Hartley platinum mine of BHP Minerals Zimbabwe has halted operations. Bindura Nickel Corp. and Rio Tinto Zimbabwe Ltd produce PGM material as a by-product of nickel refining. Zimphos produces phosphoric acid and fertilizers at Msasa/Aspindale from phosphate rock produced at Dorowa Mine.

The above information shows that the mining and processing industries are very active in most countries of the region and constitute an important sector of their economies, for some of the countries the most important sector.

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3.2 Outline history of mining in southern Africa and its interactions with communities and labour

This section traces how mining evolved in the region and how its effects on workers and communities developed.

Ancient mineral users in Southern Africa

It was probably in eastern or southern Africa that humans first used minerals, in the form of flint or stone for weapons and tools. This was in the Palaeolithic Period, about 1.5 million years ago, and the practice spread to other regions of the world later in the Pleistocene Epoch. These uses – known as Acheulian industry - were characterized by the employment of simple stone hand axes, choppers and cleavers (Britannica, 2001). Specularite has been mined in Swaziland for 28 000 years, probably as a cosmetic (Saunders, 1994) and the earliest rock art found in Namibia is thought to be 25 000 to 27 000 years old.

Cave art, is associated with the emergence between 20 000 and 15 000 BC of the earliest of the historically recognizable populations of southern Africa, the Pygmy, San and Khoi peoples. The art form used pigments such as iron oxides for red and yellow, manganese dioxide for black and calcium and magnesium compounds for white. In the same period, eggshell beads were used as adornment, and coloured stones must have been used for the same purpose where available.

Gold was also used for ornamentation from a very early period, and when mines in the areas of the Upper Nile and the Nubian Desert could no longer meet the demands of the Egyptian pharaohs, deposits elsewhere, possibly in Yemen and southern Africa, were exploited (Kirkemo et. al., 1997). Copper was first used for the same purpose as gold, as a symbol of opulence for display. The subcontinent had no Copper or Bronze Age as there was in Europe, for example (Watts, 1961; Iliffe, 1995) as surface copper was rare in sub-Saharan Africa except in Central Africa. But copper articles found their way into the region from elsewhere.

The earliest known metallurgy in southern Africa was thus the smelting of iron, which had a major impact on African history. Iron-working probably came to sub-Saharan Africa in about 500 BC, through trans-Saharan trade (Saunders). It may have started in southern Africa in about 300 BC, in Zambia (Holmes, 2001), though there is evidence of very early iron-working in the Great Lakes region of East Africa dated at 810 BC (Iliffe). Iron-working is associated with the advent of pastoralism, for which the first evidence in the subcontinent dates to some 2000 years ago and it has even been claimed that in much of eastern and southern Africa there was no agriculture before the advent of iron.

Early iron smelting furnaces have been found in many countries of the region such in the Tswapong hills near Palapye, Botswana, dated around 190 AD (Parsons, 1999). Later Iron Age sites revealed iron tools, fragments of pottery, gold ornaments and copper wire. These sites included Bambandyanalo (settled about 1050 AD) and Mapungubwe (about 3 centuries later), both in the Messina district, Manekweni in south-western Mozambique, Great Zimbabwe, which was settled between 1200 and 1400 AD, and Thulamela in the Northern Province of South Africa, settled between 1240 and 1630 AD (Geocities). These settlements owed their prosperity mainly to the export of gold (Saunders).

In southern Africa pottery made from clay is associated with Iron Age settlements. Pottery appeared in the upper Zambezi valley, south-western

Zimbabwe and Botswana late in the first millennium BC (Ilfie, Britannica). An example found at St Lucia bay has been dated to about 300 AD (Saunders).

Copper began to be mined and refined in southern Africa in the late first millennium AD, for example in Zambia in about 350 AD (Holmes). Hundreds of the mine workings of the period, such as in the Northern Transvaal, remain. Malachite, the copper carbonate/hydroxide, was the preferred ore because it is easy to smelt. Veins of ore were followed by digging shafts and drives, some of them running for hundreds of metres at depths of around 15 metres (Saunders). The ore was dug with iron picks and short iron chisels and, where it occurred in hard rock, it would be split by heating with fire and quenching with water.

Gold was obtained from alluvial beds where possible but also by open-pit mining and from quartz outcrops. At Rooiberg, tin was also smelted to add to copper to produce bronze. Smelting took place at sites where there was water, clay suitable for constructing a furnace, and a source of fuel, usually charcoal. The simplest smelter consisted of a hollow in the ground, over which was built a dome-like structure of clay, and skin bellows were used to supply the draught through reed tuyeres around the bottom.

More sophisticated clay furnaces were used for iron, which requires a higher temperature. The iron produced by smelting in that period was sponge iron, which can be beaten into shape. Sometimes the furnace was over-heated and this, together with carbon particles, produced steel, which was discarded because it could not be worked. Metal workers were accorded special political or mystical status and no women were allowed near iron furnaces. Iron smelting technology in southern Africa continued until the 19th century, when the British army in Natal considered using local iron for wagon fittings and found it superior to that imported from Britain. An iron furnace was still in operation in Venda in 1888 (Cowey, 1994).

The Europeans look for gold

Contact with early European explorers provided further purchasers for gold. Among the first of these explorers were Portuguese who reached north-western Angola in 1482 and later Portuguese expeditions reached further south (Britannica). They were not, however, interested permanent settlements or in going into the interior, as their main purpose was to reach India. By the last middle of the sixteenth century, however, the Portuguese attitude had changed. By 1515 they had through the force of arms seized the Indian Ocean trade and established themselves on the coasts of Angola and Mozambique. In about 1530 they expanded into the Zambezi valley to control the trade in precious minerals and they continued into Malawi in the seventeenth century.

Iron Age people used and traded metals between settlements, with Stone Age people and with explorers. Conflicts must also have occurred over ownership of metal products and over control of deposits.

When Dutch and British expeditions visited the Cape in the first half of the seventeenth century, European copper and iron articles, and later brass, were among the more important items offered for barter with Khoikhoi in return for food. This practice continued during the next century between indigenous people and members of various European settlements in the Cape. The Portuguese had already participated in the slave trade in Africa. Domestic slavery was already part of the social order in central Africa, when prisoners of war and criminals were kept in bondage (Britannica). The Dutch East India Company forbade Jan van Riebeeck from enslaving the indigenous people of the Cape but he was allowed to import slaves, for example from Batavia and West Africa. Some of these slaves probably worked in salt pans near the colony (Saunders) and in quarries producing stone for construction.

In 1807, shortly after the British occupied the Cape for the second time, the slave trade was abandoned and slavery at the Cape was formally abolished in 1834. In

1852, when the British recognized Boer independence, the Boers agreed not to practice slavery. In the 1830s to 1850s, however, the Inboekseling system was prevalent among the trekkers. Children were captured during commando onslaughts and indentured to their masters until adulthood, or even for longer periods. Their masters had complete control over them and could even offer them for barter.

When the wage system was introduced in the Cape and Natal, local and migrant labourers were recruited mainly for domestic service, as artisans in the towns, for farm work and in sugar plantations. When diamond mining and that of the gold fields in the Transvaal developed, the demand for cheap labour led to Africans being forced off their land and compelled to sell their labour.

"Modern mining" in southern Africa is often considered to have started in 1852 (e.g. Van Rensburg and Pretorius, 1977), a divide which may refer more to the start of written records on mining in the region than to the actual operations. In that year the Dutch colonists made systematic attempts to recover copper from outcrops around Okiep in Namaqualand. The first exploitation of coal on a substantial scale was near Molteno in the Eastern Cape soon afterwards, in 1870 (de Jager, 1976), for local use in the colony.

Diamonds and restriction

The major development towards modern mining occurred fifteen years later when alluvial diamonds were found near Hopetown. By 1870 there were at least 100 000 diamond diggers spread 100 miles along the banks of the Vaal River and this activity was intensified when in 1871 the diamond pipes of the Kimberley area were discovered. In 1873 about half of the population of the workings at the Kimberley mine were white (Saunders).

The workings were crowded and there were no safety regulations or control, so there were many accidents, for example when rubble being hauled over the

heads of workers suddenly collapsed. As workings became deeper, access roads were undermined and collapses of ground were common. The increasingly difficult conditions required more working capital, so smaller claims amalgamated. Large-scale amalgamation followed as a result of volatile diamond prices, with De Beers Mining Company achieving total control of the Kimberley mine in 1889.

Whites in Kimberley feared the Africans and accused them of theft, illegal diamond buying and other crimes. They demanded that the Africans be kept to separate areas and management supported this demand to prevent the possibility of collusion between white, coloured and African workers. The result was that African workers were confined to compounds while not at work, these compound encouraging the spread of disease.

The supply of labour became a contentious issue and a constraint on the development of capitalism in the region, firstly in agriculture and then in mining, and it remained so for a century. Between 1871 and 1875 an estimated 50 000 Africans arrived each year at the diamond workings, with the same number leaving each year. Labourers' wages in Kimberley were higher (at 10 to 30 shillings per week) than anywhere else in the region.

Labourers were imported from India to Natal from 1860 and indentured mainly to sugar planters though some worked on Natal coal mines. They were treated as badly as were the African labourers and the practice of indentured immigration lasted to 1911.

One of the early attempts to obtain labour for farmers in Natal was by Theophilus Shepstone, the Natal Secretary for Native Affairs. In 1873 Shepstone made it compulsory for Africans who stayed for more than five days in Pietermaritzburg to accept any offer of employment at a prescribed wage, but this didn't go far enough in solving the labour shortage. There was a potential supply from

Mozambique and other Northern areas, but the Zulu kingdom and the South African Republic lay between the source and the demand.

The Zulus and the Boers were seen as threatening the passage of labour to Natal and to the diamond mines. This factor, together with the need to develop communications and transport in the region and the wish to persuade local colonists to bear more of the costs of the colonies themselves, produced a new perspective in the British authorities' view of South Africa. These authorities began to see southern Africa as a potential area of riches and they started to push for a confederation of southern African states, to be controlled by Britain.

The result was Shepstone and Carnarvon's annexation of the South African Republic in 1877, an annexation that lasted only for three years. These factors also led Shepstone and Frere to instigate the invasion of Zululand in 1879. Despite a defeat of the British at Isandlwana, the Zulu kingdom was dismembered by 1881 and annexed in 1887. After the defeat of the Zulus a hut tax was imposed in order to oblige Zulus to seek work on the labour market, and this was a major cause of the disruption of traditional Zulu society.

The development of the South African gold fields accelerated the expansion of mining together with its consequent social and labour problems. Gold started to be produced in significant amounts at Eersteling near Pietersburg in 1871, and more gold was found near Lydenburg, Pilgrim's Rest and Barberton over the next 15 years. Many miners in the region, especially in the de Kaap valley, succumbed to malaria.

The alluvial gold mining in Mpumalanga required little labour and could not support much of it though Africans did find a market for food among the diggers. But the first mining law of the South African Republic (SAR) after its restoration in 1880 prohibited Africans from participating in mining other than as labourers for whites (Saunders).

The Witwatersrand mines intensify the pattern

In 1886 gold-bearing conglomerates were found on the Witwatersrand and in the same year the rich Main Reef Leader was discovered at Langlaagte. By 1888 the boom in Mpumalanga gold was over, and though production there still continues it is at a minor scale compared to the Witwatersrand and OFS fields. These deposits were extensive, but deep and of comparatively low grade. They therefore required large amounts of capital (as well as labour) and were therefore operated by large mining companies. Demand for equipment also increased, with the first stamp mill being commissioned in 1885. Fees and customs revenues at Natal harbours increased dramatically and transport systems expanded.

In 1889 the deepest of the Witwatersrand gold mines began to intersect pyritic ore, which gave a much lower recovery in the mercury amalgamation process then used. The market slumped, many of the prospectors left the area and further take-overs followed. The industry was saved only by the adoption of the Scottish MacArthur-Forrest process, which worked by dissolving the gold in cyanide instead of amalgamating it with mercury.

The Chamber of Mines was founded in 1887 to act in the interests of the mining companies, including representing them to the SAR government, for example on labour issues. African labourers were housed in compounds similar to those in the Kimberley diamond operations. A pass system and lack of "legal" accommodation restricted their movements and prevented visits from family. Wages were low, which limited their activities, including the amounts of money the labourers could send home. The women left behind in the rural areas were forced by the resulting poverty to look for paid work, producing a rural poverty that is still prevalent.

New laws made breach of contract a criminal offence and African labourers were forbidden to move from one mine to another. African trade unions were barred

but white artisans, including immigrants, were allowed to form trade unions. For both black and white, however, the deep, narrow mines were dangerous and unhealthy and the death rate at that stage was high.

Rhodes' Glen Gray Act in 1894 reduced the amount of land an African in the Cape Colony could own and restricted inheritance of this land to the eldest son. A labour tax was also imposed on Africans who were not employed. These measures succeeded in their intention of driving more Africans off the land and into wage labour, including moving them into the mines.

When gold was found in the Tati district in Bechuanaland, the SAR attempted to annex the area, but in 1885 part of Bechuanaland was proclaimed a British colony and the other part placed under British "protection". Rhodes formed the British South Africa Company in order to exploit what he expected to be rich gold deposits north of the Limpopo and in 1890 he sent up a heavily armed "pioneer" column, including prospective miners and settlers. The column invaded Bulawayo and deposed Lobengula. It took a while to establish mines in the new colony but when they were established a system of forced labour was introduced as well as intensive recruitment from Northern Rhodesia, Mozambique and Nyasaland. The difficulties of mining profitably in Southern Rhodesia resulted in wages, food, housing and health conditions being cut back ruthlessly and morbidity rates were exceptionally high (Britannica). When the South African war cut off communications to the south, grain prices increased and many local Africans deserted the mines to return to farming.

Mining in Rhodesia revived after this war and zinc was produced at Broken Hill by 1906 and lead by 1915 (Watts). Shallow copper deposits in the area appeared poor in comparison with the massive formations in Katanga and were neglected until the 1920s when it was realized that they were indications of economic sulphides at depth. The Bwana Mkubwa Mine re-opened in 1922 on a larger scale and scientific prospecting soon resulted in the discovery of the Mufilira and

Nchanga deposits. Roan Antelope Mine came into production in 1931 and copper mining expanded swiftly thereafter.

Difficulties in the way of the mining industry in the SAR in the 1880s such as monopolies on dynamite and rail transport increased costs and the industry believed that the labour force was insufficiently controlled (Saunders). These were among the factors that persuaded the uitlanders to first press for reform and then, when they obtained support from the British government, to instigate the second South African war in 1889.

Building the industry on migrant labour

During the three years of war, mining on the Reef declined drastically. After the defeat of the Boer Republics in 1901, the British government in South Africa worked to revive industrial growth by expanding mining on the Witwatersrand. This, they hoped, would dilute Afrikaner nationalism and mould the South African colonies in a British imperial pattern. But African workers had begun to desert the mines because of the low wages and poor conditions. A commission of enquiry in 1903 found that a large shortage of labour existed and was expected to more than double within five years. In order to overcome this shortage, the Chamber of Mines imported some 64000 labourers from China between 1904 and 1907.

This step faced the opposition of white mineworkers, who feared the loss of skilled jobs or having their wages undercut by the Chinese. Afrikaners, who remained a powerful political force, also opposed it. Mainly in order to placate white mineworkers, the Chamber enforced severe restrictions on the Chinese labourers: they had to return to China after their three-year contracts, they were limited to unskilled work, and they were not permitted take part in farming or trade or to own land. They were also subjected to harsh conditions such as poor living quarters in mine compounds and being subjected to flogging, fines or imprisonment for slacking or desertion. The opposition to Chinese labour succeeded in ensuring that the system ended by 1910.

Restrictions placed on Indian workers in Natal were similar, though not quite as severe. A three-pound tax on previously-indentured Indian workers was the immediate cause of a strike at the Farleigh Colliery near Newcastle in 1913, which was followed by further strikes in Durban, Pietermaritzburg and other parts of Natal as well as strengthening the Satyagraha passive-resistance movement.

Samuel Marks, a leading entrepreneur in several industries including coal mining and breweries, though not in gold mining, maintained interest in his Lithuania town of origin: Neustadt-Sugint. He was a major inspiration for the immigration to South Africa of some 40 000 Jews from Lithuania between 1895 and 1914 (Jacobson, 1998). Soon after the first World War, however, South Africa's borders were effectively closed to these immigrants. This restricted to those who were already in the country and their descendants the innovative contributions this group could make to mining.

Though it was of short duration, the Chinese labour system enabled the mining industry to overcome its major problem and by 1907 South Africa was producing a third of world gold output. However, the restrictions placed on the Chinese keeping them out of skilled jobs on the mines was extended in 1911 to Africans and so the system had the effect of entrenching the general subjugation of non-white mine labour. Also, Afrikaner opposition to the importation of Chinese labourers was a major factor in cementing their political strength, so that the Het Volk movement achieved a majority in the 1907 elections to the Transvaal Legislature. This strength then succeeded in persuading the British colonies to agree to preserve the whites-only franchise for the Union Parliament other than (in restricted form) in the Cape Province.

Mozambique became a major source of supply of mining labour on the Witwatersrand, with capitation fees and delayed payments providing much of the

source country's income. This entrenched the migrant labour system, which was later further strengthened by workers within South Africa, especially the Transkei.

By 1911 the Union government under Louis Botha had passed the Natives Labour Regulation Act, which made it an offence for Africans to break a labour contract, and the Mines and Works Act, which precluded Africans from skilled work. The Native Lands Act in 1913, which limited Africans' land ownership and agricultural activities, hastened their movement to wage labour, especially on the mines. In reaction to the deteriorating position of Africans, the South African Native National Congress, later renamed the African National Congress, was formed in 1912. Afrikaner whites were also being forced off their farms by the war and drought, causing a poor white problem that had a major effect on subsequent political developments.

The colour bar as an obstacle to mining

The first World War boosted agricultural production, exports and local manufacturing, and increased prices. However, the boom lasted only a couple of years after the war and gold mining suffered a setback soon afterwards. Pressure on mining costs continued while the gold price was fixed. This moved the Transvaal Chamber of Mines, as well as a 1920 government commission, to espouse modification or even abolishment of the colour bar on the mines, in order to minimize costs by using black mineworkers in more skilled positions at lower wages than they were paying to whites. Opposition by whites to advancement of black mineworkers and decreasing living standards resulted in a number of mine strikes, culminating in the 1922 confrontation. This escalated from a strike to a movement to overthrow the state (using the slogan "White workers of the world unite!") but martial law was declared and the government sent in 20 000 troops to defeat the revolt.

In the meantime African mineworkers were also suffering from increasing inflation and continued low wages, poor housing, poverty and restrictions. In

1917 they boycotted mine stores, in 1918 participated in a campaign to resist carrying passes and in 1920 more than 70 000 African mineworkers went out on strike for higher pay.

In 1932 South Africa abandoned the gold standard, causing the gold price to double within three years and resulting in a major expansion of the mining industry. The price increases as well as German action against shipping in the Atlantic resulted in a boom in secondary industry, including the commissioning of Iscor's first steel plant. More Africans were employed on the mines but their wages hardly improved. In 1941 the African Mineworkers Union was formed and it helped to persuade the government to appoint the Landsdowne Commission in 1943. The task of this commission was to investigate the wages and working conditions of African mineworkers but it decided not to call for the abolishment of the migrant labour system and other restrictive measures, recommending only modest wage increases.

Police sent in by the Union government crushed a strike by African miners in 1946 for higher wages. The strike action was seen by whites as a continued threat to their position and was one of the factors leading to the victory of Malan's Herenigte Nasionale Party in the 1948 election. Though the United Party and its predecessors had not usually been reticent in enforcing severe restrictions on Africans, their situation deteriorated abruptly under the Nationalists. The new government enforced a string of harsh measures such as the Prohibition of Mixed Marriages Act, the Bantu Education Act, the job reservation legislation, Black Urban Areas Act and the pass laws.

Sterling was devalued in 1949 and the price of commodities such as copper therefore increased. In 1952 the Northern Rhodesia government introduced a liberal tax code that allowed new mines to amortize their capital. This led to a surge in copper production in that country and in 1960 it was second or third among "free world" producers (Watts).

The 1960s were boom years in South Africa, with the economic growth rate averaging 6% per annum. Mining maintained its position, contributing 12% to the country's GDP during 1960-1975 (Van Rensburg and Pretorius). Southern Africa contributed 3.8% of the value of world mineral production in 1973, with South Africa producing two-thirds of the region's total, Zambia 12%, Angola 10%, South-West Africa 6%, Rhodesia 3% and the other countries 1% between them. Countries of the region were among the top five world producers of gold, diamonds, platinum, copper, manganese, vanadium, uranium, asbestos and other minerals. The region's mineral resources were regarded as of major strategic and political importance, especially by the USA and USSR.

The political oppression in South Africa, Rhodesia and the Portuguese colonies strengthened until the collapse of the Portuguese regimes in Mozambique and Angola in 1975. The Soweto uprising of 1976, the increasing burden of maintaining white domination and foreign opposition combined to force the government to see the writing on the wall. South African business interests launched the Urban Foundation in 1976, with Harry Oppenheimer as one of the prime movers. The aim of the Foundation was mainly to help improve Africans' housing and education but the Africans viewed the initiative as a cover up for support of the government. A wave of strikes against low wages in several industries from 1972 included one at Western Deep Levels mine in which 12 strikers were killed by police fire (Saunders).

When such union actions continued, business and government realized that reform of industrial labour relations was needed and the Wiehahn Commission in 1977 recommended the extension of labour rights to Africans. The labour movement built on this success and in 1982 the National Union of Mineworkers was formed. The NUM shortly became one of the most powerful of South African trade unions, if not the most powerful, and was a prime mover in the formation of the trade union federation Cosatu in 1985.

In 1990 Nelson Mandela was released unconditionally and the ANC, PAC and SACP were unbanned. Negotiations started soon afterwards at Codesa between the government, the ANC and 17 other parties, followed by the approval of an interim democratic constitution by Parliament and in 1994 the first democratic elections.

The demise of the gold mining industry in South Africa was repeatedly predicted whenever the industry suffered steep increases in costs. Price increases or improvements in technology, however, deferred the decline and in 1970 the country was producing two-thirds of the world's gold. That year was, however, the peak. Costs increased further because of the need to mine at increasing depths, while the monetary role of gold declined. The result was a slowing of expansion and eventually large-scale mine closures, so that SADC countries now produce less than 20% of the world's gold. The closures caused hundreds of thousands of mineworkers to be laid off, with similar proportional effects in many other industries. Industrial action since 1994, led by the NUM, has concentrated on trying to maintain mining employment and preventing a decline in the real value of wages.

Production of copper in the region has also declined severely in the past decade, mainly as a result of poorer copper prices. Production of some other minerals in SADC has increased, for example chromite from 32 to 51% of world production over 1993-1998, while that of platinum has held steady at two-thirds of the world supply (BGS, 1999). Coal production in South Africa almost doubled from 1980 to 1998 (Segal, 2000). These other minerals have so far not compensated sufficiently for the decline in gold and copper.

Hopes for a major extension of the life of gold mining in South Africa depend to a large extent on the prospects of the Deepmine Programme (Macfarlane, 2001; SA Mining, 2001). This is a collaborative effort by a number of organizations

aimed at finding solutions to the technological problems of mining at 3 to 5-kilometre depths. Copper mining in the DRC and Zambia has the potential for major revival and expansion. Therefore the mining sector, together with processing activities such as the production of ferroalloys, could sustain the importance of the minerals sector in the Southern African region for a considerable time.

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3.3 Interactions and trends between mining, communities, society and the environment

Factors to consider

Social conflicts over minerals must date back to the Bronze Age, over ownership or control of jewellery, tools and weapons and the mineral deposits, mines or smelters from which these articles were sourced. In southern Africa the earliest disputes were over the trade routes that supplied the copper or bronze articles or materials, followed by those over local sources of iron articles and their production. During the Iron Age in this region, slaves were captured and used on mines and quarries among other activities, though probably not on smelters. Charcoal burners caused the deforestation of large areas wherever the primitive iron production occurred, including parts of southern Africa.

The previous section described the conditions of workers, especially African workers, on the Kimberley diamond workings, the continued poor conditions of mine workers on the Witwatersrand and elsewhere through the next century and some of their attempts at resistance. Many of these problems remain despite the achievement of independence by southern African states, the advent of democracy in South Africa and activities by a number of mines and mining companies to improve their social, labour and environmental practices.

Urban and rural communities are affected by mines and mining companies through a large number of factors that may be referred to as the social context of mining. Research Topic 3 (Mining and Society) of the MMSD-SA project investigates this subject in depth. All regions and countries where there is significant mining activity to a greater or lesser extent experience these social factors. Many of these interactions are, however, more marked in poor countries and areas, especially in Africa where mining is more important than in some other regions and which has some of the poorest countries.

One major group of factors is concerned with labour, in terms both of the employment of people from the specific community and the effects on migrant

labour. This includes such factors as job opportunities, job creation, retrenchments, wages and benefits, working conditions, health and safety, HIV/AIDS, training and skills development, housing for mine workers and their families, employment of women and child labour, effects on migrant labour, and so on.

Economic factors include mining contributions to GDP, exports and taxes - these affect the communities indirectly, depending on the way that governments allocate the proceeds, that is, whether a suitable amount is allocated to the specific community affected by the mining. The tax regime, for example, often centralizes the allocation of tax revenue, in which case insufficient benefit would accrue to the local areas where the main impacts are felt.

A number of mines or mining companies contribute to adjacent communities by providing or subsidizing schools, clinics, hospitals, community centres or activities, self-help schemes, roads, houses or sports facilities. Although these activities contribute to the economic benefit of the area concerned, they are often primarily implemented to ensure production. The economic benefits may accrue to a small part of the population and create "islands of development". In addition, in the past many of these facilities had access based on race. When it comes to closure many of these facilities have collapsed and have not been sustainable (Kapelus, 2001).

Political factors are also important to communities, for example by the way political authorities emphasize specific communities relative to other political constituencies. Some communities are caught up in violent conflicts and in the contest between warring parties over the control of valuable mineral resources such as diamonds, oil and columbite-tantalite. In southern Africa the political systems are characterized by the legacy of colonial authorities, by traditional leadership, new forms of democratic leadership and conflicts between traditional leadership and elected councillors. Access to the resources that minerals have to

offer – mining, labour and supplies - creates political and social conflict. In some countries such as Angola the diamond fields are contested between rebel groups and the government. Conflict can range from high-level strife such as war to lower level disputes such as over resettlement or land ownership.

Communities are also affected by the ways in which mining interacts with their physical environment. These effects cover a large number of aspects, from the disposal of solid wastes to pollution of water sources and air to the need to reclaim mined-out areas. In general terms world wide, the mining industry does not enjoy a good public reputation for sound environmental management (Ashton, 1999). However, the situation is changing as a result of increasing public awareness and consumer pressure. The mining industry has realized the economic benefits of improved environmental management and has increasingly been participating in or even leading this improvement.

According to the view of at least one influential NGO* (Non-Governmental Organization) many of the current problems may be summarized by the concept of "environmental justice". At least in the past, pollution and environmental degradation followed the line of least resistance, with cost considerations rather than the interests of adjacent residents usually determining the methods of waste disposal. Since most mines were established in what were then rural areas, most of the adjacent residents were among the poorest in the country, the least sophisticated in terms of technology and interaction with authorities and therefore the least able to offer resistance.

Poor people are also affected most by environmental degradation because they have less access to alternative sources of water, cannot afford defences such as filters and cannot afford to move elsewhere. Environmental degradation also affects urban areas, usually those that have grown up around mines in previously rural areas, but even there the effect on poor people is the largest. Those who directly benefit least from mining are the poor (even foreign shareholders are

among the major beneficiaries). The poor are among the most severely affected by environmental hazards. That is, according to this view, these hazards are distributed inequitably.

Reclamation of land affected by mining is not always satisfactory, especially for the mines that closed before laws were passed to demand reclamation. Older South African mining operations started at a time when there was little or no explicit concern for the surrounding environment. Disposal of wastes was carried out in a manner designed solely to minimize costs, rather than to prevent pollution or facilitate rehabilitation (Ashton). In many instances, old mines were simply abandoned and no attempt was made to rehabilitate the surface workings when the economic life of the ore body was exhausted.

This situation placed the responsibility for rehabilitation with its accompanying economic burden on the State. Internationally, there is often no apparent source of funding other than government for cleaning-up large-scale abandoned degraded areas of many types (Epps, 1996). In South Africa, underground fires continue to burn at two closed coal mines in Mpumalanga; coal waste dumps are not all completely, effectively and finally prevented from burning; and abandoned open pits are scattered around the subcontinent. Polluted effluent from gold mines in the Grootvlei area is still being discharged into the Blosbokspruit, termed "a disaster which has already happened".

Concern has been expressed by a number of Community-Based Organizations (CBOs) and NGOs about a lack of monitoring and evaluation of mining impacts. They are also concerned about a lack of clear, efficient and effective procedures, or training and awareness campaigns, to enable communities to monitor environmental management. A further concern is what is seen as a passive role of government on these issues (Mthetwa, 2000). These CBOs and NGOs would like to see:

- ◇ benchmarking to measure sustainability

- ◇ respect for the "no-go" option
- ◇ use of the best available technology to prevent environmental degradation
- ◇ commitment to environmental research
- ◇ full reclamation of all mined land
- ◇ independent audits
- ◇ full disclosure and consultation
- ◇ citizen review boards
- ◇ public support of environmental reforms and treaties, and
- ◇ establishment of a fund to address reclamation of abandoned mines.

The mining industry is also criticized because of its extraction of non-renewable resources. Its response is that mineral deposits become an asset only after exploration and development. Coal with an ash content of greater than 12%, for example, was considered merely as "carbon-contaminated rock" until pulverized-fuel boilers were developed that could use this coal and a demand was started for that grade of material.

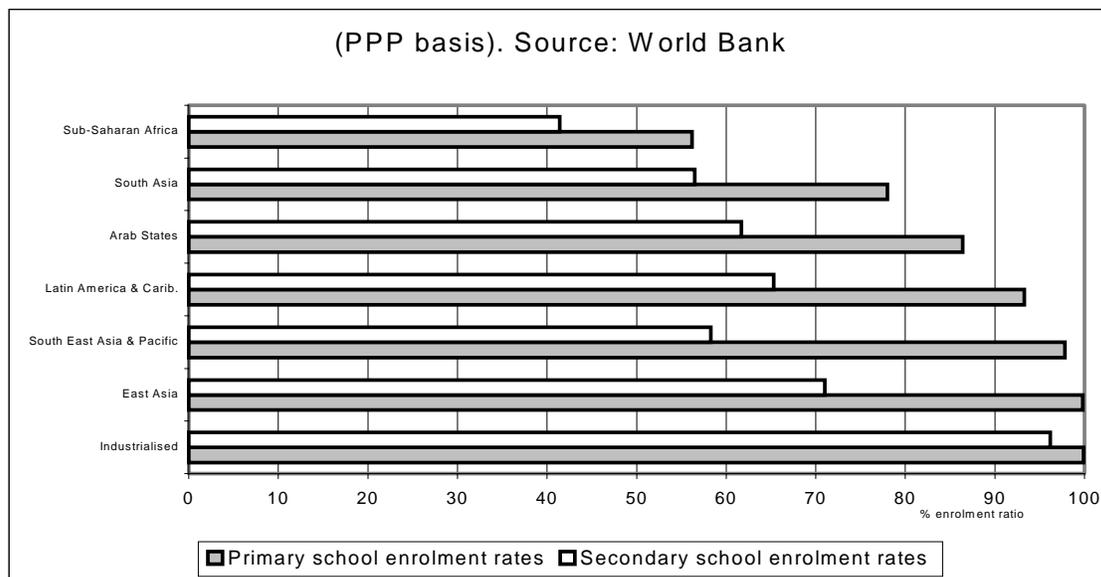
Rights to occupation of land are also affected by mine development, and the industry has been accused of inequity in compensation. Mines offer landowners compensation for the land taken over but non-owning occupants and their families are usually left with no compensation. One exception was the Aquarius platinum development near Marikana in the North-West Province of South Africa, where a needs analysis was performed and the 500 occupants did receive compensation. The way in which the compensation was worked out in such cases and issues of resettlement are dealt with in Research Topic 3 (Mining and Society). The Bafokeng community, in the same platinum area, is the community that has achieved the most benefit from mining, having a seat on the Board of a major platinum company and receiving dividends from its operations in return for granting the company rights to the deposit.

Hostels or other accommodation established by mines or plants in the midst of more established communities often causes conflict, as the miners are likely to have different interests, cultural backgrounds and political affiliations to the established residents. This could have been one of the causes of the attacks at Boipathong in the Vereeniging area. The mining companies are moving away from hostel accommodation to family-type units but in many cases migrant workers do not want to invest in urban accommodation.

The agenda

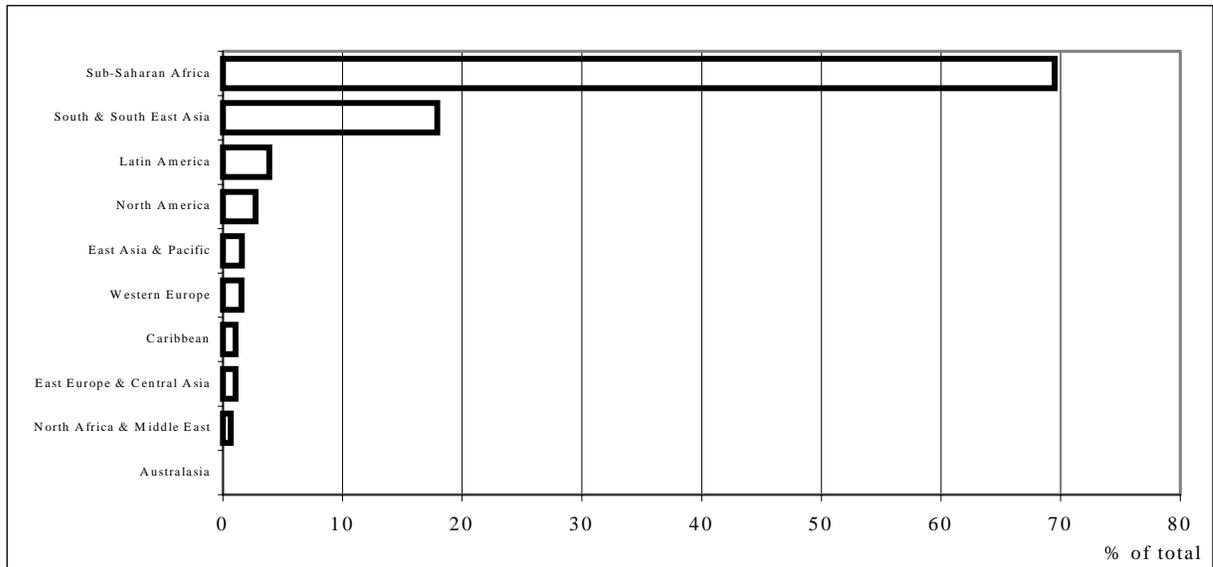
The development agenda for southern Africa is large. Figure 2, Figure 3 and Figure 4 show details of the gaps between this and other regions in a number of fields. Figure 2 shows that sub-Saharan Africa has a per-capita GNP one-fifteenth of that of the industrialized countries and a quarter of that of Latin America.

Figure 2. Gross National Product per capita for 1998



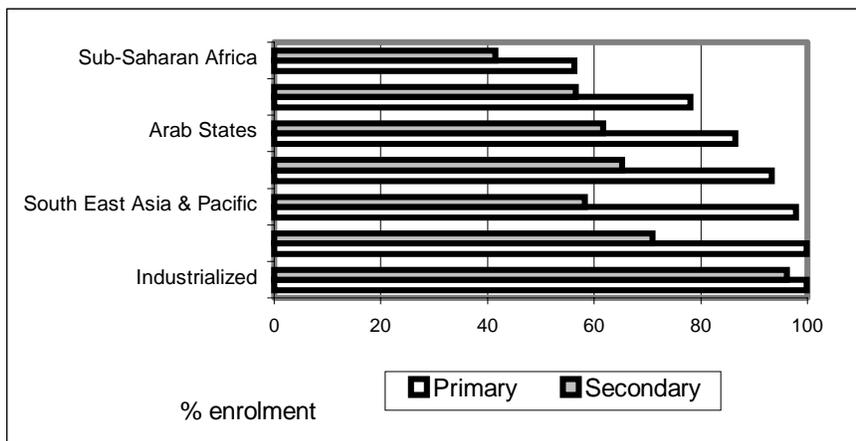
The health situation in sub-Saharan Africa is almost desperate. It has 70% of the world's AIDS cases (Figure 3), the lowest life expectancy of all the regions and seventeen times the infant mortality rate compared to the industrialized countries.

Figure 3. People living with HIV/Aids, end 1998



Sub-Saharan Africa has the lowest school enrolment of all the regions (Figure 4): (1997 data. Source: UNDP).

Figure 4. Net enrolment ratios for primary and secondary school



In all the above cases, sub-Saharan Africa has the worst rating of all the regions, with south Asia rating just above sub-Saharan Africa. World Bank data show that sub-Saharan Africa has an adult illiteracy rate ten times that of Europe, with only south Asia having a higher rate. Interestingly, sub-Saharan Africa has received

the highest amount of overseas development assistance per capita (according to UNDP) while having the highest debt ratio.

Examples of effects of mining on the environment

A good example of these effects is that of the mine dumps deposited by gold mines in and around Johannesburg from Ferreirasdorp (now Selby) to Randfontein. Dust is blown off the dumps into the houses of adjacent residents, damaging household equipment, appliances and cars and ceilings. It is reported that the dust also causes a form of silicosis, the most vulnerable people being children, elderly residents and other people remaining continuously in the area. Often dumps are not protected by fences or the fences have disappeared. Water runoff is often acidic, burdening municipal authorities with the need to remove the pollution. Many of the dumps are very large, one having a 28-hectare base.

The Group Areas Act in the 1950s was used to force residents out of Sophiatown from where they were settled to Meadowlands in Soweto. They now live on the edge of the dumps, on the downwind side. This situation started during the colonial era in southern Africa, well before the apartheid regime. A similar situation also occurs in many other regions and countries, even in industrialized countries, where an example was the Aberfan coal dump in south Wales that collapsed and submerged a school in the 1970s.

The situation has also continued in the democratic era in South Africa, with a settlement established under the RDP (Reconstruction and Development Programme) at Braamfischerville where 12 500 people live almost up to the base of the dump. The open areas near dumps also attract informal settlement by people who have no practical alternative living space. The result is that about one and a quarter million people live south or south-west of the dumps within reach of the prevailing wind.

Some of the dumps have been re-vegetated but this process is not always successful. The choice of species, sequencing of planting, maintenance and other factors have to be given careful attention. There should be a clear indication of projected end use of the rehabilitated land, such as whether it is to be used for agricultural purposes, housing, forestry, recreation, etc. Also, rehabilitation is unfortunately frequently seen as being synonymous with re-vegetation (Smithen, 1997), which leads to the rehabilitators ignoring other requirements such as how the land is to be used. However, new dumps can be sited with greater regard for the consequences for residents. This resiting is more likely if residual gold values are present in the dump material. The residual values usually result from the low recoveries of gold in old plants and may make it economically worthwhile to reprocess the dumps. The Ergo plant near Springs, for example, has reprocessed a couple of dozen dumps in the area, re-depositing the tailings further south near Vosloorus.

Many other environmental problems have resulted from mining in Southern Africa. Asbestos mining is an example: the suit in the London High Court by affected people in South Africa against Cape PLC (The Star, 2001a) has given a great deal of publicity to lung cancer and other illnesses resulting from inhalation of asbestos fibres (Thom, 2001).

Mineral processing and use, which are part of the minerals sector, cause their own environmental hazards. Sulphur dioxide emissions in Mpumalanga have limited the establishment of new coal-fired power stations in that area and emissions from platinum smelters in the North-West Province are threatening to cause similar problems. Ferrochrome smelters in the North-West Province, Gauteng and Mpumalanga can produce the highly toxic hexavalent form of chromium if not operated at the correct redox conditions, and seepage has been reported from ferrochrome plants near Rustenburg into groundwater.

Integrated steelworks in South Africa have been major sources of air pollution, especially in Pretoria where the topographical position of the works reduces the dispersion of pollution. Air pollution at integrated steelworks includes sulphur and nitrogen oxides and particulate matter containing leachable metals such as cadmium and lead (Granville et. al., 1993). Oil, suspended matter and organic chemicals contaminate large quantities of water at steelworks, so that the water has to be treated before it can be disposed of. The blast furnaces at Iscor's Pretoria works have been closed, but pollution of groundwater from Iscor's Vanderbijl Park works is believed to be poisoning groundwater at Steel Valley, a collection of smallholdings about 10 kilometres away (Magardie, 2001).

Fluoride emissions from aluminium smelting cells were a cause of great concern but the technology needed to control fluorides is now well established (Granville et. al., 1993). However, waste-water effluent is a problem in aluminium smelters that use wet processes to scrub air emissions from electrolytic cells and from the anode production process. Carbon from spent pot-liners contains cyanide and has been listed by the US Environmental Protection Agency as a hazardous waste. A company spokesman dubbed as "ridiculous" concerns by international financiers considering an expansion of the Mozal aluminium works in Mozambique (Makgale, 2001).

Another of many other examples is the expected dust from stockpiles and loading operations at a planned expansion of the Richards Bay Coal Terminal (Inggs, 2001). Environmentalists are already concerned about coal dust from the existing operations.

Problems similar to those in South Africa have been experienced in other southern African countries, especially since most have an apartheid or colonial past. The Tsumeb copper-lead smelter in Namibia, the Bindura nickel-copper smelter in Zimbabwe and a line of copper smelters across the Zambian/DRC Copperbelt emit sulphur dioxide from their furnaces and converters. Some

produce acid from most of the sulphur dioxide but a number do not control the emissions adequately, and some not at all. The projected Kwale mineral sands project in Kenya has been hampered by environmental and land ownership issues (Healing, 2001).

The cultural issues around mining are in many respects similar to those affecting large dams. For example, the people displaced by these dams may believe that they will suffer more than they gain from a new dam and they may not always be in a position to judge or influence the decision. The Himba, a traditional people living on the northern border of Namibia, may not get much benefit from the generation of electricity from a proposed new dam on the Kunene River, while the dam will flood their ancestors' graves (Ezzell, 2001).

Another concern is the *costs* of environmental degradation, which are believed to be rarely, if ever, calculated and used in decisions on mine or plant planning, at least in southern Africa. That is, these external costs are not internalized and are (Mthetwa, 2000) usually considered as the responsibility of government. The industry's view is that if individual companies internalize costs they would be placed at a disadvantage with respect to other companies, industries or countries that do not do so. Industry also points out that some externalities, such as development of skills or infrastructure by mining companies, are positive (Wilson, 2001). To the extent that legislation or policy demands environmental compliance, the costs of the specific steps required do constitute a partial internalization.

A similar cultural issue, this time in mining is the opposition to a projected beach sands development at Wavecrest on the Transkei Wild Coast. The opposition to this development is described (Hamann, 2001) as coming mainly from the elders of the Xhosa tribe concerned. The elders are worried about losing their power to younger members of the tribe, while the latter favour the development in the hope of getting jobs.

Among all these environmental and social problems, however, and many more, one has been identified as the priority in southern Africa, and that is the need to alleviate poverty (Nolte, 2001; MMSD, 2001). The question to ask here is to what extent do mining companies contribute towards this end.

Industry activities in favour of the environment and society

Industry has indeed undertaken a number of programmes, such as the National Business Initiative (NBI), supported by a number of mining companies. The NBI, for example, makes considerable (Robbins) contributions to the field of local economic development. The private sector has committed R1 billion into the Business Trust, launched in 1998, with programmes including tourism, education and crime prevention. This overall effort is not directed specifically to communities affected by mining, though some of the projects may well do so.

During 2000, Anglo American (2000) made community social investments of \$31.4 million, including its share in investments by joint ventures and associates. This included work in the Zambian Copperbelt towards the establishment of Zambian-owned small and medium enterprises to supply equipment and services to the mines. Anglo Platinum is seeking to mobilize small business opportunities generated by its new Maandagshoek mine in South Africa, and Anglo American has a programme of over \$140 million to promote black empowerment, for example transferring assets to the empowerment company Eyesizwe Coal.

The focus of the Gold Fields Foundation (undated) is on education, health, community development and environmental conservation. The areas of the Foundation's activities are in communities around the company's mining operations and rural areas from which the company's workforce comes as well as areas considered by government to be priorities. The Foundation receives one Rand per ounce of gold produced as well as a percentage of pre-tax operating profits. The Gold Fields Foundation contributed R10 million in partnership with

the National Union of Mineworkers to the Mineworkers' Development Agency to stimulate economic development in communities most affected by rationalization of the gold mining industry.

Billiton PLC (2000) spent \$10.6 million on community initiatives in 2000, including small business development, health, education and training, community infrastructure and the environment. One example was the Mozal Community Development Foundation in Mozambique, including compensation of local people relocated to make room for the smelter. This compensation was a combination of land, housing, seed and money. Another Billiton example was post-closure rehabilitation of land affected by opencast mining at the Chemfos phosphate mine at Langebaanweg.

These companies and other mining companies engaged in several other projects of this type, but their overall contribution in relation to their profits and the effectiveness of the projects has been the subject of discussion. It is important not to confuse the mitigation of direct social impacts such as resettlement with charity and other socially responsible initiatives. Social responsibility programmes often are directed more at the interests of the companies than at serving the community and it has been questioned whether this type of activity can be viewed as a contribution to society over and above company profits.

The issue with many of these initiatives is whether they are sustainable, especially when the mine is closed. It is not clear where the funds to manage social costs will be found. This is clearer for physical environmental effects, where government is seriously considering environmental funds for managing environmental impacts. A social fund, which would be similar to these environmental funds, has been suggested but is in dispute between labour and industry.

Company activities in favour of the environment and society started about three decades ago. Pressures by environmental groups in the United States in the 1960s led to the passage of the National Environmental Policy Act in 1969. Other countries followed, including South Africa. The Minerals Act No. 50 of 1991 requires an approved Environmental Management Programme Report (EMPR) having the support of Interested and Affected Parties (I&APs) (Freer, 1993). Section 24 of the South African Constitution specifies that everyone has the right to an environment that is not harmful to their health or well-being and for legislation to ensure that environment.

The Environmental Impact Assessment (EIA) required by the 1969 US law often led to confrontation, litigation, delays and unwarranted costs (Freer). If accepted by the authorities, it would have served the developer's purpose without satisfying other affected parties or ensuring that the developer would either respect it or update its contents. South Africa has benefited from this experience and has evolved the process of Environmental Impact Management (EIM), which seeks solutions by anticipating environmental impacts of development at an early stage. The purpose of EIA has moved from *whether* a project should be allowed to go ahead to *how* it can proceed with minimum distress to the environment. The EIM process is intended to scrutinize continuously and systematically all proposed actions that impact on the environment throughout the project's life. EIM is designed to avoid confrontation by involving the proponent, the authorities and the I&APs co-operatively.

Ashton (1999) has examined the costs of EIAs. He notes that the rule of thumb costs accepted by the World Bank is 1% or less of the total project costs. However, he adds that this estimate may be somewhat unrealistically low since the Australian mining industry has estimated that the financial outlays are up to 5% of both the capital and operating costs for new mining projects. This 5% includes the outlays that are directly associated with the integration of

environmental management into all aspects of mining operations, from scoping and assessment through to implementation, monitoring and auditing.

Legislation does exist to protect occupants of land displaced by mining. South African laws include the Extension of Security of Tenure Act, the Land Reform Labour Tenants Act; and the Interim Protection of Informal Land Rights Act, which apply in rural areas, and the Prevention of Illegal Eviction and Unlawful Occupation of Land Act, which applies in urban areas. Other southern African countries have similar laws, such as Malawi's National Environmental Management Act, Tanzania's Mining Act, Zambia's National Environmental Action Plan, its Environmental Protection and Pollution Control Act, and legislation in progress in other countries of the region (SADC, 2001). The concept of a Social Impact Assessment has been discussed but is not yet approaching acceptance at government level, though the Mineral Development Draft Bill, published on 18 December 2000, requires each mine to have a social plan which provides for the remediation of negative socio-economic impact of mines.

National environmental legislation provides for communities to participate in environmental management, but this can be tokenism if they are not helped to do so effectively. Local councillors are considered by some people to be ineffective because the councillors are said to place more emphasis on faster and more quantifiable benefits such as the provision of housing than they do on environmental protection, for which they generally lack background and training. Government officials vary in the amount of zeal applied to environmental problems, depending partially on which regional office of the DME (Department of Minerals and Energy) they represent. There is a need for ongoing rehabilitation during the life of the mine, which could be considered as part of the operating costs. This is one reason why the laws or their application are believed to need strengthening. Even without this strengthening some companies have a positive attitude to social and environmental protection, but others see it as a

burden and merely go through the motions. Mines do pay into a trust fund for rehabilitation on closure, but this could be expanded to provide for community workers.

In general, companies are now more conscious of the environment and the amount of monitoring has increased, but the approach still can not be called systematic. The NBI is supported by a number of mining companies in contributing to local economic development and industrial companies participate in an environmental forum to discuss their approaches to general environmental issues. However, there appears to be no organization specific to mining companies to co-ordinate their activities in these areas. Chambers of Mines may have committees for this purpose, but these organizations represent mainly major companies, and not all of them, and are closed to public participation.

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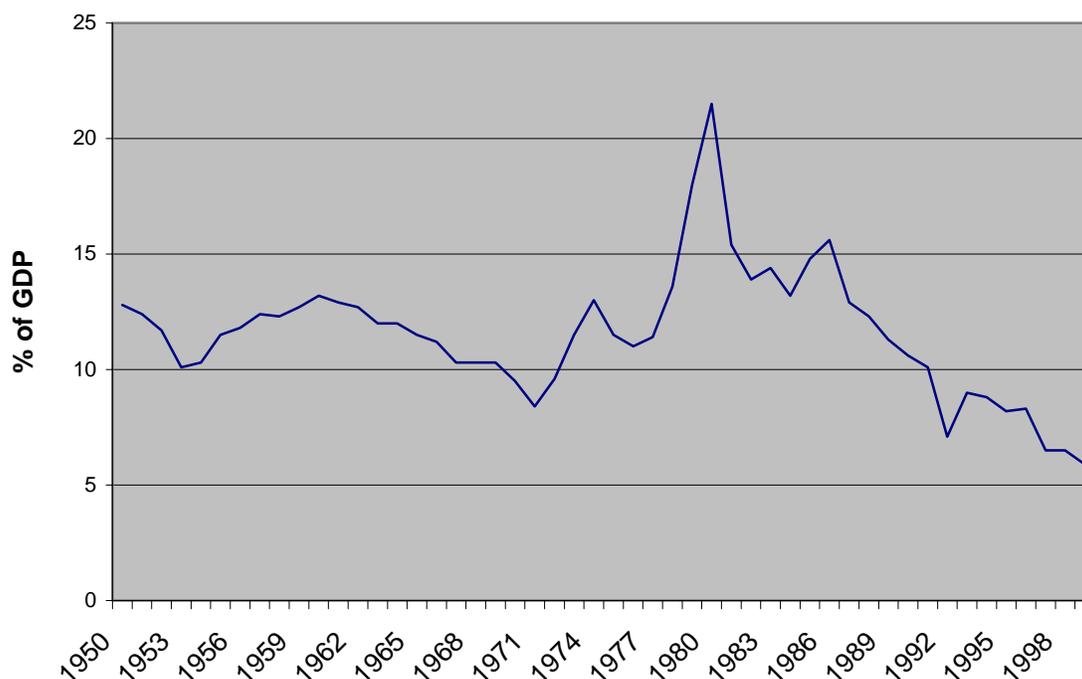
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* Much of the information quoted and views expressed in this section but not specifically referenced were obtained from this NGO and from the Chamber of Mines of South Africa.

3.4 Trends in the impact of mining on the economy

The previous section (no. 3, Industry Description) listed the contribution of mining as a proportion of GDP in southern African countries and showed that the contribution for the region as a whole was lower in 1997 than in 1973. A fairly continuous series for South Africa (Figure 5) shows that the proportion was approximately constant at around 12% until the early 1970s and then increased to a peak in 1980. This increase resulted mainly from high commodity prices, especially for gold: the price of gold increased at an average annual rate of 37% in both US dollars and Rands over the decade from 1970 to 1980 (Segal, 2000). Since then the proportional contribution of mining in South Africa has been in almost continuous steep decline.

Figure 5. Contribution of mining to South African economy, 1950-1999

Sources:

1950-1978: Lombard, 1980
 1980-1991: Jourdan, 1993
 1992, 1999: Loxton, 2001
 1979, 1993-98: COM, 2001.

The absolute value of mining 's output increased, at current prices, in South Africa from 1992 to 1999 from R26.6 billion to R44.2 billion (Loxton) but inflation was a major constituent of this increase. The relative slowdown in mining has continued, with growth in this sector in South Africa being only 0.1% in the first quarter of 2001 (Ebersohn, 2001). Economic growth in the whole of the continent in 2000 was just enough to keep pace with population (Bus. Rept, 2001). High oil prices played a big part in the growth, which implies that mining other than oil did not make a major contribution during those three months.

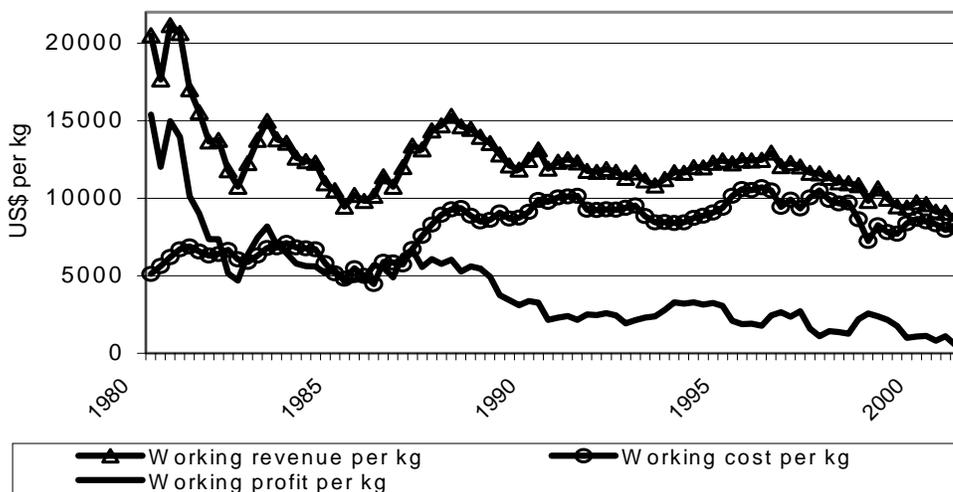
Mining supplies inputs into other industries in the region, thus contributing indirectly to GDP, a contribution that is not included in the above data. For example, coal is used to produce electricity, which in turn is an input into the

smelting of aluminium. The mining industry contributes to southern African economies in a number of further important respects (Segal). It plays a critical role as a foundation for economic growth and development. It is one of the few industries that can provide the critical mass for the development of infrastructure, financial systems, capital markets and education systems. The multiplier effects of the industry are very significant, in terms of GDP, employment, social, income terms of trade and investment. Nevertheless it can lead to the classic Dutch disease syndrome, of over-dependence on one particular commodity.

Mining contributed 43% to the region’s exports in 1997 (see section 3, Industry Description). For South Africa there was a persistent, almost continuous, decrease in the proportion from 62% in 1980 to 35% in 2000 (Jourdan, COM).

Figure 6 shows the main reasons for the deterioration of mining in the region since 1980. The increasing working costs (together with the static or decreasing gold price) led to decreasing working revenue and profits. This, together with increasing capital costs, meant that there was less motivation for establishing new gold mines or replacing worked-out sections.

Figure 6. Working revenue, costs and profit (excluding capex) for South African gold mines. (Source: Chamber of Mines of South Africa)

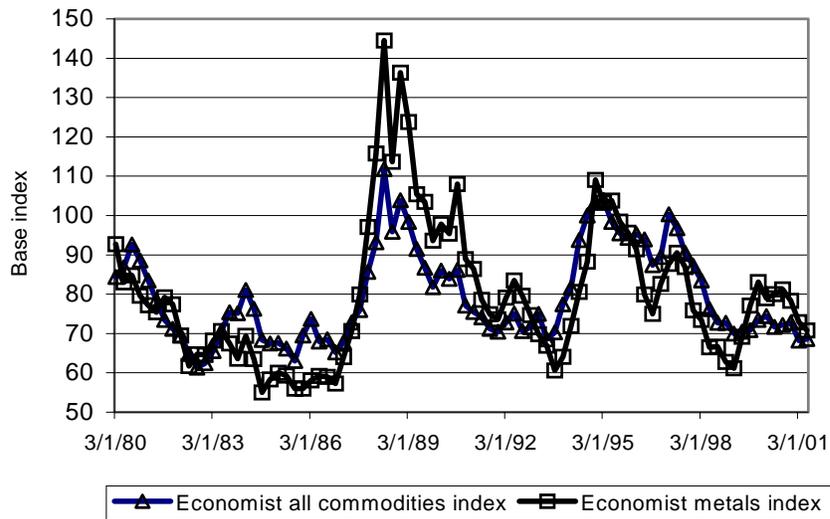


A further aspect of the relative decline of mining was government revenue. Mining companies contributed only 1% to South African government revenue during the 1990s compared to 12% in the 1970s and 1980s (Segal). The reason for the decrease was the sliding scale of gold mining taxation, which linked taxation to profits. Revenues from diamond mining also decreased, principally as a result of declining prices.

However, this picture of the mining industry in decline could be changing and the reason is, paradoxically, that decline itself. Gold, which accounted for over 60% of South Africa's mineral sales in 1983 (Minerals Bureau, 1985) now accounts for less than a third (Minerals Bureau, 2000), so that the other minerals have become the dominant factor. With the exception of gold and manganese, all of South Africa's major minerals have experienced long-term growth (Segal). Three sectors (coal, PGMs and chrome) have doubled since 1980 and non-gold mining grew faster than the economy from 1980 to 1998. Although the non-gold minerals have not yet compensated for the decline of gold (in terms of mining's share of GDP), there are good prospects for further growth of these minerals. There are also good prospects for the revival of mining in other SADC countries, for example of copper in Zambia. The prices of most minerals, however, have been declining on a long-term basis and mineral economists believe that they will continue to decline.

Figure 7 shows the cyclical nature of commodity prices. Further information from the same source shows that these prices follow industrial production and that the period of the cycles is decreasing.

Figure 7. Cyclical volatility, illustration of commodity cycles



Source: Chamber of Mines

The potential improvement in mining’s impact on the economy is shown by the increase in exploration activity in Africa. An estimate gives the continent’s share of world exploration spending in 1998 as 17.5%, up from seven percent in 1993 (Segal), Table 8 lists mining exploration expenditures and mining fixed domestic investments (FDI) in southern African countries other than South Africa. In that country the contribution of mining and quarrying to gross domestic fixed investment declined from 13.3% in 1990 to 8.9% in 1999 (Minerals Bureau, 2000).

Table 8. Mining exploration expenditure 1997 and Mining FDI 1998

Country	Mining exploration expenditure 1997	Mining FDI 1998
Angola	2.3	
Botswana	10.8	250
Lesotho	6.6	
Mozambique	13.2	8
Namibia	9.3	10
Tanzania		48
Zambia	45.0	162
Zimbabwe	1.7	544
Total	86.6	1022

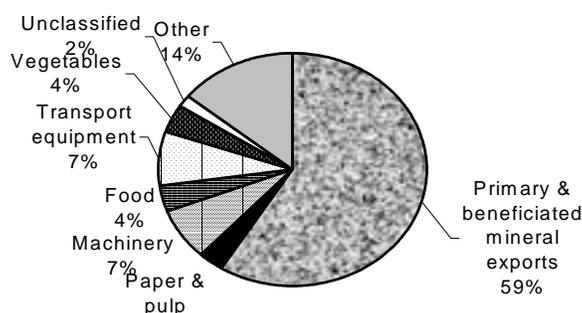
Data are in US\$ millions. Source: Segal (2000)

A SADC report (2001) lists recent individual exploration activities and expenditures in SADC countries.

When beneficiated mineral are included with primary minerals in South Africa's exports for 2000, the total contribution increases to 59% (Figure 8).

Figure 8. Breakdown of merchandise exports for 2000.

Source: Chamber of Mines



The largest share of gold mining value generated in South Africa was the amount earned by labour (62% in 1990-98 compared to 42% in 1970), followed by capital

expenditure (14% in 1990-98), attributable profit (14%) and mining tax (7%) (Segal).

Mining companies make their investment decisions after consideration of many of the factors that have been discussed. These decisions are driven by the relationship between expected returns (after taking into account the costs of the operation) and risk. That is, foreign and domestic investors will only invest in projects where the rate of return covers the risks and the costs of the project. The main costs include those of capital, labour, technology, intermediate products and logistics. The risks include those related to property rights, legislation, political factors, security, the labour market, and marketing. The investment being considered is measured against the investment hurdle rate, which is the rate of return required by an investor to cover the risks and costs of a project over the long-term (Source: Chamber of Mines).

Total returns to shareholders in southern Africa in 1995-1999 were low. The value of all stocks on the Johannesburg Stock Exchange increased by only 8.6% over 1995-1999 compared to the increase of 17.5 % in the total world market index and 25.9% in the Dow Jones industrial average (all in local currencies). Some examples of the reasons for this performance are the high costs in a number of areas. The cost of capital is too high, because of high interest rates, tax rates and currency volatility. The cost of labour per unit of output is very high as a result of apartheid education and poor management practices. Industry believes that rigid labour laws also increase the costs of labour. The costs of logistics are also high, as the lack of competition in service provision results in high prices, which disadvantage exporters. Efficiency in the use of cheap electricity is poor, resulting in weak competitiveness.

The above data refer to the direct contribution of mining to the GDP. Indirect contributions to the economy include aspects (COM, 2001) such as:

- Capital formation: gross domestic fixed investment, attraction of foreign and domestic capital
- Forward linkages: material inputs into other industries (e.g. energy generation)
- Backward linkages: purchase of goods and services from domestic industry
- “Income Terms of Trade Multiplier”, i.e. the impact on forex earnings and the balance of payments
- Consumption expenditure by mine employees, and
- Social multipliers - employment, health care, education, physical infrastructure.

Data on most of these aspects have been extracted and analysed and some of them are examined in this report.

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3.5 Role of small-scale and artisanal mining in the region

Small-scale mining activities in southern Africa

Main source: SADC, 2001

Nearly all countries in the region have recognized small-scale mining (SSM) as a means of alleviating poverty and empowering the local community. A number of support programmes have been established member States. The programmes range from provision of loans and grants, equipment and plant hire schemes to making policy provisions that will enhance and support small-scale activities.

In some countries of the region such as *Angola* there is a long tradition of SSM that is not captured by official statistics. There is no specific legal provision for SSM in Angola but licensing procedures have been considerably simplified to encourage these activities and SSM projects are not required to submit detailed and rigorous reports on the operations carried out. The National Directorate of Mines and the Angola Geological Institute are available to attend the needs of small-scale miners.

In *Mozambique*, small-scale gold and gemstone mines are numerous throughout the country, in particular in the Alto Ligonha pegmatite field in the Northern Zambezia and the Southern Nampula Province. Alluvial gold panning and mining is carried out in Manica, Tete, Niassa, Zambezia, Nampula and Cabo Delgado Provinces and there is a small but successful lapidary industry. Small-scale miners get their loans, technical and financial support from a Mining Fund.

In *Namibia*, the number of SSM miners is estimated at between 500 and 1000 people, mostly one-man operations digging for semi-precious stones and industrial minerals. Two organisations have previously represented SSM: the Association of Prospectors and Miners of Namibia and the Namibia National Small Miners Association. A Small Miners' Assistance Centre was set up in January 1997 and the Minerals (Prospecting and Mining) Act of 1992 makes provision for small-scale miners.

South Africa has an inhibited SSM sector due principally to problems of access to mineral rights, previous lack of a comprehensive support system and lack of an

appropriate institutional and legislative framework. Among the constraints facing new entrants into the mineral industry is the inability to obtain adequate development capital due to the lack of knowledge about project evaluation and planning. Unlike normal commercial enterprises, mining project evaluation and planning also entail expensive up-front costs in terms of exploration and environmental impact assessments before an acceptable business plan can be developed for financing purposes.

The White Paper on a Minerals and Mining Policy for South Africa requires that environmental, health and safety standards be maintained and that small mineral deposits be exploited optimally in order to make a positive contribution to the economy. Artisanal mining is discouraged because it usually does not maintain health, safety and environmental standards but support is directed towards the development of a sustainable small-scale mining sector. The DME supports and assists SSM through the National Small Scale Mining Development Framework. This is a comprehensive support system comprising of technical support, support on environmental management issues, facilitating the establishment of training facilities, establishment of a self-sustaining institutional and financial support system and introduction of appropriate regulatory and administrative procedures.

Mintek, the South African metallurgical research and development institution, assists small-scale miners to develop beneficiation processes. It does this both directly and through the National Steering Committee for Small Scale Miners (NSC) and the Rural Development Council. Both of the latter were formed by the State and the Science Councils to help small-scale miners to start up their mining and beneficiation ventures in compliance with health, environmental and safety regulations. Mintek has developed for small-scale use an environmentally friendly process to replace the use of mercury to extract gold. With state support, Mintek is establishing a demonstration plant to train and assist small-scale miners. The Council for Geoscience has made field visits to a number of SSM projects as part of its co-operation with the NSC. The geological input into these projects entailed

compilation of existing data and geological mapping to establish ore reserves. Small operators need this information to produce their business plans, without which the Department for Mineral and Energy Affairs cannot issue a mining permit.

Twenty Mines Offices in *Tanzania* offer extension services to SSM. A demonstration plant for gold processing is being installed in Matundas, Chunya district as a training and technology transfer centre. Three similar plants will be installed in Mpanda, Igunga and Tarime Mining Centres. A government agency company is offering loans for SSM equipment and tools and technical management services to small-scale miners in the Lake Victoria gold fields. In addition, training manuals (Mining Equipment Supplies Guides and a Small Scale Miners' Handbook) have been prepared in Swahili and are sold at cheaper prices to small-scale miners.

Mines bureaux of the *Zambian* Ministry of Mines are to be established in Chipata, Kkushi, Livingstone and Kitwe, manned by qualified professionals and technical personnel. The purpose of these establishments is to make available technical and logistical assistance to small-scale mines. The European Union has granted Zambia a 30 million ECU loan facility under the SYSMIN project to fund and encourage SSM development in the country.

In *Zimbabwe*, mine geologists are available in the three regional offices of Harare, Bulawayo and Gweru to attend to the needs of small-scale miners. Routine visits to mine sites are made to assist miners with geological issues. Geological reports are prepared for these miners, as well as recommendations on exploration work, sampling and ore resource estimation. These services are offered free of charge. Mining engineers in the regional offices in Harare, Bulawayo, Gweru and Masvingo offer free assistance in optimal mining methods, installation of equipment, diamond drilling, processing of plant hire applications and issues related to mine safety. A metallurgist provides services such as

chemical analyses and assays and provides appropriate processing routes for samples submitted by small-scale miners. In addition advice is rendered in the field on ways to improve plant recoveries. The information is given free of charge.

A Mining Industry Loan Fund is available in Zimbabwe for small-scale operators for capital development, electricity installation, bridging finance, etc. at an interest rate of 12%. Repayments are made on the successful completion of the development phase of the project. There is a Plant Hire Scheme that procures common used mining equipment such as compressors, hoists, generators, concentrator bowls, James tables, crushers, diesel engines, pumps, ball mills etc. The scheme also fabricates equipment such as portable magazines, windlasses and extractor boxes, at workshops located in Harare, Bulawayo and Gweru.

Minerals mined

Artisanal miners concentrate on alluvial minerals, outcrops or shallow deposits, where mining technology and safety issues are less sophisticated. This also applies to many, if not most, SSM activities. The minerals recovered are therefore those that occur in such deposits. The deposits can be small since they do not need to support massive capital expenditures, though small-scale miners also work sections of large deposits. SSM activities also include recovery from dumps or pegmatites. Small-scale miners work those minerals where they can use relatively simple extraction methods or sell raw minerals or concentrates to larger operations. Examples of these minerals are gold, copper, chromite, diamonds, semi-precious stones, beach sands (for zircon and ilmenite), mica, beryl, talc, lithium, tantalite, scheelite, clays (mainly for bricks) and other industrial minerals.

Beneficiation methods

Small-scale miners producing gold most commonly extract the metal by mercury amalgamation, often vaporizing the mercury into the atmosphere (and sometimes

poisoning themselves) and discharging heavy-metal pollutants into adjacent watercourses. The environmentally friendly process being developed by Mintek to replace the use of mercury, as mentioned above, is based on the use of chlorine in the form of a readily available solid compound. Heap leaching with cyanide is also used by SSMs, as well as by medium-sized companies for small gold deposits. Heap leaching is also used for oxidized copper, by means of sulphuric acid. For most industrial minerals as well as beach sands, chromite and diamonds, physical concentration by means of gravity methods such as James Tables are the preferred methods, though froth flotation is sometimes employed. Tumbling is used to polish semi-precious stones. Small-scale manufacture of building bricks often goes together with the recovery of the clay or similar minerals.

Interaction with large-scale organizations

In the past, large mining companies were usually opposed to SSM, giving their reasons mainly as threats to the stability of product prices. They also believed that SSM's poor environmental and safety practices reinforced the negative public image of mining. In some cases, particularly in the platinum industry, the large companies held a stranglehold on access to the deposits. In the past few years, however, at least in South Africa, some of the larger companies have bowed to the political encouragement of SSM and the political opposition to long-term freezing of deposits, or they have at least presented the appearance of co-operating. Some such companies have therefore made available to SSMs dumps or sections of deposits, probably those that they are not likely to develop themselves. Some have realized that SSM may not after all threaten the prices of their products to a major degree and have co-operated in improving SSM's environmental and safety methods. In some cases the larger companies have reached agreements to purchase concentrates from small-scale miners, though this has often required more careful assay and control of the quality of the concentrates used.

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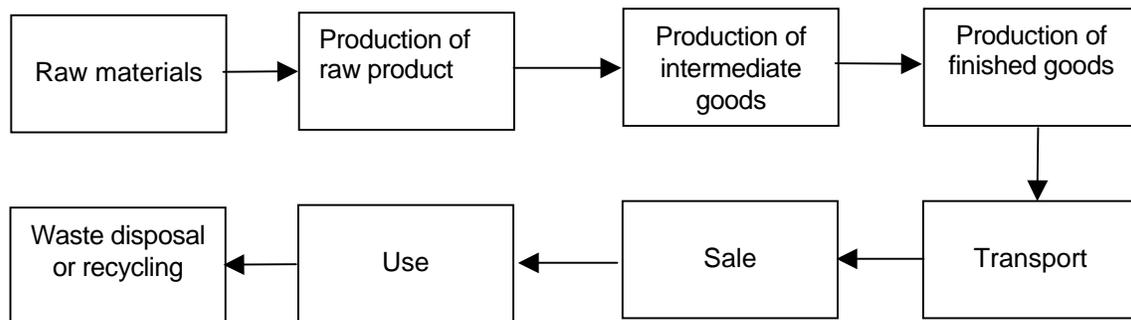
3.6 Supply chain issues

What do we mean by the supply chain?

The mineral chain can be looked at in a number of ways, for example as a broad supply chain or a processing or product chain.

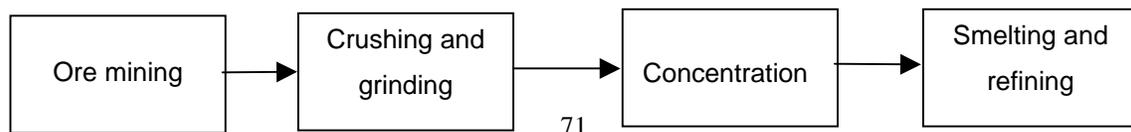
The broad supply chain can be considered as in Figure 9:

Figure 9. Broad supply chain



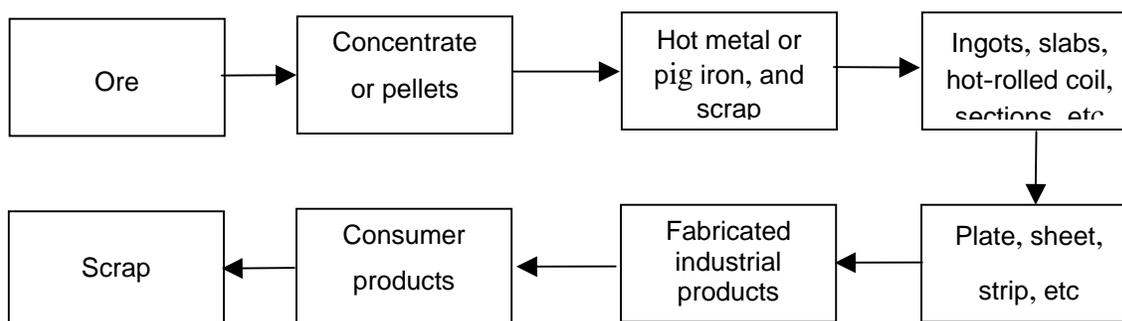
Issues around the supply chain formulated this way can be very broad, including questions such as the economics, politics, sociology and technology of the production and supply of the products of each stage. One specific point is that the development of electronic commerce to speed up transactions is expected to improve the management of the supply chain. For the present study, which concentrates on mining and processing, a product or processing chain is the most relevant way of looking at the supply chain. A typical generalized processing chain of this sort is given in Figure 10, though this version still only applies to metals and even then not to all metals:

Figure 10. Generalized processing chain



However, this kind of chain can only be applied for a specific metal or mineral, as more of the specific steps can be seen. For example the product chain for iron and steel is given in Figure 11

Figure 11. Product chain for iron and steel



One of the main issues raised around such a chain is the progress along the chain (i.e. the degree of processing achieved). Some of the other issues of interest are the values added along the chain, the constraints on this progress, the inputs required for each stage in terms of price and availability and the competitiveness of the saleable products.

Degree of processing achieved in southern Africa

This is often listed in terms of the production beneficiation ratio (PBR) or export beneficiation ratio (EBR) for a particular mineral or element in a specific country or region. The PBR is defined as the content of the element in the beneficiated product produced as a percentage of the content of that element in the amount of the first saleable product produced. The EBR is similar, referring to the contents and amounts of the material exported in each form rather than those of the products produced. The latest available EBRs for South Africa and SADC are in Table 9.

Table 9. Export beneficiation ratios for South Africa and SADC

Ratios (%)	SA 1999 ¹	SADC 1988 ²
Antimony concentrate to antimony trioxide	100	
Chromite to chrome alloys	81	100
Copper concentrate to metal	94	96
Iron ore to iron and steel	16	100
Manganese ore to metal and alloys	46	n.a.
Nickel matte to metal	n.a.	55
Phosphate concentrate to acid and fertilizers	55	100
Tin ore to metal		100
Zinc concentrate to metal	100	100
Lead ore or scrap to metal		100

¹ Excluding SA. Source: Minerals Bureau, 2000

² Granville et. al., 2000

Although South Africa is undeniably the most developed mineral economy in the region, its degree of beneficiation before export was less than that in SADC excluding South Africa. Part of the explanation is the low market for some of the processed materials in SADC outside South Africa. An example is the low value for iron in South Africa, where the processed product (steel) is used to produce fabricated products rather than being totally exported, as shown by a PBR (30%) that is higher than the EBR (16%).

Values added in processing

A detailed investigation on the stages of processing of major minerals was done in 1989 (Granville and Statham). This gave in tabular and graphic forms the amounts produced at each stage of processing both in South Africa and the world, together with the values at each stage of the content of the element concerned. Although the raw data in this report is well out of date, the relative

numbers are likely to be less so. For copper, for example, the relative data are listed in Table 10.

Table 10. Copper products: Amounts produced in South Africa and relative values

Product group and use	Proportional amount (%) ¹	Relative value ²
Industrial machinery, marine, Military, coins, jewellery	5	2.8
Plumbing, industrial machinery	0	2.2
Consumer and general products	5	2.2
Transport	5	2.2
Electrical and electronic parts	13	2.2
Building and construction	5	2.2
Electrical equipment and supplies	0	2.2
Alloys: wrought and cast	1	1.7
Oxygen-free copper	0	1.0
Phosphorus-deoxidized copper	3	1.0
Electrolytic tough-pitch copper	2	1.0
Electrowon primary copper	3	1.0
Electrorefined primary copper	2	1.0
Scrap alloy	1	0.7
Scrap copper	1	0.8
Sulphide ore	1	
Oxide ore	29	

¹ Amount of the specific product produced in South Africa as a percentage of that produced in the world

² Value of the specific product per unit of copper contained compared to that of primary copper.

Table 10 shows that the value added for copper products above the value of the raw refined metal is relatively low, at up to 180%. For a number of other materials the added value is far higher than for copper. A more recent study gives the relative values for chromium (Table 11) and those for other elements (Table 12).

Table 11. Relative values of chromium products

Process	Product	Contents	Relative value ¹
Concentration (South Africa)	Chromite Transvaal	40% Cr ₂ O ₃	1
Concentration (Zimbabwe)	Chromite - Great Dyke	48% Cr ₂ O ₃	1
Submerged arc furnace	High-carbon ferrochrome	52% Cr	4
Perrin process	Low-carbon ferrochrome	68-70% Cr	6
Dissolve HCFC in sulphuric acid and electrowin	Chromium metal	100 % Cr	51
Alumino-thermic	Chromium metal	100 % Cr	21
Cast and roll	Ferritic stainless steel sheet	18% Cr, no Ni	26
Cast and roll	Grade 304 HR sheet	18% Cr, 8% Ni	39
Roll	Grade 304 CR sheet	18% Cr, 8% Ni	43
Construct	Fabricated structure (ferritic)	18% Cr, no Ni	64
Cut and weld	Cone-bottom tank	Grade 316L, 8% Ni	147

¹ Value of one ton of contained chromium in the product relative to that in the chromite ore

Source: Granville et. al., 2000

The values of the contained element in the highest-processed products of eight elements relative to that of the contained element in the first saleable product of each are listed in Table 12.

Table 12. Relative values of high-processed product for eight elements

Element	Product	Relative value
Chromium	Cone-bottom tank	147
Copper	Electric motor	117
Diamonds	Polished	385 ¹
Gemstones	Set in jewellery	173
Gold	Dental filling	2.6
Iron/steel	Tank	68
Phosphorus	Super phosphoric acid	68
Platinum	Auto-catalyst	6

¹ One-carat stone

Source: Granville et. al., 2000

Inputs required for processing

The requirements for processing of eight selected minerals are examined by Granville et. al. (2000). For some of the elements several alternative or complementary processes are considered. The requirements are given in terms of the capital input, operating costs and inputs of the major raw materials, fuels and utilities. For example, a plant producing one million tons per annum of direct-reduced iron (DRI) by the Midrex process is expected to require US\$175 million capital and to cost \$20 million per annum to run. The plant will use annually 1.45 million tons of iron ore, 10 million gigajoules of natural gas, 4000 tons of refractories, 115 gigawatt-hours of electricity and 1.5 million cubic metres of water.

Constraints

Among the constraints on processing that relate to input requirements are the following:

- A deposit of at least 60 million tons of *iron ore* is necessary to sustain a facility to produce annually one million tons of steel coil or billet. In southern Africa only Angola, Mozambique, South Africa, Swaziland, Zambia and Zimbabwe have sufficient resources, though they are not all of suitable grade, characteristics or economically viable.

- *Natural gas* for *DRI* production is available or expected to be so soon, in Mozambique, Namibia and South Africa; so far for inland plants the *coal*-based Corex process is favoured over the gas-based Midrex, though they can operate in tandem.
- For high-carbon *ferrochrome* to be produced and exported economically, *transport* costs should be reasonable.
- The production of *stainless steel* is a very competitive business and input costs, especially of nickel, chrome, scrap, electricity and transport should be low relative to other producers.
- *Technologies* for the refining of *platinum*-group metals are closely guarded and *markets* may be difficult for new producers to penetrate.
- A supply of *ammonia* is necessary for the manufacture of nitrogen-containing *fertilizers*. Plants for the production of fertilizers need to be constructed of *exotic materials* such as stainless steel or rubber/plastic composites. A large phosphoric acid plant produces much *waste* in the form of phospho-gypsum, which has to be disposed of though it is not normally a hazardous waste.
- *Diamonds* are abundant in southern Africa but political uncertainties in the main diamond-producing countries are not conducive to large-scale *investments* for processing plants. A recovery circuit for *ferrosilicon* used for the processing is essential.
- Southern African countries face large deficits of the *skills* required for geological exploration, mining engineering, metallurgy and management.
- The availability of *water* is limited in many areas of the region, including many near to mineral deposits.

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3.7 Land access and use issues

Land reform, property and mineral rights

Under common law, ownership of the land includes ownership of the minerals in the land. However, the law in South Africa developed in such a way that the right to minerals can be separated from the title to the land (DME, 1998). Minerals rights constitute rights in land. They are officially registered by the State and are a form of property protected by the South African Constitution.

Therefore, when considering the effect of mining on land rights and access to land, the main issue is that of mineral rights and access to minerals. This will be taken to apply to the southern African region as a whole, as it is understood that a similar situation applies in most of the countries of the region in regard to the inclusion of minerals in land rights. Other land issues such as dispossession and resettlement are discussed in section 3.3 (social issues).

The Reconstruction and Development Programme (RDP) was published by the African National Congress in 1994 and adopted by the Government of National Unity that followed the elections of that year. It declares that land is the most basic need for rural dwellers. Apartheid policies pushed millions of black South Africans into crowded and impoverished reserves, homelands and townships. Inequities in land distribution remain, as only a small minority of black people can afford land on the free market. The RDP declares that the minerals in the ground belong to all the citizens.

Section 25 of the South African Constitution provides that no one may be deprived of property except in terms of law of general application. That section also states the nation's commitment to land reform, and that property is not limited to land. According to section 24 of the Minerals Act (no. 50 of 1991), mineral rights and other rights in land may be expropriated in the public interest against compensation.

The mineral rights ownership system

The present South African system of mineral rights is a dual system in which both the State and some private individuals or groups own mineral rights. A majority of the rights are thought to be held by private interests. The 1998 White Paper (DME) noted that a distinguishing feature of the South African mining industry was that almost all privately owned mineral rights were in white hands. Subsequently some black-controlled companies have gained access to mineral rights in South Africa but these rights are still a small proportion of those held by the major mining companies.

The RDP considers that the current system of mineral rights prevents the optimal development of mining and that we must seek the return of private mineral rights to the democratic government, in line with the rest of the world. In line with this principle, the DME has proposed a change to the minerals rights system. The proposed system is part of a revision of minerals legislation, with the proposal having gone through the consultation process via a draft policy document, a Green Paper, a White Paper, several open consultation stages and a draft Bill.

The White Paper describes the views of proponents of private ownership of mineral rights as maintaining (among other assertions) that:

- a) It has been and remains ideally suited to effective utilization of South Africa's distinctive ore bodies, for example by providing the absolute security of tenure necessary in the development of very deep gold mining along the West Wits line.
- b) Holding of mineral rights is a crucial parameter in the valuation of a mining company by international investors.
- c) Private ownership of mineral rights affords the absolute long-term security of tenure that attracts investment. It is preferable to a pure licensing system involving administrative discretion.
- d) Private ownership encourages trade in and utilization of mineral rights.

The Paper describes the views of opponents of private ownership as:

- a) Minerals are part of the nation's endowment so that the State is the rightful custodian.
- b) South Africa (along with the USA) is out of step with other major mining countries where public ownership of mineral rights has led to successful exploration and mining industries.
- c) Private ownership suppresses exploration activity.
- d) It allows hoarding of mineral rights and constitutes a barrier to entry.
- e) Complex and fragmented mineral rights holdings militate against new investment.
- f) The system is inaccessible to small-scale miners.
- g) It limits equitable access to mineral rights and resources.

The Paper raises the possibility of imposing a tax on privately held mineral rights, which would not be payable by operating mines or where active exploration is taking place. If the owner of the mineral rights is unable or unwilling to pay the mineral rights tax, the rights may be sold to a purchaser or transferred to the State.

Minerals Development Draft Bill

After inviting and receiving comments on the White Paper, the Department published in December 1988 a Minerals Development Draft Bill (Government Gazette, 2000). This Bill delineates its points of departure as:

- a) Mineral resources are the common heritage of all South Africans and belong collectively to all the peoples of South Africa;
- b) A universally recognized right of a State to exercise full and permanent sovereignty over all its natural resources;
- c) Public trusteeship of South Africa's mineral resources to redress the results of past racial discrimination and ensure that historically disadvantaged persons participate in the minerals and mining industry and benefit from the exploitation of the nation's mineral resources;

- d) Ensuring security of tenure for prospecting and mining operations; and
- e) Social upliftment of communities affected by mining.

The draft bill requires prospecting organizations and mines to have approved environmental management programmes. It also requires mines to have social plans containing details of their socio-economic impacts and to specify the measures to be used to remedy the impacts during the life of the mine and after closure.

The South African mining industry, as represented for example by the Chamber of Mines, fought this policy for several years, asserting a number of the opposition views listed above. In a policy document published on its website in June 1995 (COM), the Chamber describes as its fundamental premise on the issue that:

“Metals and minerals in the ground do not constitute wealth. Wealth is created only when the capital invested in the process of converting minerals in the ground into saleable products is returned in real terms with a profit. Production of a product at a loss, or at a profit insufficient to provide a real market-related return on investment, does not add wealth to the country and should not be supported by the state.”

However, the industry and the government eventually reached an agreement, with government modifying some aspects that the industry believed would allow too much room for administrative fiat and would therefore introduce uncertainty. In a joint media statement by the Department and the Chamber on 10 June 2001, agreement was declared on the following key issues:

- Policy principles underlying the draft Bill.
- A need to attract investment in the mining and minerals industry.
- Security of tenure.
- Discretionary powers of the minister and good administrative law.

- That the mineral rights regime should be brought in line with the internationally accepted norms and standards which recognize the state's custodianship of the nation's mineral resources.
- The appeal process to the courts.

Mechanisms were agreed to implement the transitional measures with a view to phasing in the new legislative framework with minimum disruption to the mining industry.

A new draft of the bill was expected to be ready in July 2001. It will stipulate objective criteria the minister will have to follow for allowing or refusing a licence and will make explicit reference to companies' rights of appeal (Innocenti, 2001). The government and the Chamber also agreed to work together to promote black empowerment in the mining industry and a \$100 million fund will be set up to finance small-scale mining companies and to finance acquisitions.

Mining licenses and leases

Table 13 lists the duration and renewal periods applicable in a number of southern African countries. The specifications for the licenses and leases also include the acreage allowed, requirements for relinquishment and the minimum obligations for work and expenditure.

Table 13. Duration of licenses and leases

Country	Type of permit	Max ^m duration	Renewal
Botswana	1. <i>Mining lease</i> 2. <i>Restricted mining lease</i> 3. Industrial Minerals	1. 25 yrs 2. 15 yrs 3. up to 5 yrs	1. up to 25 yrs 2. up to 15 yrs 3. up to 5 yrs
Namibia	1. Mining claim 2. Mining licence	1. 3 yrs 2. 25 yrs or mine life	1. 2 yrs 2. no limit
South Africa	Mining authority	Detd. by RD	Detd. by RD
Tanzania	Mining licence	25 yrs or mine life	15 yrs
Zambia	1. Large scale mining licence 2. Small scale mining licence 3. Gemstone licence 4. Artisanal mining right	1. 25 yrs 2. 10 yrs 3. 10 yrs 4. 2 yrs	1. 25 yrs 2. 10 yrs 3. 10 yrs 4. Non-renewable
Zimbabwe	1. Mining lease 2. Special mining lease	1. Unspecified 2. 25 yrs	1. Compliance 2. 10 yrs

Source: Granville et. al., 2000

Distribution of the benefits

The exploiter of the minerals may compensate the mineral rights owner for the depletion of the non-renewable resource by paying royalties, generally on the basis of production or revenue.

Section 3.4 (Impacts on the economy) gave a description of the distribution of the proceeds of gold mining between in South Africa between labour, capital, profit and tax. Labour is the sector that earns the largest proportion of the added value.

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4. DRIVERS OF CHANGE

Supply/demand considerations

The domestic market for most mineral commodities produced in the region is relatively small. Local sales tonnages other than for industrial minerals exceed exports only for coal and chrome ore (Minerals Bureau, 2000) and the latter is largely converted to ferrochrome, refractories or chemicals for export. Therefore mining in the region is oriented towards the export market and demand for its products depends on world trends.

The supply of minerals from the region depends in turn on these markets as well as on economic and political developments in the countries of the region and on reserve constraints. Sudden increases in demand may put pressure on labour, safety and environmental practices in order to increase production. This effect, however, is likely to be the exception as most facilities producing minerals or metals are limited by capacity considerations and the need to avoid over-rating of expensive equipment.

Longer-term increases in demand are likely to have more effect on these practices, especially if reserves or investments do not keep pace. Long-term decreases in demand put pressure on profits and lead to cost-cutting, which may also affect labour, safety and environmental practices. Eventually, a continued slump in demand (as well as cost increases) causes mines to close. This produces the various problems around mine closure, as seen for example in the South African gold industry in the past decade,

These effects can be summarized by Segal's (2000) quotation that "price cycles offer a convenient alibi for poor management decisions".

Restructuring and changing corporate profiles

(This section is derived mainly from the report by Segal, 2000).

The traditional mining houses had their origin in the need to raise large amounts of capital from abroad for massive expensive mining developments in South Africa in the late 19th and early 20th centuries. The thrust came with the development of diamonds in Griqualand and accelerated with that of gold on the Witwatersrand (see section 3.2: history). These mining houses ran centralized operations for almost all the functions needed for their mines, from accounting through metallurgy to marketing.

This method provided the expertise that individual mines could not have afforded, as well as providing the capital needed. The mining houses therefore maintained their dominance of the industry in southern Africa, especially in South Africa, through most of the 20th century. All seven major mining houses in 1946 (Anglo-American, General Mining, Union Corporation, Gold Field, Rand Mines, JCI and Anglovaal) still dominated mining and manufacturing industry in the region in 1990, though General Mining had merged with Union Corporation and Rand Mines with the industrial conglomerate Barlows. The high point of this system was reached with the development of the Free State gold fields in the 1950s.

After 1960, however, the situation changed radically. After Sharpeville, South Africa became increasingly isolated in the world. At the same time the capital needs of the gold mines slowed when the Free State field were fully developed. The capital accumulated by the mining houses was turned to non-mining applications such as the manufacturing industry, this diversification being encouraged by the fact that local markets were protected from foreign competition. During this period mining in most other southern African countries became nationalized to some degree, with national companies taking over from South African mining houses.

By the early 1990s cost increases in the gold mines and static commodity prices exerted mounting pressure both in southern Africa and abroad, causing profits in the mining industry to decline rapidly. Capital markets started to undervalue

mining houses compared to their assets. This led to houses being “unbundled” or split up into individual companies so that some would not be so undervalued.

In the mid-1990s the South African economy started to open up to foreign competition and the industry started to emphasize productivity in order to withstand this competition. Unprofitable shafts or plants or even complete mines closed and the industry increasingly applied cost-saving methods. These developments decreased mining production and resulted in large lay-offs of labour, especially in South African gold mining.

Now mines are more efficient and able to survive at lower commodity prices. It is claimed that this efficiency can stave off even more radical downsizing. Restructuring has made room for medium and small companies, a number of which are black-controlled. None of the traditional mining houses remains and the South African mining industry consists of a variety of types of companies, from small firms focused on individual commodities to global mining groups. Some of the major holding companies, transformed from the old mining-house pattern, have listed offshore in order to raise capital to gain access to and develop foreign mineral deposits. Services and supplies, which formerly were integrated in the mining houses, are now commonly outsourced to independent specialized concerns. Similar pressures are being felt in other southern African countries, as they are in the rest of the world. The South African Gold Fields group has sold the Tsumeb company in Namibia to Ongopolo, a small company, and government-owned Zambian copper mines are being privatized.

Technology

The mining industry has instituted a large number of critical technological innovations in the past couple of decades, as it has done in earlier times. Many of these innovations were first developed in South Africa. Others were adapted from overseas technology for use here. Leading examples in recent times have included the following.

- The McArthur-Forrest cyanidation process that saved the Witwatersrand gold mines in the late 19th century (see section 3.2: history).
- Satellite imaging methods have reduced the costs of geological exploration.
- Geographical information systems make it possible to accurately map geological parameters for exploration purposes at dramatically reduced cost.
- Other information technology allows geologists, mining engineers, metallurgists, financial analysts and managers to use a vastly larger amount of data to predict, design, plan and control operations and installations.
- Mine support systems such as disc props and better prediction of seismic disturbances have improved safety and productivity in deep mines.
- Draglines and very large trolley-assisted trucks are used to mine deposits to greater depths than surface mining could manage in the past, and at lower grades. This equipment is used to mine commodities such as coal, copper, iron and phosphates.
- Metallurgical methods such as carbon-in-pulp have revolutionized gold recovery, and biological oxidation has made it possible to recover gold and base metals from more difficult ores.
- Smelting reduction methods such as the Corex process use ordinary steam coal to replace expensive or unobtainable coking coal in the integrated steel plants. However, Corex requires an application for the by-product gas for it to be economically viable.
- New smelting methods have replaced reverberatory furnaces and cyclic converters for non-ferrous metals and platinum. This has made it possible to convert the sulphur dioxide produced to sulphuric acid and to decrease a major source of air pollution.
- Technology has been developed to smelt platinum ore from the previously unrecoverable UG₂ reef. This has doubled PGM reserves.

These and many other technological advances have reduced costs, extended the range of ores that can be recovered, and improved safety and productivity. This has maintained or extended the viability of mining for a number of commodities and slowed the decline of others. The negative effect is that some of them have decreased the demand for labour in mines that previously were labour-intensive. It has safeguarded other jobs by making it possible for other mines to continue. Another positive effect on labour is more radical: many of the innovations have brought about a change in the labour market from unskilled, uneducated workers to those with technical ability and education. These workers are capable of filling management positions and a number of previously disadvantaged people have graduated to this role. The innovations have encouraged the start of replacement of migrant labour by workers living permanently with their families near the mines.

The application in southern Africa of advanced technology developed elsewhere will accelerate as a result of globalization. First-world countries are addressing issues now that will impact on second- and third-world countries in the near future (Macfarlane, 2001a). For example, first-world countries have advanced significantly further in the reduction of fall-of-ground accidents through the application of new technology and stringent legislation. The development of automated roof-bolting equipment has been necessitated by legislation that prevents entry into unsupported ground, even for the purpose of installing support. One can expect that stronger emphasis will be placed on the need to develop automated equipment in stoping operations in southern Africa.

Legislation and policy changes

Section 3.7 (Land access and use issues) described legislative developments concerning land and mineral rights. The 1998 White Paper on a minerals and mining policy for South Africa and the South African Draft Minerals Development Bill in 2000 also dealt with other aspects of mineral and mining policy. These included mining taxation, prospecting information, beneficiation, marketing,

participation in ownership and management, mine health and safety, human resource development, housing and living conditions, environmental management, regional co-operation and governance.

Government policy expressed in these documents on environmental management includes a risk-averse approach and the polluter-pays principle, consideration of the “no-go” option, equitable and effective consultation with I&APs and the principles of Integrated Environmental Management. For regional co-operation the government will encourage mining companies to engage in operations across in the region and the continent. It will participate in co-ordinating policies in the region by, for example, removing barriers to movement of capital, labour, goods and service, though avoiding destabilizing moves, and by co-operating in the harmonization of standards.

Observers believe that legislation on mine health and safety, which makes the employer primarily responsible for the health and safety of employees, is satisfactory. However, they also believe that recent disasters such as the methane explosion at the Beatrix mine in May 2001, when 12 miners died and two were injured (Schuettler, 2001), show that the legislation is not implemented properly. Government policy supports this view by the intention of strengthening this implementation.

Legislative changes have also been made in mining in other southern African states (SADC, 2001). In Angola, for example, several legal statutes govern mining and petroleum development. Most of the statutes have been updated within the last few years, with the most significant initiatives including:

- Revision and regulation of the Mining Law and the Diamond Law;
- Establishment of new systems for better control of marketing of diamonds;
and
- Reduction of the size of the diamond concessions for better control of mining and avoidance of sleeping investors.

In Botswana the new Mines and Minerals Act was passed by Parliament in 1999 and became effective on 1st December 1999. The key feature of the revised licensing regime is that the whole process from prospecting to mining will be automatic and predictable, removing some of the uncertainty and stages of negotiation that previously existed. Namibia's 2000 Diamond Act is being revised further and a consultant is drafting a Minerals Policy.

The Government of Zambia has developed a mining policy that aims at encouraging private investment in exploration and mining. The Government has withdrawn direct participation in the operations of the mines. The Zimbabwe Mining Development Corporation will be restructured and a fast track privatization programme will be implemented taking into account the indigenization process. This is part of fulfilling Government's intention to divest from the mining sector.

Stakeholder pressures and concerns in the region.

The major issues raised by the various types of stakeholders include the following. Many have been discussed in previous sections.

Labour

- Safeguarding employment
- Job creation
- Effects of retrenchment
- Health and safety
- Remuneration
- Housing
- Training and career development.

Industry

- Economic development
- Taxation
- Technology development
- Labour supply and skills
- Markets
- Availability, cost and transfer of capital
- Regulation

Government

- Mineral development
- Tax revenue and effects of taxation
- Small-scale mining
- Migrant labour
- Beneficiation
- Transformation
- Environmental management

Communities

- Poverty alleviation
- Displacement, resettlement and compensation
- Contributions by mining companies to community development including schools, clinics, hospitals, etc.
- Environmental degradation and reclamation
- Mine closure
- Employment of women
- Child labour

MMSD held a multi-stakeholder meeting in Johannesburg in November 2000 in preparation for the definition of the approach to be adopted and the work to be planned for MMSD-SA. The objective of the meeting was to hear the concerns of

the major stakeholders in the sector (labour, industry, academia, CBOs and NGOs and small-scale mining) and their approaches to MMSD.

Other groups also have interests and concerns. They include financial markets, overseas customers, consumers, international agencies, suppliers of services and supplies, transport, etc. However, they are not as directly involved or as influential as are the above groups.

Regional initiatives and activities

The Organization of African Unity is a continent-wide institution and does not have any formal branch directed at mining in southern Africa. The OAU was dominated by political considerations even in its detailed operations and its direction was towards political liberalization of the continent (Mukwita, 2001). It was succeeded in May 2001 by the African Union, which will concentrate on economic development. However, the AU's specific operations have not yet been defined. The last summit meeting of the OAU started on 9 July 2001 in Lusaka and will deal with preparations for the initiation of the AU among other issues. It will also consider the Millennium Africa Recovery Programme (MAP) initiated by the presidents of three African countries including President Mbeki of South Africa, and the OMEGA plan proposed by the President of Senegal.

The United Nations Economic Commission for Africa is based in Addis Ababa. It sometimes deals with mining, for example in an investigation in about 1993 on the development of copper in the continent, but also does not formally deal with mining specifically in southern Africa. It is also limited by political considerations, for example in the appointment of officials. The United Nations Development Programme has, in collaboration with UNECA, presented a Regional Co-operation Framework that deals with the economy of the region as a whole.

The major regional organization is SADC, the Southern African Development Community. This was formed in about 1980 as the SADCC (Southern African

Development and Cooperation Conference) as a tool to withstand the economic domination of South Africa in the region during the apartheid era. It was also intended to support the “Frontline states” (those bordering on or near to South Africa) in that period. It changed to SADC when South Africa joined after that country’s first democratic elections in 1994.

SADC is organized on a sectoral basis, with each sector being based in a different country of the region. The financial and administrative sector, for example, is based in Gaborone, Botswana and the mining sector in Lusaka, Zambia. SADC-MCU is responsible for the mining sector and shares premises and some facilities with the Zambian Department of Mines. The structure of SADC is, however, undergoing change and SADC-MCU will probably become part of a wider industrial sector of SADC.

The objectives of SADC include economic growth and development, alleviation of poverty, enhancing the quality of life of the peoples of southern Africa and supporting the socially disadvantaged through regional integration and achieving sustainable utilization of mineral resources and effective protection of the environment (SADC, 2001a). The Heads of State and Government have signed a Protocol on mining to provide the legal basis for co-operation in mining between SADC member states but the Protocol is not yet effective as it has not been ratified by these member states.

A strategy for 1997-2001 for the mining sector was, however, approved by the SADC Council and is effective. It includes the SADC-MCU programme, which is divided into six sub-sectors: Geology, Mining and Marketing, Mineral Processing, Environment, Human Resources Development, and Information. The programme currently comprises 26 projects with a total estimated cost of US\$16.2 million of which 67% has been secured, mainly through commitments from member states.

Over half of the projects in the SACD-MCU programme are on geology with another 30% on environment, including those on water quality, air pollution, spontaneous combustion of coal, occupational health and safety and others. SADC-MCU reviews annually the performance of the mining industry in the region and in its member countries on a wide range of aspects. These aspects include production, policy and administration, exploration and regional mapping, data acquisition, mineral processing, small-scale mining, the environment, mining investments, employment and dissemination of information (SADC, 2001).

MIASA is the Minerals Industry Association of Southern Africa, consisting of industry representatives, usually the Chief Executive Officers of the Chambers of Mines in the countries of the region. MIASA deals specifically with mining, minerals and metals and its main purpose is to speak for this industry in regional organizations. Its major representation of this type is on SADC-MCU. MIASA supplies a great deal of information to these organizations but its publications are not made generally available.

Comesa – the Commission for Eastern and Southern Africa – includes most of the same countries as does SADC but has been overshadowed by the latter. Its activities concentrate on tariffs and customs regulations and do not deal much with mining. The Southern African Customs Union deals with the latter issues only and is restricted to Botswana, Lesotho, Namibia, South Africa and Swaziland.

There are other regional and continental institutions (governmental, labour, industrial, NGOs, etc.) in Africa that deal with specific sectors other than mining. Examples are the African Telecommunications Union and the Southern African Regional Poverty Network.

External influences on the development of the sector

The idea behind the globalization movement is to remove tariff and other barriers to the free movement of goods, capital, labour, skills and other factors of production. This is intended to increase competitiveness and reduce costs, moving investment to where the costs of production are lowest in the world. The theory says that this would include moving some investments to developing countries, presumably because labour costs tend to be lower there. This is intended to create jobs and alleviate poverty in these countries.

Global developments have indeed affected the job market in southern African mining. They have resulted in an increasing demand for skilled labour and a lowering of demand for unskilled labour¹ (Business Input, 2001). Globalization has forced a shift to production processes that require more skilled labour and thus less unskilled labour as mentioned in Section 4 (“Drivers of change” under “Technology”). The effect is also borne out in research by Borhat² (Table 14) where over the period 1970 to 1995 there was significant growth in the demand for educated labour across all sectors while there was a significant decline in employment for uneducated labour.

Table 14. Formal sector employment trends in South Africa

	No education	Lower than standard 5	Standard 6 to 9	Matric	Tertiary	Total
Mining	-90.7	-38.6	106.9	632.5	1947.1	-31.0
Manufacturing	-59.8	-27.6	51.4	324.0	1477.4	41.9
TOTAL SA	-78.9	-24.4	52.9	359.0	2027.5	17.6

1970 to 1995, % change. Source: Business input, 2001

¹ The Department of Trade and Industry in its recently released new industrial strategy for South Africa recommends that South African companies do not rely on unskilled cheap labour – since global forces are making this source of comparative advantage redundant.

² Haroon Borhat, “Decomposing Sectoral Employment Trends in South Africa”. Quoted in Business Input, 2001.

The above table does not reflect the declines in formal sector employment across all sectors of the economy after 1995. However, it is still clear that the category of uneducated unskilled labour is the category that has lost most in the job stakes as a result of globalization. At the same time, as a result of apartheid education and the turbulent 1960-80's period, the dominant racial group in this uneducated and unskilled category are black people.

Business believes that job losses in all sectors excluding mining are a direct result of South Africa's reintegration back into the global economy where businesses had to break off the shackles of the isolation and protectionist era and become more internationally competitive. Globalization was not something that could be resisted and in fact has provided a more competitive base for SA exports and the country's ability to attract investment. In the case of the mining industry the primarily reason for job losses is described as a result of the fall in commodity prices, higher working costs and ore depletion.

Most of the major industrialized countries, as represented for example by the G7 group, are keenly in favour of globalization, probably because it is expected to increase their access to markets and to reduce the prices of intermediate inputs and consumer goods. The World Trade Organization has become identified with this approach, though the WTO includes representation by some developing countries. Some of the latter countries also give support to the movement, though perhaps not as enthusiastically, in the hope that globalization will increase their access to markets in industrialized countries.

There is also vigorous opposition to the movement, as can be seen from the large-scale disturbances at recent WTO and G7 meetings such as those in Gothenburg, Prague and Seattle. The opposition has included labour and other groups from the industrialized countries themselves. At a Labour Law conference in Durban in July, an American academic said that globalization had not brought growth or reduced poverty in Africa but made things worse. He believes that

globalization in its current form “actually looks a lot like colonialist exploitation but hides its hand behind the free market” (Nhlapo, 2001).

A journalist (Zungu, 2001) comments that the global investment and trading system has created a formidable army of dissatisfied people: political leaders disempowered in their own countries by the markets and international bureaucracies, civil organizations fighting for democracy and human rights, and trade unions. He reports that exactly the opposite effect of the intended stimulation of growth has happened. Savings have moved from poor to rich countries rather than the other way round and interest rates in the former have risen. International investment in developing countries, especially during the past five years, has been volatile, short term and speculative, thus increasing economic instability.

It has been suggested (Leimann, 2001) that globalization is likely to lock countries in to areas where they have a competitive advantage. In southern Africa these areas would be mainly primary industries, especially the supply of unprocessed ores or concentrates. It would thus make it more difficult for the region to develop further processing or the manufacture of finished goods, industries that have been the basis for development of a number of previously undeveloped countries such as Korea.

Nevertheless, as mentioned above, some developing countries see no alternative but to go along with the globalization movement. If they fail to do so, they will remain uncompetitive and their industries will not be capable of accessing overseas markets. SADC countries, for example, have adopted market systems, undertaken privatization, introduced incentives and reduced tariffs in order to induce investments (Granville et. al., 2000). Industrialized countries have not, however, sufficiently reduced their trade barriers to African imports despite promising to do so. Progress that is made in reduction of trade barriers is in some cases being offset by the imposition of import protection in the

guise of environmental, labour or social protection. It is therefore regarded (Minnit, 2001) as essential that rules and standards be set to guide sustainable development.

The trade barriers consist of both tariffs and non-tariff barriers, the latter including such measures as:

- Import quotas
- Environmental and safety standards
- Different exchange rates for different transactions
- Excessive import documentation requirements
- Product standards and specifications
- Advance deposit requirements for imports
- Delays with customs procedures
- Local subsidized production
- Foreign exchange restrictions
- Exchange rate control
- Health requirements
- Labelling requirements.

An additional problem with non-tariff barriers is that many of them are difficult to identify accurately.

These tariffs and non-tariff barriers are believed to be among the reasons why the share of SADC countries in added-value products is quite small and that these countries remain suppliers of raw materials to the industrialized world. World wide average tariff rates have declined since the mid-1990s and are expected to decline further but they are still significant. In the minerals sector tariffs tend to increase as value is added, from minimal tariffs for ores and concentrates, through low tariffs for metals and alloys, to high tariffs for semi-finished goods and especially for finished products. For example, the United States allows cobalt matte, waste and scrap in free of tariff but in 1999 still levied

on NTR (Normal Trade Relations) states a 45% ad-valorem tariff on wrought cobalt and cobalt articles.

The World Bank Group has long played an active role in the extractive industries. However, as shown by the above description, the role of the WBG in these industries is being questioned. The World Bank is therefore planning a review of its activities in this sector (McPhail, 2001).

It should be noted, however, that southern Africa and other developing regions are not the only victims of increasing competition. Unbundling, restructuring, mergers and productivity drives are common in world industry generally. The re-entry of global mining groups to this region, however, has accelerated these effects.

The effect of globalization on technology used in the region is mentioned above in terms of its effects on labour. An example of the effect of technological globalization on safety procedures and legislation is described in Section 4 (“Drivers of change”). Globalization is also affecting variety of other areas, such as legislation and practices on energy production and use and recycling. Information technology is expanding the application of new methods all over the supply chain, including, for example, mineral and metal sales (see section 3.6).

Other global organizations having an effect on the southern African mining sector and on sustainable development in the region include the International Labour Organization, the World Mining Congress and environmental groups such as the Worldwatch Institute, the Worldwide Fund for Nature and Greenpeace. The Global Mining Initiative is a major driver towards getting the industry to embrace sustainable development in practice. GMI is to hold a conference in Toronto in May 2002 with the intention of bringing together high level representatives from a variety of stakeholders to discuss new directions for the industry.

Research Topic 5 (on managing mineral wealth) of the MMSD-SA project is expected to discuss in detail the questions of globalization, North-South dynamics, protectionism and country and regional competitiveness,

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5. CONCLUSIONS

Introduction

The baseline assessment is executed in qualitative terms and is intended to describe the factors that may change over time. However, it will be more difficult to assess whether changes have occurred, and to what extent, without quantitative measurements. The report is, inevitably, biased towards the South African situation but information obtained for the whole region has diminished this bias.

Regional interpretation of sustainable development

This is described in the working document “Locating the mining and minerals sector within the southern African vision for sustainable development” but the interpretation given there appears to apply world wide rather than being specific to Southern Africa.

Industry description

In Southern Africa mining contributes significantly to economic activities, fixed investment, employment opportunities, infrastructure, secondary industries, gross capital formation and foreign exchange earnings. Mining output constitutes 8% of the region’s GDP. For individual countries this proportion varies from less than 0.1% to 34% (for Angola). Southern Africa contributed 8% to the 1973 world mining production excluding oil.

Major minerals

The minerals of major importance in southern Africa were selected in terms of the criteria of reserves and grades, distribution of reserves between countries of the region, availability of technology and infrastructure, competitive global advantage, and economic impact. The selected minerals are chromium, coal, cobalt, copper, diamonds, gold, iron, manganese, nickel, phosphates, platinum-group metals (PGMs), semi-precious stones and titanium. Southern Africa is the main producing region of five major minerals: chromium, cobalt, diamonds, gold and platinum-group metals, and is one of three major producing regions for semi-precious stones.

There are extensive data for mineral reserves and resources in the region but they suffer from lack of information and standardization on their degree of assurance. For eight minerals, Africa south of the equator has more than 45% of the world's reserves. They are chromite, PGMs, diamonds, vanadium, vermiculite, manganese, gold and fluorspar.

Labour information

The total labour force in the SADC mining industry was 2.0 million in 2000 including 1.5 million in the informal mining sector in Tanzania. A factor of four has been frequently used as the employment multiplier effect. This takes into account the number of people in formal or informal employment that depend on mining. A total of 341 000 mineworkers in South Africa, or 43% of the industry's 1990 work force, lost their jobs over the following ten years. The average wage received by mine workers in South Africa in 1999 was US\$628 per month.

Stages of production

Manufactured or fabricated products are produced from minerals in South Africa (cobalt, copper, diamonds, gold, PGMs); Zambia, Zimbabwe (copper, gold); and Botswana, Mauritius, Namibia, Tanzania (diamonds). Most countries of the region produce iron and steel products, mainly from scrap.

Outline history of mining in southern Africa and its interactions with communities and labour

It was probably in eastern or southern Africa that humans first used minerals. Southern Africa missed the Bronze Age as conventionally defined. Iron metallurgy, however, became well entrenched in the region and many sites are known where metals were extracted and worked well before the arrival of European colonial rule.

The industrial development of the region started with the discovery of diamonds, accelerated with the exploitation of gold in South Africa and copper in Zimbabwe,

Zambia and Congo and peaked in the 1960s and 1970s. After that gold and copper started to decline and efforts by the trade unions now concentrate on trying to maintain employment.

There has been a consistent theme in the history of mining in the region ever since slavery at the Cape was formally abolished in 1834. This theme has been the extended series of severe restrictions enforced on mineworkers, together with poor living conditions, low wages and extensive use of migrant labour. After the first world war this situation started to be seen as an impediment to growth but white political hegemony entrenched the situation until the early 1990s.

Interactions and trends between mining, communities, society and the environment

Many urban and rural communities in southern Africa face problems that result from mining, especially displacement and environmental degradation. Mines provide employment but leave behind serious unemployment when they close. A number of mines or mining companies contribute to adjacent communities by providing or subsidizing schools, hospitals or other facilities or programmes. However, questions are raised about the implementation and sustainability of these activities. Poor people are more affected than others are by environmental degradation, and poverty is in itself a contributor to this degradation. In general, companies are now more conscious of the environment and the amount of monitoring has increased but the approach still can not be called systematic.

Trends in the impact of mining on the economy

The proportion of mining in the economy of the region as a whole was lower in 1997 than in it was in 1973. The absolute value of mining's output increased at current prices but inflation was a major constituent of the increase. However, minerals and metals are still the largest element in the region's exports and there are prospects for revival of mining's contribution based on minerals other than gold.

Role of small-scale and artisanal mining in the region

Nearly all countries in the region have recognized small-scale mining as a means of alleviating poverty and empowering the local community. A number of support programmes have been established in a number of member States ranging from provision of loans and grants, equipment and plant hire schemes and making policy provisions. Artisanal mining is, however, discouraged because it usually does not maintain health, safety and environmental standards. Large companies, after a long history of opposition to small-scale mining, have started to accommodate it.

Supply chain issues

The degree of advance along the processing chain for minerals in South Africa varies from low for iron ore to high for antimony and zinc. For the rest of SADC the degree of beneficiation before export was greater than in South Africa for a number of minerals, at least in 1988. Part of the explanation is the low market for processed materials in SADC countries outside South Africa. The value added in manufactured products above the value of the raw refined mineral or metal is up to a factor of 380 (for diamonds). Input requirements for the processing of some minerals are described, as well as constraints on the processing that relate to input requirements.

Land access and use issues

When considering the effect of mining on land rights and access to land, the main issue is that of mineral rights and access to minerals. Private mineral rights are held mainly by white interests and it is considered that the current system of mineral rights prevents the optimal development of mining. The policy of the South African government is therefore to ensure national ownership of mineral rights through the “use it or lose it” principle. The government has published draft legislation for this purpose. Large mining companies have until recently vigorously opposed this direction but are now starting to accept it. Other southern

African countries already have legislation and regulations in place for the same effect.

Supply/demand considerations

The supply of minerals from the region depends on export markets as well as on economic and political developments in the countries of the region and on reserve constraints. Long-term booms or slumps in demand put pressure on labour, safety and environmental practices.

Restructuring and changing corporate profiles

The mining industry in the region has restructured from large, integrated mining houses. The reasons included cost increases, decline in prices, competition from companies elsewhere, reduction of the amount of capital required and stock market under-valuation of integrated companies.

Technology

The mining industry has instituted a large number of critical technological innovations. This has reduced costs, extended the range of ores that can be recovered, and improved safety and productivity. It has maintained or extended the viability of mining for a number of commodities and slowed the decline of others. Some technological innovations have decreased the demand for labour but the process has maintained viability and safeguarded some jobs. Many of the innovations have brought about a change in the labour market from unskilled, uneducated workers to those with technical ability and education.

Legislation and policy changes

Government policy on environmental management includes a risk-averse approach and the polluter-pays principle, consideration of the “no-go” option, equitable and effective consultation and the principles of integrated environmental management. Government encourages regional co-operation. Legislation on mine health and safety is satisfactory but government intends to strengthen implementation

Regional initiatives

The major regional organization is SADC, the Southern African Development Community. Its mining sector has a programme covering geology, mining and marketing, mineral processing, environment, human resources development, and information. A number of other regional or continental organizations operate in Africa, including the Organisation of African Unity/African Union, the United Nations Economic Commission for Africa and the Commission for Eastern and Southern Africa. The only regional organizations specifically directed at mining are SADC-MCU and MIASA.

External influences

Globalization is believed to have had negative effects on Africa, which has lowered its trade tariffs but has continued to face tariff barriers in industrialized countries. Nevertheless, developing countries see no alternative but to go along with the globalization movement and to make efforts to become competitive so that their industries will be capable of accessing overseas markets.

The main fields of interaction between mining and society in southern Africa have been reviewed and significant questions and problems in these interactions have been identified. The overall MMSD project is expected to analyse possible approaches to solving these problems and to propose, where feasible, the most appropriate solutions.

5. RECOMMENDATIONS

A baseline study is not designed to recommend future action since its function is to provide a description of the present status to serve as a basis for comparison with the future situation. However, suggestions can be made that are intended to facilitate the descriptions and measurements and make them more reliable. In the present case, data published by differing sources, for example on employment (section 3.1), should be investigated and standardized. Government departments in the region and SADC would be best placed to achieve this end.

A specific point that invites a recommendation concerns industry co-ordination on social and environmental issues. Despite the existence of the NBI and the Industrial Environmental Forum (section 3.3: Industry activities in favour of the environment and society) there appears to be no organization specific to mining companies to co-ordinate their activities in these areas or open to the public to explain their operations in this regard. It is therefore recommended that industry consider steps to intensify their co-ordination on social and environmental activities.

The need to set rules and standards to avoid the unfair imposition of non-tariff trade barriers was discussed in section 4 (External influences on the development of the sector). This is an area for attention by WTO, the United Nations, the European Union and similar bodies.

Table 15. Summary of recommendations

Recommendation	Data standardization	Industry co-ordination on social and environ	Co-ordination of standards for trade
Responsible bodies	Regional governments, SADC	Industry	UN, WTO, European Union, etc
Timescale, years	1 - 5	1 - 5	3 – 10
Report section	3.1	3.3	4

APPENDIX: LIST OF ABBREVIATIONS

BGS	British Geological Survey
CBO	Community-Based Organization
COM	Chamber of Mines of South Africa
DME	South African Department of Minerals and Energy
DRC	Democratic Republic of the Congo
DRI	Direct-reduced iron
EBR	Export beneficiation ratio
EIA	Environmental impact assessment
EIM	Environmental impact management
f.o.b.	free on board
FDI	Fixed domestic investment
G7	group of 7 major industrialized countries
GDP	Gross domestic product
GMI	Global Mining Initiative
GNP	Gross national product
Ltd	Limited company
MAP	Millennium Africa Recovery Programme
MIASA	Minerals Industry Association of Southern Africa
MMSD	Mining, Minerals and Sustainable Development
MMSD-SA	MMSD Southern Africa
n.a.	not available
NBI	National Business Initiative
NGO	Non-Governmental Organization
NSC	National Steering Committee for Small Scale Miners
PBR	Production beneficiation ratio
PLC	Public liability company
Pty	Proprietary
R	Rands (currency)
RDP	Reconstruction and Development Programme
RT6	Research Topic no. 6 (Baseline survey) of MMSD-SA Project
SA or RSA	Republic of South Africa
SACP	South African Communist Party
SADC	Southern African Development Community
SADC-MCU	SADC Mining Co-ordinating Unit
SAR	South African Republic (before 1904)
South Africa	Republic of South Africa
SSM	Small-scale mining
UNDP	United Nations Development Programme
USGS	United States Geological Survey
WBG	World Bank Group
WTO	World Trade Organization