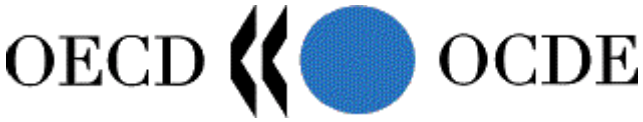

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# Environmental Impacts of Foreign Direct Investment in the Mining Sector in Sub-Saharan Africa

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## 1. Background

Foreign direct investment is important to the future of development of Africa, as it is a means of increasing the capital available for investment and the economic growth needed to reduce poverty and raise living standards in the continent. In addition, it can contribute to sustainable economic development, as it can result in the transfer of new technologies, skills and production methods, provide access to international markets, enhance efficiency of resource use, reduce waste and pollution, increase product diversity and generate employment (Loots, 1999; Ngowi, 2001;UNCTAD, 1997). However, in the absence of regulations governing natural resource extraction, or when they are weak or poorly enforced, increased openness to foreign investment can accelerate unsustainable resource use patterns. The ability of developing countries to attract FDI, maximise the associated benefits and minimise the risks depends on the effectiveness of their policy/institutional frameworks and institutions (Wilhelms, 1998; Pigato, 2001).

The aim of this paper is to review and analyse both the positive and negative environmental effects of FDI in the mining industry in Sub-Saharan Africa. The physical environmental impacts will be the main concern, but relevant social issues will be explored, where they have a significant bearing on the balance of benefits/risks associated with FDI or where they are closely related to the environmental issues.

This analysis will lead to the formulation of policy recommendations for enhancing the environmental (and where relevant social) performance of FDI in the mining sectors and maximise the benefits of FDI. This will include:

1) measures which can be taken by host countries, notably to improve policy/institutional/regulatory frameworks both to attract FDI flows and to monitor compliance with applicable rules;

2) measures which can be taken by foreign investors to improve their performance;

3) measures which OECD countries governments can take to support 1) and 2).

The analysis will focus on West, East and Southern Africa. Five countries, which have succeeded in attracting relatively large sums of FDI to their mining sectors in recent years, Ghana, Mali, Tanzania, South Africa and Zambia, will be looked at in detail. Kenya, which up until now has attracted little investment in the mining industry, but could be the target of significant investment if a planned mining project goes ahead, is also studied.

Countries in conflict or undergoing severe political and civil unrest will be excluded from the analysis, as they raise an entirely different set of issues. Therefore despite the large mineral resources in countries such as Angola and the Democratic Republic of Congo, they will not be discussed.

## 2. Introduction

The mining industry has traditionally been a major recipient of foreign direct investment in sub-Saharan Africa, and has commonly been an important foreign exchange earner for the region. Over the forty years to 1993 Africa's share by value of world mining output declined from 23% to 10%, as a result of poor policies, political interference and lack of investment (Allaoua and Atkin, 1993). This decline can be attributed to lack of investment in systematic geological mapping, poor technical data on mineral endowment, weak institutions and policies, poor infrastructure, the lack of cheap and reliable energy resources, deteriorating commodity prices, poor investment climates and the scarcity of indigenous technical and professional manpower (Quashie, 1996). In recent years, steps have been taken to address some of these issues with thirty-five countries publishing new mining codes by the end of 1995. These have generally resulted in reduction of tax levels, liberal import tax exemptions for equipment, and easing of immigration laws for expatriates (Abugre and Akabzaa, 1998).

Absolute levels of FDI to African countries have increased from an annual average of $1,9 billion in 1983-87, to US$ 3,1 billion in 1988-1992 and $6 billion in 1993-1997 (UNCTAD, 1999). Since reaching US$ 9,4 billion in 1997, FDI decreased to US $8,3 billion in 1998 (Loots, 1999). In 1990 sub-Saharan Africa received US$ 923 million in FDI, which rose to US$ 7949 million in 1999 (World Development Indicators, 2001).

The flows of FDI to sub-Saharan Africa have traditionally been to oil and natural resources (Allaoua and Atkin, 1993; Morisset,2000), although there has been a trend in recent years to invest in services and manufacturing (UNCTAD, 1999). For example, 75% of FDI in Africa in the period 1985-1991 was concentrated in the mining and oil extraction industries (Allaoua and Atkin, 1993). FDI to sub-Saharan Africa tends to be concentrated in a few countries, and in the period 1986-1996 three countries, Nigeria, Angola and Ghana were the dominant recipients. In fact 41% of the average inflows in the period 1995 to 1998 went to four oil exporting countries in the region, namely Angola, Congo Republic, Equatorial Guinea and Nigeria (Pigato,2000).

According to Loots (1999) 15,3% of FDI in Africa in 1997 was in the primary sector, of which 60% went to mining and natural resource extraction, including fossil fuels. In general there is a lack of data on FDI flows at the sectoral level (Bennell, 1997; Marr, 1997). In this study detailed sectoral data was only found for FDI stocks for South Africa.

Although the mining industry occupies a relatively small part of the land surface, it does have significant and often irreversible impacts (Danielson and Lagos, 2001). By its nature, mining has a permanent environmental impact in that a non-renewable natural resource is exhausted. Environmental impacts can occur during all the phases of a mining project, exploration, disposal of waste rock and overburden, ore processing and plant operation, tailings (processing wastes) management, infrastructure (access and energy) and construction of camps and towns. Table 1 below outlines the main physical environmental impacts of the mining industry, as well as a broad time frame over which they occur. Possible remediation and/or mitigation measures are also summarised.

The environmental legacy of past mining, frequently poses major problems (Danielson and Lagos, 2001), which are similar to the potential impacts of existing mines, but pose the problem of liability for clean up and its costs. The largest liability in this field is acid mine drainage which may be a long term problem, such as in the Rio Tinto region in Spain, which has been a source of acid mine drainage for at least 2000 years (Balkau and Parsons, 1999). Some examples of past mining environmental legacies in sub-Saharan Africa include:

- Environmental problems related to copper mining in Zambia prior to privatisation;
- Abandoned pits and shafts over a large area of unregulated artisanal mining in West Africa. These pose a safety risk to local populations and animals (Balkau, 1999); and,
- Tailings dumps from past mining activities around Johannesburg in South Africa, which are a source of dust affecting the health of neighbouring populations. In some cases the responsibility for the rehabilitation of the dumps can be attributed, but economic conditions have prevented rehabilitation (Balkau, 1999).

The major impacts of abandoned mine sites are acid mine drainage, loss of productive land, visual effects, surface and groundwater pollution, soil contamination, siltation, contamination of aquatic sediments and fauna, air pollution from dust, risks posed by abandoned shafts and pits, and landslides due to collapse of waste and tailings dumps (Balkau, 1999).

This legacy creates several issues, listed below, which need addressing (Balkau, 1999):

- The extent of current damage.
- The effects of the damage on local and national development.
- What are the rehabilitation costs, and who is liable for them?
- Did the original activity contribute to development, and to what extent?
- Did local authorities approve the activity at the time?
- What is the current ownership status of the sites? Have viable companies taken over ownership?
- Do the sites have potential for redevelopment?
- What legislation, if any, exists concerning the sites?

Clean up costs are likely to be large. In the US, the cost of remediation of acid mine drainage, which affects some 20 000 km of watercourses, was estimated to be between $2billion and $ 35 billion in 1998 (Balkau and Parsons, 1999).

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Table 1. Physical environmental impacts of mining (Sources: Acquah, 1995; Balkau, 1998; Balkau and Parsons, 1999; Robb and Robb, 1998; Tosen and Conklin, 1998; Viljoen, 1998; Wilson, 1998a,b.).

| Phase | Activity | Physical Impact | Time Frame | Mitigation |
|---|---|---|---|---|
| General issues | | Energy consumption<br>Climate change<br>Abandoned equipment<br>Loss of cultural or archaeological heritage sites<br>Effects on indigenous populations<br>Loss of biodiversity | Life of mine<br>Permanent<br>Long term<br>Permanent<br><br>Permanent<br>Can be permanent | Energy conservation measures<br><br>Adequate dismantling and disposal<br>Evaluate risks prior to operations.<br>Public consultation<br>Consultation, community relations<br>Rehabilitation |
| Exploration | Access road construction | Potential influx of population may lead to increased natural resource use | Potentially long term | Minimise where possible |
| | Line cutting | Removal of vegetation<br>Soil erosion<br>Possible habitat destruction | Short-term if mitigation | Minimise line width,<br>Revegetation where necessary |
| | Trenching and pitting | Land scars<br>Danger to fauna, livestock | Short term | Infill after sampling, mapping.<br>Revegetation |
| | Drilling | Noise and vibration (impact is dependent on proximity to settlements)<br>Land clearing for drill sites<br>Soil and water contamination by oil spills | During drilling only<br><br>Short term<br>Rare and minor in general | Discussions with public to minimise nuisance<br><br>Revegetation<br>Good maintenance of machinery. |
| Mining | In general | Plant and mine noise<br>Blasting vibrations<br>Health and safety related to explosives handling<br>Loss of land<br>Solid waste | Life of mine<br>Life of mine<br>Life of mine<br><br>Can be permanent<br>Life of mine | <br><br>Adoption of stringent safety procedures<br>Rehabilitation where possible<br>Implement good disposal practices |

| Phase | Activity | Physical Impact | Time Frame | Mitigation |
|---|---|---|---|---|
| Mining[2] (cont.) | Strip or open-cast | Vegetation removal | Life of mine | Reclamation by infill of depression with waste rock, replacement of topsoil, revegetation |
| | | Increased soil erosion | Life of mine | Reclamation as above |
| | | Diversion of water courses | Life of mine to permanent | |
| | | Increased sediment load in rivers | Can continue post-mine | Reclamation as above |
| | Open-Pit | Land scar plus potential danger to inhabitants and fauna | Permanent | Stabilisation of pit walls<br>Block access to the area - poses long term liability problems<br>Pits may be used for waste disposal or filled with water (reservoir/recreational facility) |
| | Shallow underground (less than 300 m deep) | Collapse over workings | Potentially long term well after mine closure | Stabilise workings with waste rock |
| | | Acid mine drainage (surface and underground water contamination due to acidity and dissolved metal content) | Syn- and post-mine | Seal workings |
| | Deep underground | Land subsidence | Potentially long term | Infill with mine waste stabilised with cement; revegetation |
| | | Disposal of mine water | Syn-mine | Discharge into streams if good quality. Use in processing.<br>Treatment of poor quality water prior to discharge |
| | | Acid mine drainage | Long term, potentially permanent | Neutralisation with lime; use of man-made wetlands (densely planted reed beds to neutralise acidity and precipitate metals) if small volumes are involved. This is a major environmental problem in South Africa. |
| | | Seismic disturbances | Syn- and post-mine | |

| Phase | Activity | Physical Impact | Time Frame | Mitigation |
|---|---|---|---|---|
| Mining[3] (cont.) | Dredging | Vegetation removal | Life of mine | Infill of dredge ponds with tailings sands after dewatering. Reshaping of sand to conform as closely as possible to the original topography. Cover with conserved topsoil. Revegetation |
| | | Severe disruption of ground surface | Life of mine | |
| | | Ground-water table fluctuations | Life of mine | |
| | Waste rock and overburden disposal | Visual impact | Long term to permanent | Landscaping and revegetation of dumps. Use of waste as backfill in underground mines |
| | | Land alienation | Long term to permanent | |
| | | Airborne dust | Syn-mine | Spraying with water. |
| | | Acid drainage | Syn- and post-mine | Rehabilitation as for visual |
| | | Erosion leading to increased sediment loads | Syn-mine | Rehabilitation as for visual |
| | | Burning discard dumps (coal) | Long term | Compaction, covering and revegetation to prevent air ingress |
| Ore processing/plant operations | Roaster plants and smelters | $SO_2$, $NO_X$, $As_20_3$ emissions can lead to air pollution. | Emissions are life of mine | Installation of filters on stacks. Conversion of recovered $SO_2$ to sulphuric acid |
| | | Fallout can cause soil and water contamination | Potentially long term | Depends on mitigation of emissions |
| | | Disposal of smelter wastes (slag). Dumps may cause visual impact | Post mine-life, potentially permanent | Reclamation of dumps |
| | Other plants (tailings, the process wastes are dealt with separately) | Process water discharge can lead to soil contamination and water pollution | Syn-mine life | Recovery of effluent for recycling as process water. Treatment of process effluent solutions (e.g. cyanide destruction) prior to release into tailings dams. |
| | | Use of hydrological resources | Syn-mine life | Maximise use of recycled process water. |
| | | Hazardous chemicals handling and disposal | Syn-mine life | Chemicals handling, storage and disposal procedures |

| Phase | Activity | Physical Impact | Time Frame | Mitigation |
|---|---|---|---|---|
| Ore processing/plant operations[2] (cont.) | Heap leach operations | Contamination of surface and underground waters by cyanide-bearing solutions | Syn-mine and potentially post-mine life | Line leach pads. Design of closed circuit to recycle leaching solutions. Treatment of waste solutions to break down cyanide |
| | Tailings dams | Water pollution from seepage, windblown dust | All impacts are syn- and post-mine life and may be long-term | Line tailings dam. Seepage trenches. Treatment of process waters prior to damming |
| | | Waterlogging of adjacent land | | Line tailings dam. Collect and recycle water in seepage trenches. Monitor water levels in adjacent land |
| | | Wind blown dust | | Revegetation |
| | | Tailings erosion | | Revegetation |
| | | Tailings rupture - release of toxics (e.g. cyanide) | | Emergency situation. Sound engineering design; continuous monitoring and verification of dam stability. Prepare emergency plans |
| | | Intoxication of wildlife drawn to water | | Block access to tailings dam area |
| | | Land loss | Permanent | Revegetation and rehabilitation in order to allow future use of land |
| | | Visual effect | Permanent | Landscaping and revegetation |
| Access and energy infrastructure | Access roads | Function of proximity to suitable access to infrastructure and energy sources as well as proximity to protected areas, water bodies<br>May cause population influx | Long term | |
| Mine towns/construction camps | Worker influx | Forest degradation; water supply contamination; destruction of fauna<br>Sewage | Long term, potentially permanent<br>Life of mine town | Construct necessary facilities |
| Decommissioning/post-closure activities | | Acid drainage<br>Subsidence<br>Waste dumps | Long term (100's years) | See mining and processing operations above |

The mining industry has in recent years turned its attention to the environmental impacts of its activities, and in particular is addressing the issue through the Global Mining Initiative (www.globalmining.com) and the Mining, Minerals and Sustainable Development Project (MMSD) which is addressing the issue of the contribution of the mining sector to sustainable development (www.iied.org/mmsd/). In 1998 the industry started the Industrial Network for Acid Prevention as part of its contribution to dealing with the legacy of abandoned mines (Balkau and Parsons, 1999).

Projects can also have major socio-economic impacts. Positive impacts can include increased employment, better health care, improved infrastructure and schooling. On the negative side there may be disruption of traditional cultures, introduction of STD's, basic commodity price increases, population displacement, land use conflicts and loss of livelihood (Danielson and Lagos, 2001; Machipisa,1998; Abugre and Akabzaa, 1998).

Details of the mining industry, FDI and their environmental impacts in the chosen example countries are described in sections 3.1 to 3.6 below. The countries are represented by geographical region starting with Southern Africa, then West Africa and finally East Africa.

Good quality data on impacts of FDI on the environment in the natural resources sector is lacking and coupled with the lack of sectoral FDI data, it is extremely difficult to attribute a particular environmental impact to FDI. In the following sections, the problem will be approached by looking at the environmental regulatory framework concerning the mining industry in the example countries, as well as examples of particular projects for which some data is available. An attempt will be made to assess whether environmental regulations are respected and enforced, and whether or not mining companies are in advance of current laws.

In addition to regulatory requirements, the environmental behaviour of the industry is a function of the corporate culture and the company commitment to the environment, as well as leverage by financial institutions. In this respect FDI could play an important role, as according to Gentry (1999) there is more environmental policy leverage over FDI than other forms of private investment.

## 3. FDI and its environmental impacts in the mining sector in selected Sub-Saharan African countries

### 3.1 South Africa

South Africa is richly endowed with minerals, and possesses the principal world reserves of gold, manganese, platinum group metals, chromium, vanadium and alumino-silicates. In addition there are large reserves of other minerals including iron ore, coal, diamonds, uranium, titanium and nickel.

Mining is important to the country, and directly contributed about 6,5% of GDP and 33,5% of total export revenues in 1999 (Gaven et al, 2001. See Table I.1). Gold mining is dominant, but has been declining steadily due to lower grades and greater depth of reserves. Recently there has been more emphasis on investment in downstream manufacture of finished products (EIU, 1999a).

Since 1994 South Africa has been a major recipient of FDI in sub-Saharan Africa (Table 2). There have been large annual variations in FDI, largely due to investment in privatised government utilities, such as the national telecommunications company. Sectoral data are only available for FDI stocks (Table 3).

The surge in stocks in 1999, is mainly due to investment by Placer Dome of Canada in the so-called Southdeep project, an underground gold mine in the Witwatersrand Basin. The project is a 50:50 joint Venture between Placer Dome and Western Areas Limited, and will involve a projected investment of $ 750 million (www.placerdome.com)

The South African Constitution enshrines the right to an environment that is not harmful to health or well-being and to protection of the environment for the benefit of present and future generations (South African Government Gazette, 20 October 1998). Mining is regulated by several laws of which the most important are the Minerals Act (Act 50 of 1991) and the Mine Health and Safety Act (Act 29 of 1996). A new law, the Minerals Development Act, which may be enacted in 2002, is currently being developed.

Table 2. FDI flows to selected sub-Saharan African countries (million US $)

| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| Ghana | 15 | 20 | 23 | 125 | 233 | 107 | 120 | 83 | 56 | 17 |
| Kenya | 57 | 19 | 6,4 | 1,6 | 3,7 | 32,4 | 13 | 40 | 42 | 42 |
| Mali | -7 | 1,2 | -21 | 4 | 17 | 111 | 84 | 39 | 36 | 40 |
| South Africa | -89 | 254,1 | 3,4 | 11 | 374 | 1 248 | 816 | 3 811 | 550 | 1 376 |
| Tanzania | 0 | 0 | 12 | 20 | 50 | 119,9 | 150,1 | 157,9 | 172 | 183,4 |
| Zambia | 203 | 34 | 45 | 52 | 56 | 97 | 117 | 207 | 198 | 163 |

*Source: World Bank World Development Indicators 1999; 2001; UNCTAD, 2000.*

Table 3. FDI stocks - South Africa (million Rand)

| | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|
| FDI stock - mining | 2 897 | 3 593 | 7 269 | 114 095 |
| Total FDI stock | 58 708 | 89 295 | 91 862 | 318 630 |
| Percentage | 4,93 | 4,02 | 7,91 | 35,81 |

*Source: South African Reserve Bank Quarterly Bulletins.*

Administration of the industry falls under the Department of Minerals and Energy (Botha et al, 2000). The industry is also subject to the National Environmental Management Act of 1998, under which regulations for the industry are being developed.

Under the Minerals Act, all operating mines must have an environmental management plan (EMP) approved by the Department of Minerals and Energy. The aim is to ensure a cradle to grave approach to environmental management. To assist companies in complying with this requirement an Environmental Management Programme Report has been developed, which covers a description of pre-mining environment, motivation for and a description of the project, the EIA and an indication of how the impacts will be managed. The EMP requires adequate provision for financial guarantees for rehabilitation and arrangements for monitoring and auditing (South African Government Gazette, 20 October 1998). Financial guarantees can take the form of bank guarantees or the establishment of a dedicated environmental trust fund. The aim of the government is to apply uniform standards of environmental management across all mining operations including artisanal mining.

Once approved by the government, the EMP becomes legally binding, and non-compliance may be sanctioned by suspension or withdrawal of a mining licence, or prosecution of the licence holder (Department of Minerals and Energy, 2000).

The Act entrenches rehabilitation of the surface after mining. On completion of mining operations, a closure certificate will only be given if the EMP has been implemented and successfully managed through the mine life, and if rehabilitation has been carried out to the satisfaction of the authorities (Wilson, 1998a). In addition, prior to operation, a mine must obtain a water permit, which regulates water use and discharge from the Department of Water Affairs and Forestry.

The major impacts of mining in South Africa are related to mine dewatering, tailings management, atmospheric emissions and acid mine drainage, which in some cases are specific to the type of mining. South Africa is also confronted by the problem of the environmental legacy of past mining, particularly acid mine drainage from abandoned coal and gold mines. In this respect, if the owner of a coal mine, which closed between 1956 and 1976, can be identified he is responsible for pollution

control and rehabilitation. It should be noted that atmospheric emissions have decreased with the introduction of EMP's and increasing enforcement of legislation. (Robb and Robb, 1998; Tosen and Conklin, 1998).

Over the years environmental performance has improved, in part driven by regulation, but in some cases industry driven. An example of this is the Chamber of Mines code of practice for the rehabilitation of strip mining for coal which was drawn up in 1976, four years before the relevant legislation (Wilson, 1998a).

Due to the relatively low level of FDI in the South African mining industry, its contribution to environmental impacts is probably low. It has not been possible to collect specific data on environmental impacts related to FDI in the mining sector. The following proxy measures are used to assess the linkages: the annual environmental management report of an affiliate of a major multinational group, corporate attitudes to the environment at the Southdeep project, and government decision making on a proposed mining project in a wetland area (the Richards Bay Minerals case below).

As far as the Southdeep project is concerned, activities were compliant with applicable corporate standards and South African environmental regulations in 2000 (www.placerdome.com). Reclamation and mine closure costs for the Placer Dome group as a whole were $8/oz of gold produced. This is 3,4% of total production costs ($230/oz of gold produced; Paler Dome Financial Results 2000).

Certain companies are striving to surpass national guidelines. A case in point is the Palabora copper mine (a member of the Rio Tinto Group, head office in the UK) whose environmental management system has been ISO 14001 certified since 1998. The company has instituted a Safety, Health Environment and Quality management system with the aim of ensuring adhesion of all employees to environmental goals. The mine is situated next to a major game park, and as such is the subject of close scrutiny by the government, the National Parks Board and the local community. As part of the environmental management system, the company conducts internal audits on a monthly basis, and independent external audits on a bi-annual basis (PMC, 2000).

Key environmental issues at Palabora are air pollution, water management, land disturbance and radiation. In 1999 the company achieved a 19 percent reduction in $SO_2$ emissions, which were well below national guidelines. On the negative side the company registered a 10 percent increase in energy consumption, dominantly coal burning in the smelter furnace, and therefore greenhouse gas emissions. In order to minimise dust levels, haulage roads are regularly sprayed, as are dumps prior to revegetation (PMC, 2000; Viljoen, 1998).

Concerning water management, the processing plants operate on a closed water circuit, with maximum use of recycled water where possible. Shallow seepage from tailings is recovered in a seepage cut-off trench and returned to the processing circuit. Deeper recovery systems are currently being installed. Groundwater quality is constantly monitored (PMC, 2000; Viljoen, 1998).

Rehabilitation is occurring in parallel with operation of the mine, with the aim of returning the land to a condition as close as possible to that existing prior to mining. Waste rock and tailings dumps are revegetated with indigenous plants, with the objective of establishing a self-sustaining vegetation. On the negative side the open pit, now some 700 m deep will not be filled after operations, but measures will be taken to block access to the pit. A detailed closure plan, created in consultation with the local community has been drawn up, and a decommissioning fund established. In 1999, the closure and rehabilitation cost provisions were about 8,6 percent of the year's profits after financial costs and taxation. These cost provisions are the net present value of the estimated cost of restoring environmental disturbance that had occurred up to the balance sheet date. (PMC, 2000).

In addition, on the socio-economic side, the company has created the Palabora Fund, which receives 3% of net annual profits ($15 million to date) in order to implement community projects within a 50 km radius of the mine. These projects are dominantly aimed at improving education standards, technical training, and job creation (PMC, 2000).

The government's concern with environmental protection is illustrated by the fact that mines in South Africa are subject to regular inspection, and inspectors have the power to suspend operations if

necessary. In addition, the government may refuse authorisation to mine if it considers that potential environmental risks outweigh the economic benefits of a project.

This is illustrated by the decision not to allow heavy mineral sands mining by Richards Bay Minerals (RBM), an affiliate of the Rio Tinto Group, near the St. Lucia Estuary. This is the largest estuarine system in South Africa, and has been recognised as a Wetland of International Importance under the Ramsar Convention (Heydorn, 1996).

RBM has a good record in the application of its mining technology and subsequent rehabilitation and revegetation of dunes sands. The latter comprises reshaping the dunes and replanting with a vegetation as close as possible to the original plant cover. In some cases this has allowed replacement of mono-species plantations by indigenous vegetation (Heydorn, 1996).

Despite this record, and a very thorough EIA, there was major public concern about the project, as doubts remained as to the effects of disturbance of the dune stratification on water seepage and replenishment of the lakes in the area, possible over-extraction of water from the main river feeding the estuary, and effects of the visual impacts on tourism amongst other things. In 1993 an EIA Review Panel decided against mining, a decision which was confirmed by the South African government in 1996 (Heydorn, 1996).
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**3.2 Zambia**

Zambia is the most dependent of African countries on its mining industry, dominantly copper-cobalt mining, which contributed 90 percent of export earnings in the mid-1990's, a situation unchanged from the 1960's. The stability of percentage contribution to export earnings masks the fact that the absolute value has varied markedly due to variations in world copper prices, and diminishing copper production in Zambia. The Zambian government nationalised the copper industry in 1968 and 1969, a policy, which was reversed in the 1990's. In addition to copper and cobalt, the Zambian mining industry also produces lead, zinc, gold, coal and precious and semi-precious stones (Draisma, 1998).

After the early 1990's when FDI flows to Zambia were between US$34 million and US$ 50 million, FDI flows rapidly increased to US$207 million in 1997 before falling to US$163 million in 1999 (Table 2). In the late 1990's the Zambian government privatised Zambia Consolidated Copper Mines (ZCCM), as well as other parastatal organisations, which contributed to the increase in FDI flows.

In the past, legal provisions and regulations for controlling the environmental impact of mining have been marginal in Zambia, despite the launching of the National Conservation Strategy in 1985 (Draisma, 1998). Mining companies had no obligation to observe environmental protection, and according to Draisma (1998) the government assured them that they would not be charged for remediation of any damage caused.

The 1985 National Conservation Strategy was the first step to protection of the environment, in that it laid the basis for future legislation. In 1990, the Environmental Protection and Pollution Control Act (Act No. 12 of 1990) was enacted, which made Zambia a frontrunner in this field in Southern Africa. The law provided regulations for environmental protection and pollution control as well as creating support institutions including the Environmental Council of Zambia (ECZ), which has a wide mandate including environmental impact assessments and monitoring (Draisma, 1998). In 1992, the Ministry of Environment and Natural Resources was set up, and the law started to be seriously implemented, although questions remain as to the capacity of local councils to police industry (Draisma, 1998).

In 1995 the government passed the Mines and Minerals Act, which regulates the mining industry. This act fails to address requirements such as environmental management adequately, as it is less stringent than the 1990 Environmental Act. In addition the Act has yet to be backed by mining regulations (www.hsrc.ac.za).

In 1996 it was announced that a new law on air pollution would be enacted, and that the ECZ would set emission levels for industry and control adherence to these limits. In the same year the National Environmental Plan, an Environmental Support Plan funded by the IUCN and World Bank, was launched (Draisma, 1998).

As far as physical environmental impacts of copper mining are concerned, air and water pollution pose major problems. HYPERLINK Air pollution includes dust from waste dumps and tailings, which has contributed to increased bronchial diseases, and from $CO_2$, NOx and SOx emissions from smelter stacks, as well as lead and cadmium poisoning near Kabwe. Water pollution is also a problem with some rivers having copper levels 80 times accepted levels in the early 1990's (Draisma, 1998).

In 1992, in response to government pressure and legislation ZCCM published an environmental policy plan and formed an internal environmental protection department a year later. The policy aimed to integrate sound environmental management in company strategy, minimise environmental impacts and remediate past degradation and satisfy standards higher than those laid out by the government. Government enforcement of regulations resulted in the company being fined for excessive $SO_2$ emissions in 1996 and 1997 (Draisma, 1998).

At the time of privatisation, the problem of the mature environmental liability of ZCCM mines and smelters was passed on to the government, as the opinion was that new owners should not take on responsibility for damage for which they were not responsible (McKay, 2000; Kabwe, 2001). This is confirmed by the development agreements between the government and the new owners, which exempt them from environmental liabilities related to the past activities of ZCCM. In addition the agreements allow for delayed compliance with the provisions of environmental plans drawn up by ZCCM, and environmental regulations. The role of the ECZ has also been limited as the owner may choose to refer a non-compliance dispute to a nominated expert (www.hsrc.ac.za).

With respect to the past environmental legacy it is interesting to note that the NGO, Citizens for Better Environment has drawn up a Copperbelt Environmental Programme in a joint effort with government, ZCCM and the World Bank, which is financing a US$50 million clean-up of hazardous waste left by ZCCM (Kabwe, 2001).

Since the privatisation of ZCCM, little data is available on environmental management by foreign investors. Konkola Copper Mines (KCM), now owned by a subsidiary of Anglo-American plc (UK based), is also partially financed by the IFC. The combination of the company's policy on environmental issues, and the FC loan conditions, means that environmental concerns will be treated seriously. Financial institutions providing credit or insurance coverage are commonly significant investors in mining projects. Potential environmental impacts of these projects are financial risks for the project backers, which has led to institutions adopting environmental evaluation and monitoring measures, as well as means of improving project environmental and social management. Since the mid-1980's, development banks, and providers of insurance coverage, have integrated environmental and social assessments as part of their lending programmes. Companies seeking financial backing are increasingly required to demonstrate their commitment and capacity to implement environmental best practice in order to obtain funds from institutions which finance projects in developing countries. This is the case for the IFC. In addition, although these institutions may only supply a small portion of the funding, their approval is often necessary to enable companies to obtain further funds (Warhurst, 1998).

KCM had to carry out a detailed audit including the preparation of environmental and social assessment and management plans and has had to implement mitigation measures, as a condition for obtaining IFC backing. These plans were made available to the public both in Zambia and internationally through the World Bank Infoshop prior to consideration of the project by the IFC Board of Directors. Currently, the company faces the problem that its smelter facilities use old technology, but aims to reduce emissions to comply with government standards within three years.

KCM has introduced community health programmes in co-operation with the WHO and Zambian government. A proposed resettlement programme is also being conducted under World Bank guidelines with the co-operation of the local communities.

As part of the overall privatisation of ZCCM, FDI-financed projects involving treatment of slag and tailings dumps have been commissioned. In the case of the former an overall investment of $100 million is envisaged in a high technology plant to extract copper and cobalt from existing smelter slag (Tassell, 2001a).

Both the slag and tailings treatment will have positive environmental impacts as they will reduce the concentration of contained metals in the dumps, thus diminishing the risk of heavy metal contamination of groundwater via seepage from the dumps. A second positive impact of the increase of FDI in the mining sector in Zambia will be the substantial decrease in SO2 emissions due to modernisation and upgrading of existing plant facilities. However, there is a downside, in that total copper production will eventually double (Tassell, 2001a), thus increasing natural resource use.

Privatisation of ZCCM has led to major social impacts. A case in point is the Kanshsanshi Mine, where population displacement was required, but consultations with the population were inadequate and there was no compensation. It should be noted that there are no provisions in this respect in the 1995 Mines and Minerals Act (www.hsrc.ac.za).

One of the major indirect impacts of mining in Zambia has been urbanisation of the population, with the country being the second most urbanised in sub-Saharan Africa. This has largely been the result of the establishment and growth of mine towns. These towns are facing serious health and environmental problems, including collapse of waste collection systems, cholera and typhoid (Draisma, 1998). Prior to privatisation, the mine towns relied directly on ZCCM for provision of essential services. The new owners consider this to be a function of central or local government, which often lack the capacity for adequate provision of services. In order to address the problem the Zambian government and ZCCM have created a company to manage water and sanitation services on a cost-recovery basis, but as yet results are poor (www.hsrc.ac.za).

**3.3 Ghana**

The mining industry in Ghana is dominated by gold, of which it is the second largest producer in Africa, and of which it has been a leading exporter since the 16$^{th}$ century (Morris, 1996). Other important mineral commodities include bauxite, manganese and diamonds (EIU, 1999b). Mining is a major earner of foreign exchange for Ghana, and contributes about 5,5% to GDP. In 1996 gold and bauxite mining contributed 46% of Ghana's foreign exchange earnings (Aubynn, 1997). It is also a major recipient (approximately 60%) of foreign investment.

FDI in Ghana increased rapidly from US$ 15 million in 1990 to US$233 million in 1994, and then decreased to US$17 million in 1999 (Table 2). The data for 1999 is subject to caution as the World Bank World Development Indicators for 2001 cite US$ 17 million, whereas UNCTAD (2000) quotes a figure of US$115 million.

In Ghana the Ministry of Mines and Energy supervises the mining industry. The environmental aspects of mining are directly regulated by the Environmental Protection Council Decree of 1974 and Mining Regulations of 1970. The Minerals and Mining Law of 1986 makes provision for environmental protection and pollution prevention (Acquah, 1995). Under the 1996 Minerals and Mining Law the Minister of Mines and Energy is responsible for regulations restricting mining activities near water bodies, preventing water pollution amongst other things. The 1994 Mining and Minerals Regulation are meant to prevent permanent environmental damage by mining and encourage sound stewardship (Vormawor and Awuku-Apaw, 1996). The regulation has three parts including guidelines for exploration, mining, processing and decommissioning, guidelines for preparation of an EIA for new projects and guidelines for preparing and Environmental Action Plan (EAP) for existing projects. Both EIA's and EAP's are made available to the public. The EAP has to be submitted for approval by the Environmental Protection Council (EPC) every two years.

Concerning environmental legislation, a Ministry of Environment, Science and Technology was established in 1993. In 1994 the EPC, which was an advisory body, was transformed into the EPA (1994 Environmental Protection Agency Act) which has powers of enforcement and control. This act also establishes a National Environment Fund whose sources of income include grants from the government, levies collected by the EPA, donations and gifts. The aims of the fund include environmental education of the public, research and investigations related to the functions of the EPA, and human resource development (Vormawor and Awuku-Apaw, 1996)

Enforcement mechanisms in the mining industry include termination of prospecting licenses in cases of non-remediation and of bad environmental practice. The Chief inspector of Mines can effect appropriate measures if a mining company does not comply with environmental requirements, and

recover the cost from the company. In extreme cases the mining lease can be terminated. Directors and officers of companies can be held liable for environmental offences of their companies (Acquah, 1995).

Available data does not permit an assessment of mining company compliance with environmental regulations, or the actual enforcement of the law by the relevant authorities. However, according to Anane (undated) there have been at least two cases of clear infringement of environmental regulations in other industries (illegal importation of toxic waste, and air pollution by an asbestos products factory) in which no punitive action was taken. This could indicate either a lack of willingness, or a lack of capacity in this respect.

HYPERLINKCompanies are required to submit an annual environmental report, as well as copies of audits undertaken. These audit reports are not available to the public (Acquah, 1995).

It is worth noting that Ghanaian government does not have an exclusively regulatory approach to the environment, but also relies on economic measures to promote environmentally sound practices. Owing to the lack of environmental standards in the mid-1990's, WHO, World Bank and EC measures were used (Acquah, 1995).

Since minerals are non-renewable resources, a Mineral Development Fund was set up, whereby 10 percent of all royalty payments are recycled to mining areas to provide local infrastructure, and invest in other non-mining forms of development. A further 10 percent are used for financing regulatory institutions and the Geological survey (Acquah, 1995).

Environmental impacts of large-scale mines include visual effects, vegetation loss, water and atmospheric pollution and effects on local health.

Mineral extraction and processing are responsible for 10 percent of Ghana's industrial pollution. As far as air pollution is concerned this is due to $SO_2$, $As_2O_3$, NOx and particulate matter emissions. For example $SO_2$ and As emissions at Obuasi (Ashanti Goldfields, a Ghanaian company whose major shareholder is London-based. The mine is partially financed by IFC) are 1000 times higher than any world standards (Aubynn, 1997). In the case of water pollution, the major problem is the use of mercury by artisanal miners, river diversion and disposal of wastes in rivers by these miners (Aubynn, 1997; Morris, 1996). Formal large-scale mining has also contributed to water pollution, and companies have supplied wells and pumps to local inhabitants to ensure them an alternative drinking water supply when required. However, the responsibility for maintenance costs of these wells is currently a contentious issue (Mate, 1998).

There are also negative social effects that need addressing, including displacement from land and loss of livelihood for women subsistence farmers, mining related diseases, and deforestation (Aubynn, 1997; WRM bulletin 41, 2000; Drillbits & Tailings, 22 December 2000). Land use issues are particularly important as the main gold producing areas coincide with major logging and agricultural zones. In some cases, mining operations have disrupted local economic activities. Farmers have generally been given cash compensation for crops and loss of livelihood, but not similar land and the means to continue farming. In the Tarkwa area this caused community protests in 1996 (Mate, 1998).

In most cases these problems are being addressed, and in the case of Ashanti Goldfields at Obuasi , the company is in advance of environmental regulation in the country (Vormawor and Awuku-Apaw, 1996). In the case of Ashanti, a loan from the IFC was conditional on an environmental audit, which detailed technological and managerial requirements necessary to improve environmental performance. Recent research appears to show that improvements in environmental management at Ashanti are driven more by these loan conditions than legislation (Warhurst, 1998).

The introduction by Ashanti Goldfields of a new gold extraction technology, bacterial leaching, which obviates the need for cyanide treatment, is a positive step as it is environmentally cleaner (Acquah, 1995; Morris, 1996). The introduction of this technology occurred as a result of recapitalisation of the company during privatisation, and thus does show improved environmental performance directly linked to FDI in the sector.

The EPA publishes an annual categorisation of mining companies on the basis of their environmental management practices. This takes into account compliance, reporting, reclamation plans and bonds and social policy of the companies. The relevant weighting of these factors is unknown. The rating consists of five categories, A to E, from best to worst. In 2000, only one company received a B rating with the others rated C to E (www.epa.gov.gh).

Exploration and mining in Forest Reserves in Ghana is currently a major environmental issue. In 1996, the government placed a moratorium on exploration in these areas, but due to the fact that exploration had previously been allowed, some companies had invested in delineating resources in these areas. To resolve the problem, the government authorised 17 companies, which had spent the most on exploration in the Forest Reserves, to continue work, subject to strict environmental guidelines. The situation is still problematic as several companies have advanced their projects to a stage where a decision can be made on mining, which is not allowed under present laws. The Ghana Chamber of Mines has formulated guidelines for mining in the Forest Reserves, which are now subject of discussion between the various stakeholders (Tassell, 2001b).

Nevertheless, Ghana does face severe environmental problems related to mining, many of which are related to artisanal mining (Box 1). In 1989, artisanal mining was legalised, but the use of outdated machinery and techniques and lack of administrative supervision are causing environmental degradation. Although this type of mining does not involve FDI, it is mentioned here, as the problem does need addressing. In this respect, the Ghanaian authorities should envisage providing more technical assistance to artisanal miners, particularly where environmental protection is concerned.

**Box 1: Artisanal Mining**

Up to 3,5 million people are active in the artisanal and small-scale mining sector in Africa (Zamora, 1999). There is no recognised definition of the terms small-scale and artisanal mining, but commonly they are subdivided into formal small-scale mining, and informal artisanal mining (Peake, 2000).
Artisanal mining is often carried out in a primitive manner using hand tools, and its principal characteristics are (Labonne and Gilman, 1999; Peake, 2000):

- Little or no mechanisation
- Labour intensive
- Low safety
- Untrained personnel
- Migrant labour
- Low pay and/or earnings
- Low productivity
- Lack of capital
- Little or no consideration of environmental impacts
- Mining of richest parts of deposits, which may render the remainder unprofitable
- Exploitation of minerals requiring little treatment, and yielding readily saleable products such as gemstones and gold
- Unknown reserves.

Artisanal mining is commonly illegal, with the miners having no formal property rights. In Ghana legal and illegal artisanal mining coexist (Tassell, 2001b). Currently as many as 40 000 miners, of whom some 11 000 are legal, are involved in artisanal mining activities in Ghana. (Acquah, 1995; Mate, 1998). Annual gold production by artisanal miners in Ghana is about 160 000 oz (about 5 tonnes; Tassell, 2001b), which is equivalent to 6,8 percent of total production. In Mali, artisanal mining production is about 2 tonnes per year (8,4 percent of total production in 1999).

It is generally accepted that artisanal mining is adopted as a last resort subsistence activity in the face of extreme poverty, lack of other employment opportunities and in some cases food shortages (Bullington, 2001; Labonne and Gilman, 1999; Parsons, undated). In West Africa, artisanal mining is commonly a dry season activity, as the inhabitants turn to farming during the rains. However, there are also sites where it is a year round activity.

The sector can contribute meaningfully to the economy by stemming migration from rural to urban areas, by its contribution to foreign exchange earnings, and by enabling the exploitation of reserves that may be uneconomic for large scale mining (Jennings, undated).

Due to lack of regulation and technical capacity artisanal mining can cause severe environmental damage including river diversion, mercury contamination, increased sediment loads in rivers, deforestation, removal of vegetation, river bank degradation and the abandonment of open pits and trenches which pose a danger to livestock and wildlife (Parsons, undated).

There also major social problems associated with the activity, including high accident rates in the mines, high rates of HIV infection, land conflicts caused by the presence of large transient populations, crime, poor sanitation and child labour. At the Koma Bangou site in Niger, at least 40 000 people are involved in mining gold, and a limited survey of prostitutes (50 out of 2000) revealed that 2/3 were HIV positive. Health problems are commonly exacerbated by the lack of health services at artisanal mining sites (Bullington, 2001, Labonne and Gilman, 1999). In a study of salt and soda ash artisanal mines in Niger, it was revealed that 47,5% of the workers were children (ILO, 1998).

A major problem in dealing with problems related to artisanal mining, is it commonly occurs in the poorer countries of the world, which lack the resources to regulate the sector effectively (Parsons, undated). As a result of this, the international community started addressing the issue of artisanal mining with the publication of the Harare guidelines in 1993, which were supplemented during a meeting in Calcutta in 1996. The UN, the ILO and the World Bank are in trying to deal with the issues of small-scale mining. Efforts have included an ILO meeting in 1990, which recognised the importance of the activity, and called for various forms of assistance to the sector. In 1993, a UN organised seminar agreed on the Harare Guidelines for small-scale miners, development assistance agencies and NGOs. In 1995, the World Bank ran a Round Table on Artisanal Mining which called for an integrated solution involving government, NGOs, miners' associations, donor organisations and international mining companies (Zamora, 1999).

This resulted in a strategy which aims to establish enabling conditions for artisanal mining, alleviate technical and financial constraints, and ameliorate environmental performance and the living and working conditions of miners.

In 1996 further recommendations were outlined at a conference on small-scale mining in Calcutta, and in 1995, the World Bank created the 'Consultative Group for Artisanal and Small-scale Mining' (CASM), whose aim is to assist the World Bank in reducing poverty, particularly in rural areas (Zamora, 1999).

However, according to Jennings (undated) efforts to date have been concentrated on technical assistance and have failed to address basic economic and social issues. In addition the sector is generally low on government priorities. Specific attention needs to be paid to ensuring land title and property rights, access to finance, labour and social issues, living and work conditions, decreasing environmental impacts, and improving technical and business skills.

In 1989, The Ghanaian government legalised small-scale mining and started implementing a policy involving simplified licensing and technical assistance by the government (Acquah, 1995; Zamora, 1999). In order to provide assistance to legal small-scale miners, the Ghana Chamber of Mines plans to develop closer links with them. In addition certain bigger mines in the formal sector have yielded areas of their concessions to small-scale miners in order to foster good relations (Tassell, 2001b).

In Mali, artisanal miners are required to be in possession of an annually renewable artisanal mining permit ("l'autorisation d'exploitation artisanale") which is not a property right. Artisanal mining comes under the administration of local authorities. The government has set aside specific areas ("couloirs d'orpaillage") which are reserved for artisanal mining, although mining companies may operate in these areas, with the accord of local and authorities. Artisanal mining is also tolerated in areas where no mineral rights have been granted, or if agreed to by the licence holder (Ordonnance N° 99-032/P-RM du 19 Août 1999). The Malian approach is common in much of francophone Africa.

The South African government treats all types of mining equally under the law. However, it has recognised the potential for small-scale mining (including artisanal mining) to contribute to economic

development, and to this end created the National Small-scale Mining Development Framework in 1999. Its aim is to provide administrative and regulatory guidance, and technical and financial assistance to small-scale miners. The framework is run by a National Steering Committee, whose policy is to allow no compromise on environmental and health and safety standards, and therefore provides assistance in this respect. The cost of the assistance is recovered once a project is viable and generating sufficient income (NSC, 2000).

### 3.4 Mali

The mining industry in Mali was dominated by artisanal mining for gold and to a lesser extent diamonds for hundreds of years. Due to changes in the legal and fiscal framework for investment the country experienced a gold rush in the early to mid-1990's (EIU, 1996a), although other sectors also attracted some investment. Activity has diminished as a result of declining gold prices and the inability of junior mining companies to raise equity finance, nevertheless two additional major mines (Yatela and Morila) have come into production in the last two years. As a whole the country is still relatively unexplored, and is considered to have potential for bauxite, manganese, base metals and lithium. In 2000 Mali was the third largest gold producer in Africa.

Gold is the second most important export earner in Mali contributing to 37 percent of foreign exchange earnings (www.izf.net). The effect of recent investment in gold mining in Mali is apparent in the increase in production from 4,6 tonnes in 1991 producing 23,7 tonnes in 1999 (EIU 2000c), of which artisanal mines contributed about 2 tonnes.

Other minerals exploited in Mali are phosphates, marble and kaolin (www.izf.net).

Foreign direct investment in Mali was characterised by net outflows in 1990 and 1992. FDI increased to $111 million 1995 and $84 million in 1996, but then decreased to $40 million in 1999 (Table 2). FDI contributed 85,1% of the average inflow to Mali from 1990 to 1998, and 72,5% in 1999. The importance of the mining sector in attracting FDI is indicated by the fact that in the period 1996-2000, 105 non-mining projects attracted 12,47% of FDI, whilst four mining projects attracted the remaining 87,53% (calculated from figures from "L'Essor, 11/7/2001")

The 1999 mining law (Ordonnance N° 99-032/P-RM du 19 Août 1999) is the main law regulating mining activities in Mali. As far as environmental protection is concerned, it stipulates the requirement of an EIA prior to the granting of a mining license for a large-scale mine. The EIA is subject to annual revision and updating. In addition companies are required to provide for a rehabilitation fund, generally in the form of bank guarantees. Non-compliance with obligations related to environmental protection and rehabilitation can be sanctioned by withdrawal of the license. Environmental protection in mining areas is monitored by agents of the Mines Department, in liaison with the Ministry of Environment. These agents have the authority to oblige operators to respect environmental conservation measures. Mine operators are required to submit annual environmental reports to the Director of Mines. The law also requires restoration of sites disturbed by exploration in certain cases. Malian law discriminates between large-scale, small-scale and artisanal mining. Small-scale and large-scale mines are distinguished on the basis of production and reserves. Small-scale mines are not subject to EIA, but are required to submit a report on the state of the environment as well as envisaged protection measures prior to granting of a license, as well as an annual report on the environment. Both large and small-scale mines are required to rehabilitate the site at mine closure. To date there is no data available on the actual enforcement of the law.

The government is currently drawing up regulations concerning mine closure, and is likely to follow World Bank recommendations in this respect. If these recommendations are followed by the Malian government, rehabilitation will probably mean returning the soil to a state in which it can support pre-mine usage, eliminating any negative effects on nearby water resources, maximum use of waste material in rehabilitation, and contouring and revegetation, where possible with indigenous species, of waste dumps to minimise erosion. Financial provision for closure and rehabilitation is already required under the Mining Law.

The Sadiola mine, a joint venture between Anglogold (South African), Iamgold (Canadian), the Malian government and the IFC came on stream prior to the new Mining Act. Nevertheless, the project

operator conducted an EIA, which emphasised a participatory approach. A major issue identified by the local inhabitants was the potential withdrawal of groundwater. A decision was made to pump water from the Senegal River via a 56 km long pipeline. In response to security concerns and the concerns of Peul nomadic herdsman, who feared that a raised pipeline could impede the movement of their livestock, the pipeline was buried for its entire length. As part of the social measures introduced by the company, boreholes used in the construction phase of the project have been equipped and passed over to local villages to improve their water supply. They are regularly monitored (Mining Environmental Magazine, 1997).

In addition the company has drawn up and implemented a Safety, Health and Environmental Policy, based on ISO 14001, and currently has five staff covering environmental protection, including one dedicated to social issues.

The operator of the Sadiola mine, Anglogold, is also applying similar policies at its other Anglogold mines in Mali (Anglogold Annual Report, 2000). In this respect the company appears to have a strong commitment to high standards of environmental management, with the executive officer for the environment reporting directly to the CEO. This commitment has been recognised by the Dow Jones Sustainability World Index, which rates Anglogold as a Sustainability Leader in the precious metals sector on the basis of corporate sustainability in terms of economic, environmental and social policies (Infomine's Headline News Digest, December 8, 2001).

In 2000, at the Sadiola mine the annual audit confirmed compliance with commitments in the EIA and EMS, and an EIA has been completed for Yatela. At Morila site-wide environmental monitoring was introduced in order to facilitate compliance with EIA commitments (Anglogold Annual Report, 2000). The extent to which the companies commitment to environmental management has been reinforced by the conditions attached to IFC financial backing of the Sadiola project, is unknown, and is a subject which requires further study.

In general, IFC environmental and social leverage consists of obligations for the borrowers to draw up, and commit themselves to implementation of environmental and social management plans acceptable to the IFC as part of the loan agreements. Disbursement of loans may also occur on stages and be dependent on fulfilment of environmental commitments. IFC environmental staff carry out regular monitoring visits to IFC backed projects.

**3.5 Tanzania**

The mining sector, although small, contributes about 2,3% of GDP and is an important earner of foreign exchange (www.tanzania.go.tz). Recent investment, particularly in gold mining and exploration have led to the rapid expansion of the sector, and Tanzania is now on target to become an important producer in the African context. Other mineral resources include diamonds, coloured gemstones, coal, salt and limestone (EIU, 1997c. See Table I.3).

FDI flows were non-existent in the early 1990's, but changes in the investment laws have led to an increase from US$ 12 million in 1992 to US$ 183,4 million in 1999 (Table 2). In 1996 the Tanzanian government issued a New Investment Policy, which was followed by the Tanzania Investment Act No. 26 of 1997. The main aims were to increase the transparency of the legal framework, deregulate the investment process, create a one stop investment agency and provide for transferability of capital and profits. In addition as far as fiscal measures are concerned, the mining industry is subject to a 30% corporate tax, no customs duties or sales tax on capital goods, 100% deduction allowances on capital goods, and a 10% withholding tax on dividends (www.tanzania.go.tz). In the period 1990-1998 34 new petroleum and mining projects, of which 22 were foreign owned, were approved, and accounted for 6,4 percent of total investment (www.strategis.ca).

As well as promoting private sector led mineral development, a major aim of the Mineral Policy of Tanzania, 1997, is to ensure that the wealth generated from mining supports sustainable economic and social development, and to minimise or eliminate adverse social and environmental impacts of mining activities (www.tanzania.go.tz).

To achieve this, mining in Tanzania is regulated by the 1998 Mining Act and the Mining (Environmental Management and Protection) Regulations of 1999, which are administered by the

Ministry of Energy and Minerals. The Act requires commissioning of independent consultants of international standing selected by the project proponent and approved by the Government to carry out environmental impact assessment (EIA) on the proposed mining operations. The project proponent must produce an Environmental Management Plan acceptable to the Government. Approval of a project involves screening, scoping, EIA and EMP evaluation by government experts. In addition relevant Regional Administration, Local Government Authorities and the public are consulted and their opinions taken into account during the approval process. The approved EMP is subject to a first review by the government after two years, and thereafter every five years (Ngonyani, 2000).

In the case of the Geita mine, a major recent investment by Ghanaian and South African companies, the EIA and EIS (Environmental Impact Statement) were submitted for approval in January 1999, prior to the Minerals Act becoming operational. A South African company undertook the EIA, and all relevant local authorities and agencies were consulted. Since the mine is located in the Lake Victoria Basin catchment area and inland drainage system, it is a particularly sensitive project. In addition, a river, which cuts across the old Geita tailings dam contains background levels of certain metals, close to those stipulated in the regulations. As a result discharge of any hazardous chemicals including cyanide into the river was excluded. Both the engineering design of the mine and the EMP took account of the topography, geology and distance of the mine perimeter from the lake (26 km). Monitoring of groundwater around the tailings dam and the processing plant was a critical aspect of the EMP, and necessitated the sinking of monitoring boreholes (Ngonyani, 2000). Currently there is no data available on compliance with environmental laws.

The Licensing Authority approved the EMP, once it was satisfied by its efficacy in protecting and managing the environment, including the biodiversity of the Lake Victoria Basin. Measures to be taken to prevent seeping or spillage and possible cyanide contamination included diversion of a river from both the old tailings dam and the newly designed tailings dam, recycling of tailings dam water back to the processing plant, and lining of the tailings dam with high density plastic liner to prevent seepage and leakage in the event of poor civil construction or seismic activities. The current mine operators have established a monitoring system at Geita Mine, which includes boreholes around the tailings dam and a decant facility. Initially samples were collected and analysed every two weeks, but this is now done on a monthly basis. Two Inspectors of Mines based at Geita carry out supervision by the Ministry of Energy and Minerals. They monitor mining activities, inspect and enforce the environmental management and protection regulations, and occupational health and safety regulations (Ngonyani, 2000).

The other major mine due to come on stream in the near future, Bulhanyulu, has been partially financed by the IFC, and as such will be required to adhere to strict environmental considerations (see sections 3.2 and 3.3 which briefly outline the role of institutions such as the IFC in this respect).

**3.6 Kenya**

Of the six example countries, Kenya has the least developed mineral industry, with production dominantly in industrial minerals, which contributed 0,14% of GDP (EIU 2000e; Table I.4). However, a recent mining project, could attract at least $137 million (construction phase costs, www.Tiomin.com) of FDI.

In the 1990's the Kenyan government implemented a series of policy measures to improve the investment climate, and FDI has increased from the 1985-1995 average of US$26 million to US$42 million in 1999 (UNCTAD, 2000; Table 2).

Until 1999 environmental concerns were inadequately covered by existing legislation in Kenya, even though there were legislative acts regulating environmental pollution. These include the Agriculture Act, the Planning Act, the Town Planning Act and Local Government Act, the Public Health Act, the Forest Act, the Water Act (though there is provision to ensure control of water pollution, there are no set national effluent standards). Regulation of air pollution remains ambiguous as there is little detail in laws concerning this. Major problems with pollution control in Kenya is the conflict or lack of co-ordination between the various authorities regulation activities, lack of enforcement of existing rules and regulations due to lack of budgetary allocation, bureaucratic inertia, lack of political will and corruption (Nasong'o and Gabsa, 2000).

Of overriding importance in this respect was the lack of a comprehensive national environmental policy, as there are environmental policies in more than five different sectors as well as various regional authorities, all of which operate without co-ordination (Nasong'o and Gabsa, 2000). A National Environmental Management and Co-ordination Act envisaged in the 1980's was finally tabled in parliament in 1999 and has been enacted. This act stipulates that prior to mining, the company must submit an EIA in order to obtain an environmental permit and a mining lease from the Ministry of Environment and Natural Resources.

Currently FDI does not play a role in the Kenyan mining industry, but the Kwale mineral sands project, which could involve investment of up to $225 million, was recently approved, and the sector will become a significant recipient of FDI. The project is discussed in some detail below, as it highlights important aspects of environmental management in the mining industry in Sub-Saharan Africa.

The Kwale project (Canadian investor) is highly controversial, but the government, which supports the project, appears to have been dismissive of public complaints. The proposed mine sites are in a fragile ecosystem in Kenya's coastal forest, which is listed as one of the world's 25 hotspots by Conservation International (www.miningwatch.ca).

Tiomin commissioned an EIA for the Kwale project, based on terms of reference which complied with World Bank standards, the Kenyan EIA guidelines and the Environmental Management and Co-ordination Act (www.Tiomin.com).

An independent South African company co-ordinated the EIA. After scoping, preliminary terms of reference were submitted to the District Environmental Committee for comments and approval in April 1999. Throughout the preparatory stages of the project (1996 to 1999) Tiomin consulted with relevant authorities (159 meetings) and local communities (55 meetings). The EIA was subject to a three months public review period, during which time meetings were held with affected parties (www.Tiomin.com).

Despite the fact that the EIA is in accordance with Kenyan law and World Bank standards, project opponents criticise the study as not going far enough (Mugo, 2001), as an independent study by Kenyatta University raised questions as to the possibility of ignored environmental impacts. However, Tiomin has questioned the validity of this EIA, as certain assumptions concerning the project are inaccurate. The International Union for the Conservation of Nature (IUCN) has also raised a number of points on the company backed environmental assessment and pointed to a number of shortcomings (www.ichrdd.ca).

The project will require displacement of 450 farming families. The company promises to return the land after 21 years, but certain opponents maintain that it will take a further 10 to 30 years to return to productivity. The company negotiated comprehensive compensation and rental agreements with landowners, but these are now being denounced as insufficient. In this respect it should be noted that inhabitants with no land title were not included as company considered them to be squatters and therefore a government problem (www.miningwatch.ca).

Compensation agreements were based upon individual property valuations made by a registered Kenyan Land Valuer. The compensation package included a base payment per acre, a payment for land improvement in function of the agricultural development of the properties, and an annual lease per acre, which is to increase by 10 percent per annum throughout the life of the project (Tiomin reply to the ICRHDD; www.ichrdd.ca).

Latest developments on this project are that the Kenyan parliament was to debate the possibility of revoking the mining license, due to lack of clarity on compliance of the EIA with local and international environmental standards. Local residents have also introduced court action to stop the project (Drillbits & Tailings, 30 June 2001).

Lack of communication is also a problem, as is illustrated by the organisation, by opponents of the project, of a conference of all stakeholders in June 2000. Despite being invited, representatives of the company did not attend (www.ichrdd.ca). However, the company maintains it did not have sufficient notice to attend the meeting, but did attend a follow up meeting the next day (Tiomin reply to the ICRHDD; www.ichrdd.ca).

### 3.7 Discussion

Environmental impacts of FDI have traditionally been analysed in terms of structural, scale, technology and regulatory or policy effects, an approach that will be adopted to a large extent below, bearing in mind that there is a scarcity of data on sectoral FDI flows and the environmental impacts of mining related to these flows in Sub-Saharan Africa. The social impacts of FDI in the mining sector will also be discussed.

***Structural effects.*** Positive structural effects occur when the target of FDI is an activity involving less environmental pressure than previous targets, such as a shift from manufacturing to services (OECD, 1997). As this paper is concentrating only on the mining industry, the main structural effect that could occur is the replacement of artisanal and small-scale mining by large-scale projects. As far as the countries in this study are concerned this has occurred at Sadiola in Mali, however at this stage it is not possible to assess whether the effects are positive or negative.

***Scale effects.*** Scale effects can be positive if the economic growth engendered by the investment results in increased demand for environmental goods and if the economic benefits are used to remediate environmental problems. Negative scale effects can occur in the absence of regulation or environmental management measures, as well as through increasing consumption of natural resources, generation of wastes and scale of operations (OECD, 1997).

As South Africa already has a large home grown mining industry, and as FDI plays a small role in overall investment in the sector, any negative scale effects of FDI are probably small. However, in the other five countries, FDI has and will continue to play an important role in the development of the mining industry. In particular, it has led to development of both greenfield sites and increases in mining and mineral production at existing operations. This has the obvious corollary of a concomitant increase in the generation of mining and processing wastes. At this stage it would seem that in this respect the environmental impact of FDI has been negative.

However, there have also been some positive effects such as in Zambia, where, as far as scale effects are concerned, the treatment of existing slag and tailings on old mining sites, may reduce the potential for metal contamination of soil and water, which would be environmentally positive.

***Technology effects.*** Technology effects can be positive benefits from the use of environmentally friendly technology (OECD, 1997). Abugre and Akabzaa (1998) consider that there is little potential for technological diffusion from investment in mining, as mines are essentially low-technology earth-moving operations, particularly where open pit operations are concerned. In this analysis, the term mining industry is not confined to the actual extraction phase of a mining operation, but also includes ore treatment and metallurgical processing, where the potential for technology transfer exists.

Due to the fact that the South African mining industry is one of the most developed in the world, and much of current mining technology has been developed locally, technological effects are likely to be small in mining *strictu senso*. Potential positive spillover is far more likely to occur in mineral processing and finished product manufacture, where foreign investors may introduce environmentally friendly technology. Lack of data precludes a judgement of this issue.

In Zambia, technological effects should be positive, as old technology is being upgraded at processing plants, and new equipment is being imported for some of the mining operations. The positive technological effects may be limited on those mines that are replacing equipment with refurbished second-hand equipment, as is the case at Chibuluma South (South African investor) where most components of the processing plant were bought second-hand and refurbished (Tassel, 2001c).

In Ghana, it is evident that positive technological spillovers have occurred with the introduction of environmentally friendly bacterial leaching of gold at some operations. The increased gold production, does of course imply increased use of the natural resource, however if wisely used, the Mineral Development Fund can replace this environmental capital and contribute to sustainability of economic development in mining areas.

It is currently to early to assess these effects in the remaining example countries, as their mining industries are either in the early stages of development, or have only recently attracted FDI.

***Regulatory and/or policy effects.*** Positive regulatory and/or policy impacts occur from the potential improvements in regulation. On the other hand, these impacts can be negative if there is a tendency to non-application or relaxation of regulation (OECD, 1997).

In the case of South Africa, the country has strong regulation and institutions with a long experience of effective supervision of the industry, as well as a government willing to forego potential economic benefits in the presence of doubts about the environmental impacts of mining development, as is illustrated by the Richards Bay Minerals case discussed in section 3.1. It is therefore unlikely that FDI in the sector will have negative regulatory or policy effects.

It would seem, however, that at worst, the commitment to the environment of foreign investors in the South African mining industry is to stick to current rules and regulations. In some cases there is an obvious attempt to do better (see Palabora Mining Company in section 3.1 above) and as such FDI may be having a small positive regulatory effect in the country.

In Zambia, regulatory effects of FDI are apparently negative, as it seems as if the government has relaxed vigilance in order to attract investment. This is particularly apparent in the development agreements discussed in section 3.2. It will also probably be necessary for the government to enhance its institutional capacities, and to ensure that its willingness to bring ZCCM to account in the recent past is also applied to the new owners.

It is encouraging to note that the environmental legacy of past mining is being addressed, as discussed above. However the costs of such remediation will probably mean that Zambia will need further outside financing of such initiatives.

In Ghana, the available data would also seem to indicate that some mining operations financed by FDI, in particular where IFC financing is present, are applying environmental standards in advance of those required by law, which may indicate that a race to the bottom is not occurring. Nevertheless, according to Abugre and Akabzaa (1998) there have been cases of lack of enforcement of EIA's and EMP's. It is possible that these are a result of lack of institutional capacity. Shortcomings also exist in the approach to impact assessment of mining projects in Ghana, particularly the lack of public consultation, and inadequate social impact assessment (Morris, 1996).

In addition clarity is required as to the governments attitude to mining activities in forest and nature reserves. The long-term benefits from sources of income such as ecotourism and biodiversity in these reserves should be balanced against shorter-term benefits from potential mines. The fact that environmental impacts will not only be directly related to the mine, but may occur as a result of increased access to the reserves must be considered. By allowing continuation of activities after the 1996 moratorium, the government would have given companies the expectation that in the case of an economic discovery, mining of the deposit would be permitted. If this is not the case, it is possible that the companies concerned will seek compensation for their investment to date. It would seem that in this case lobbying by foreign investors to continue their activities in the reserves is exerting downward pressure on environmental standards.

In Mali, foreign mining companies have until now been in advance of local legislation, probably in part due to leverage by institutions such as the IFC, but also due to the commitment of certain companies to good environmental management. Currently, therefore, it would seem that FDI is not having negative regulatory effects in the country.

In Tanzania it is too early to assess the environment-FDI linkages in the mining sector, but from the case study illustrated above it would appear that the government is taking a rigorous approach to enforcing environmental regulation and policy.

The Kenyan example illustrates several issues confronting Sub-Saharan countries with respect to the mining sector. It is the first major minerals development in the country, and it is therefore unlikely that Kenya has the necessary capacity or expertise to assess the issues (Mugo, 2001). The government has been resolutely pro-economic development, and has failed to take into account public hostility and

potential environmental costs. Communication between the project operators and the public appears to have been poor. At this stage it would seem that FDI in the mining industry in Kenya has had negative regulatory effects.

***Social impacts.*** For historical reasons South Africa has developed a culture of taking into account social impacts and of carrying out meaningful public consultations in recent years. Such approaches are commonly lacking in other Sub-Saharan African countries.

Privatisation of the Zambian copper mines has obviously had negative social effects (see section 3.2), partly because of lack of provision for social aspects of mining in the 1995 Mines and Minerals Act, and partly due to the fact that mining companies do not treat socio-economic impacts as equals of physical environmental impacts in environmental management (www.hsrc.ac.za).

The attribution of mining licenses to foreign investors for large-scale mining projects can potentially cause loss of livelihood for artisanal miners in cases where they are displaced by these projects. Currently there are several approaches to this issue in sub-Saharan Africa. In South African such conflicts should theoretically not arise, as all mining activities require licenses which confer exclusive rights to the license-holder. In Mali, the governments approach has been to set aside specific areas for artisanal mining as discussed in box 1 above. As far as Ghana is concerned (see box 1), some large-scale operations have allowed artisanal miners to continue their activities on certain areas of their mining licenses in order to avoid conflicts .

Loss of livelihood for subsistence farmers is one of the main social problems in Ghana, and investors will need to pay more attention to the issue in the future.

There are little data on social impacts of mining in Mali and Tanzania at present, however it would seem that in the case of the Sadiola mine in Mali, the issue of resettlement was addressed thoroughly.

In Kenya, the main problem facing the development of the Kwale mineral sands project is that of displacement of the local population from their lands. Again this is an issue to which investors need to pay attention.

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## 4. Conclusions and recommendations

Lack of data concerning both FDI and environmental impacts of mining in sub-Saharan Africa precludes a detailed analysis of the environmental linkages to FDI. However, from the above examples there is evidence of some companies striving to improve performance in advance of government regulation. Companies are also introducing new technology and refurbishing existing installations, which will result in better environmental performance. This would seem to indicate that FDI in the sector is in some cases leading to improved environmental management practices.

However, there is evidence to indicate that there are negative regulatory effects in some of the example countries. It is also evident that lack of institutional capacity, finance and in some cases political will, as well as lobbying by investors, is hampering efforts of host country governments to implement effective environmental regulation. In addition, social impacts of FDI in the mining industry have also been negative in some cases.

A major problem facing sub-Saharan African countries is environmental management of artisanal and small-scale mining. Part of the problem is due to the fact that many governments tend to establish different legal requirements in function of the size or type of mining activity. The notable exception to this rule is South Africa, which considers that mining regulations must be applicable to all mining operations including artisanal mines. This may imply support by government institutions in assisting small-scale and artisanal miners in managing the environment. As stated above, Malian law does not require an EIA for small-scale mining, and this could lead to major environmental problems if the potential for the development of such mines is full realised. Problems will also arise should a small-scale mine, by virtue of the discovery of increased reserves or increased production be reclassified as a large-scale mine. Will the company concerned be liable for environmental damage that may have occurred previously even if its operations obeyed the law, or will this be a liability for the government?

It has been suggested that resource-seeking FDI may be particularly influenced by differences in environmental costs (OECD, 1997). In this respect it is important to note that decisions by companies to explore for minerals and eventually mine in a given country are dominantly influenced by the fiscal regime and geological potential of the country concerned. The fact that certain governments appear to have relaxed regulations in order to attract investment, may indicate that the governments concerned consider enforcement of strict environmental regulations to be a hindrance to investment, or be a result of investor pressure. At this stage there are insufficient data to determine the causes, and this subject requires further investigation.

Another problem in Sub-Saharan Africa is that although environmental laws have been enacted, the actual decrees and regulations setting environmental standards are promulgated only after a long delay.

In the light of the above, host, OECD countries and the mining companies themselves could take the following measures in order to ameliorate environmental management in the mining sector in Sub-Saharan Africa.

***Host countries***

1. As pointed out above, sub-Saharan African countries are currently enacting, or have recently enacted, environmental protection legislation. However in some cases regulations defining the application of the law have yet to be written or promulgated. In some cases the delays may attain several years (for example in Cameroon despite environmental legislation being passed in 1996, regulations had yet to be drafted in September 2000), which inhibits enforcement of the law. There are probably several reasons for the delays, including lack of institutional capacity and in some cases the desire of governments to develop specific standards for their countries. In this respect, governments should consider applying internationally acceptable environmental standards (e.g. WHO, World Bank) rather than developing home grown ones.

   Although it may be valid to develop standards in terms of a country's carrying capacities the trend is towards both local and international environmental pressure groups insisting on the respect of internationally accepted standards.

2. Environmental rehabilitation costs are an important aspect of any mining project. There needs to be the assurance that such funds will be available at planned closure, and also in the event of premature closure of a mine due to decreases in commodity prices. In such cases, lack of prior provision for rehabilitation could leave governments facing large environmental liabilities, effectively allowing companies to externalise such environmental costs. Environmental and/or mining regulations should include requirements for bank guarantees or dedicated trust funds to cover closure and rehabilitation costs. As noted in the country discussions above, such legislation is commonly in place, but in countries which have recently developed mining industries, the necessary expertise to assess whether the funds will be sufficient may be lacking.

   Particular issues that may need addressing in this respect are (Nazari,1999):

   - Ensuring that environmental impact assessments and feasibility studies outline and cost rehabilitation and closure plans.
   - Premature closure during construction. Mitigation would require completion guarantees and implementation of a satisfactory closure plan.
   - Clear definition of post-mining land use objectives, environmental standards required and sign-off procedures
   - Periodic review of closure plans, costs and financial guarantees in order to take into account changes to the project, and outside factors such as inflation.
   - Financial failure and use of closure funds for other purposes. These can be prevented by setting up a separate non-fungible financial structure for the funds.
   - Guarantees must be provided prior to construction and operation, as closure occurs when a project is no longer viable, and thus unable to generate the necessary funds.

3. In some cases environmental concerns may be subordinated to decisions by traditionally powerful ministries such as finance and industry. There are historical reasons for this, in particular the

priority given to economic development in government policy. In the past this may have been at the expense of the environment. In Ghana, for example, the cost of environmental degradation to the economy in 1988 was estimated at $189 million, of which at least $17 million was a result of mining activities. This is equivalent to 4 percent of GDP, whilst GDP growth was 5 percent. This growth thus occurred almost entirely at the expense of the country's natural resource base, and is unsustainable (Acquah, 1995).

The potential solution to this problem is to give higher profile to the environmental ministry in government decision making. No concrete policy measure can be suggested on how to achieve this, as it is largely a question of political will. However there are certain practical measures that could be implemented.

In the case of privatisation in Zambia, development agreements were drawn up between the government and investors. As pointed out in section 3.2, these agreements allowed for delayed compliance with environmental regulations, and have thus had negative regulatory effects. In the case of such agreements, governments should ensure that full compliance with environmental regulations is required. This can possibly be achieved by a requirement for such agreements to be vetted by the environment ministry.

In francophone Africa, mining licences are only attributed after the signature of a "Convention d'établissement" which amongst other things defines the fiscal and customs regimes applicable. The possibility of including environmental conditions in the conventions should be considered.

Mining legislation should not undermine environmental protection regulations as would appear to be the case in Zambia. Again it may be possible to avoid this by ensuring that the environment ministry has the right to verify conformity of mining legislation with existing environmental regulation.

4. The question of responsibility for enforcement of environmental regulations needs addressing. One approach in sub-Saharan Africa has been to create an environmental protection agency with responsibility for monitoring and enforcement of regulations. The other has been for officials of the mines ministry to undertake these tasks. In both cases, there is evidence for a lack of expertise or lack of will in the domain in certain countries. In Zambia (see section 3.2) doubt has been expressed as to the capacity of local authorities to police environmental performance (Draisma, 1998). In addition although the government has shown willingness to enforce environmental regulations in the past (Draisma, 1998), the recent investment agreements related to privatisation of the copper mining industry, would seem to indicate that the government is weakening the role of the ECZ as well as allowing for delayed compliance with legislation (www.hsrc.ac.za).

   In the case of Ghana, although there is no direct evidence of lack of enforcement of environmental regulations in the mining industry, this has occurred in other industries (Anane, undated). As mentioned in section 3.3, this may be due either to lack of political will, or of capacity.

   In countries, such as Kenya, where environmental legislation is recent, lack of capacity, budgetary allocation and political will also appear to be important issues. Governments in sub-Saharan Africa will therefore need to address these problems.

5. The exploitation of mineral resources raises the important distributional issue of how revenues (taxes or royalties) from mining are re-invested. In addition to using the revenue to finance infrastructure and essential social services in mining areas, investment in alternative forms of economic development will be necessary. One possibility is to establish a development fund either by using a percentage of royalty payments as in Ghana, or specifically earmarking tax revenue from mining operations for the purpose.

6. It is evident from the country examples that social impacts are generally inadequately accounted for in many mining projects. It may therefore be necessary for governments to legislate to this end. Any such legislation should be the result of consultations between government, mining companies and the public.

7. As mentioned in Box 1, artisanal mining can have significant negative environmental and social impacts. Currently efforts are underway to address the issue, and it is probably premature to suggest major recommendations. However, a precautionary measure that could be taken is to prohibit the use of mercury in gold recovery. Practically this could involve the interdiction of mercury imports.

   In addition, as noted above, artisanal mining faces major problems in raising finance. One reason is lack of collateral for borrowing funds. It is suggested that governments consider regulating the sector by attributing mineral rights as is the procedure for larger operations, rather than permits which allow the holder to practice the activity. These should have the same attributes as those for larger mines, i.e. be a transferable, mortgageable property right

8. There should be a clear policy commitment on the part of governments not to allow any mining activities in natural reserves. Even allowing exploration will give companies the impression that mining will be permitted if a viable deposit is discovered, as is currently the case in Ghana. In addition to the potential for environmental degradation from mining activities, development of mining infrastructure could lead to population influx and further pressure on the environment in these areas. In Cameroon, this issue was the subject of much discussion during a seminar, held in September, 2000, to define a new mining policy for the country. There was concern that by excluding mining activities, the country could suffer economic loss, as deposits that might exist would not be developed. In general, mines have a finite life, and therefore only generate short term earnings. Natural reserves could generate significant long term earnings via alternative sustainable activities such as eco-tourism.

9. Governments may be able to assist in technology transfer from foreign mining operations to the local mining industry. At present the means for doing this require further investigation.

**Mining companies**

1. In the examples of Palabora (South Africa) and Sadiola (Mali), cited above, the environmental management record of the mining companies is in part attributable to commitment at management level to enhancing performance. In the case of Sadiola, the environmental manager reports directly to the CEO of the mine's operating company. It may be possible for other mining companies to raise the profile of environmental management within their organisations, by ensuring that environmental departments are represented at board level.

2. It would also seem that in these two cases the determination of the companies concerned to obtain internationally recognised certification for their environmental management systems, has in part contributed to improvements in their practices. The issue of which system to apply will not be addressed by this article, but as part of the mining industry's attempts to integrate environmental concerns, it may be worth promoting research into the applicability of the various systems to the mining industry.

3. The inadequacy of social impact assessment and social management plans in several sub-Saharan countries has been highlighted above. Acceptance of the mining industry's role in economic development by affected communities and the general public may be improved if practices in this domain are improved. Consultation with the affected communities at early stages of projects could allow early diagnosis of potential points of conflict.

   Communication with local communities should be an ongoing process throughout the life of a mining project. This will require establishing and maintaining a dialogue with the public and keeping them informed. There are inevitably risks associated with mining and mineral processing operations. These, as well as the planned mitigation measures, need to be explained to the public, which should also be aware of procedures to be followed in the case of a major emergency. As mining operations are commonly located in remote areas, where government institutions may lack the capacity to respond to such situations, much of the burden will inevitably fall on the project operators.

   As part of the process of gaining public acceptance, companies should consider making the results of environmental audits available to the public. The situation in Ghana, where such audits

are not available to the public, may lead to mistrust and hostility. Audits should not only be internal, but also be conducted by independent auditors on a regular basis.

4. It is up to governments to legislate in the domain of environmental protection. However in cases where legislation may be lacking, the cost of environmental mitigation measures, closure and rehabilitation must be an integral part of a company's economic analysis of a planned project.

   As far as regulations and standards are concerned, as a general policy, internationally accepted standards should be adhered to in the event of the absence of such standards in the country concerned. The standards to be used should be acceptable to the government. With respect to rehabilitation, it will be necessary to ensure that it occurs as an ongoing process throughout the life of a mine where possible.

   As stated above, the case of mining activities in natural reserves needs clarification. In this respect mining companies should undertake to exclude these areas from any mining licence application.

The above measures can probably be applied very rapidly, but where they require board or shareholder approval, companies should if possible table the proposals at the next relevant meetings.

***OECD countries***

1. As discussed in the preceding sections, one of the causes of poor enforcement of environmental regulations is a lack of capacity in the countries concerned. Support of National Environmental Action Plans by international organisations such as the World Bank, the IUCN and aid agencies, started in the 1990's. These plans aimed at creating the institutional and technical capacities needed for effective environmental monitoring, and policy formulation and co-ordination, as well as to address specific environmental problems (Acquah, 1995). OECD countries can provide further support for such initiatives, taking into account the lessons learnt to date.

2. As far as corporate behaviour is concerned, the OECD has drawn up Guidelines for Multinational Enterprises, which include the environment (OECD, 2000). OECD member countries should strongly insist that their investors follow these guidelines. As pointed out in the country analyses, improved environmental performance of mining companies has in part been driven by financial institutions' loan conditions. OECD member countries should support the financial institutions in ensuring that environmental and social management plans are standard requirements for project finance.

3. The environmental legacies of past mining may impose large costs on the countries affected, as is illustrated above by the Zambian example. South Africa faces major costs in this respect as the environmental legacies of mines closed prior to 1956 are the government's responsibility. Probably the most important legacy is that of acid mine drainage from old mines in the Witwatersrand goldfields. The possibility of providing financial and technical assistance in rehabilitating old mine sites should be considered.

4. Current measures addressing the issues related to artisanal mining should continue to be supported. The applicability of the South African approach to small-scale and artisanal mining to other sub-Saharan African countries could be investigated, perhaps with donor organisations of member countries supplying financial and technical backing where required

5. The role of international financial institutions such as the IFC in contributing to improved environmental performance via loan conditions appears to have been positive in Ghana (Warhurst, 1998). As yet, the available data does not allow assessment of the IFC's role in environmental performance at Sadiola in Mali. Further investigation of the role of international financial institutions is suggested.

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## Appendix I

## Mineral production statistics

Table I.1. Production of selected minerals in South Africa

| | 1991 | Y | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|
| Gold ('000 kg) | 601 | 611,1 | 619,2 | 579,3 | 519,8 | 494,6 | 492,5 | 464,2 | 450,9 |
| Iron Ore | 29 075 | 28 226 | 29 385 | 32 321 | 32 144 | 30 951 | 33 333 | 32 965 | n/a |
| Chrome | 5 100 | 3 002 | 2 827 | 3 599 | 5 130 | 4 982 | 5 794 | 6 480 | n/a |
| Copper | 194 | 167 | 166 | 165 | 161 | 151 | 151 | 153 | n/a |
| Manganese | 3 146 | 2 464 | 2 507 | 2 851 | 3 165 | 3 254 | 3 095 | 3 044 | n/a |
| Diamonds ('000 carat) | 8 431 | 10 166 | 10 324 | 10 857 | 9 569 | 10 166 | 10 009 | 10 705 | 10 014 |
| Coal | 178 000 | 174 072 | 182 031 | 195 805 | 203 427 | 208 362 | 218 617 | 224 827 | n/a |
| Lime, limestone | n/a | 18 320 | 18 215 | 19 719 | 18 776 | 18 495 | 18 600 | 17 248 | n/a |
| Mineral production value | 23 511 | 23 909 | 24 458 | 23 844 | 23 094 | 22 773 | 23 049 | 22 949 | n/a |
| GDP | 244 549 | 238 711 | 242 485 | 248 575 | 255 770 | 263 694 | 268 142 | 268 182 | n/a |
| Mineral production value (% of GDP) | 9,61 | 10,02 | 10,09 | 9,59 | 9,03 | 8,64 | 8,60 | 8,56 | 6,5 |

*Production figures in '000 tonnes unless stated otherwise. Value in million Rand, 1990 prices*
*Source: Economist Intelligence Unit Country Profile, 1997a, 1999a, 2000a; Botha et al, 2000; Gaven et al, 2001.*

Table I.2. Production of selected minerals in Ghana.

| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|---|
| Gold ('000 kg) | 16,5 | 26,1 | 31,4 | 38,6 | 43,3 | 51,3 | 48,3 | 53,5 | 72,9 |
| Bauxite ('000 tonnes) | 382,1 | 485,1 | 498,1 | 482,5 | 426,1 | 513 | 413,2 | 500,7 | 408,6 |
| Manganese ('000 tonnes) | 364 | 415,2 | 477,7 | 361,7 | 269,7 | 100 | 447,9 | 333,4 | 421 |
| Diamonds ('000 carat) | 150,3 | 419,4 | 584,5 | 616 | 426,1 | 422,7 | 714,3 | 585,5 | 869,4 |
| Mineral production value | | | | | 222 | 234 | 244 | 258 | 268 |
| GDP | | | | | 3 999 | 4 160 | 4 351 | 4 534 | 4 741 |
| Mineral production value (% of GDP) | | | | | 5,55 | 5,63 | 5,61 | 5,69 | 5,65 |

*Source EIU 1997b, 1999b, 2000b*

Table I.3. Gold production in Mali

| | 1991 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|
| Gold production, kg | 4600 | 6291 | 6584 | 16323 | 20589 | 23689 |

*Sources: Economist Intelligence Unit 2000c;* www.izf.net

Table I.4. Production of selected minerals in Tanzania.

| | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|
| Gold ('000 kg) | 5 436 | 8 555 | 3 245 | 2 720 | 1413 or | 318 | 323 | 427 | 4 890 |
| Diamonds ('000 carat) | 72 | 67,5 | 40,7 | 22,7 | 49,5 | 126,7 | 123,1 | 97,8 | 234,7 |
| Coloured gemstones (tonnes) | 59,6 | 26,7 | 33 | 48,5 | 111,4 | 142,2 | 509,5 | 48,5 | 95,2 |
| Coal | 33,2 | 31,8 | 40,2 | n/a | 43,2 | 52 | 28,5 | 45,1 | 75 |
| Salt | 30,8 | 18,6 | 35,2 | 32,5 | 105 | 86,7 | 72,5 | 75 | 35,9 |
| Phosphate | 2,4 | 4,8 | 2,2 | n/a | 6,7 | 0,7 | 2,1 | 1,4 | 7,3 |
| Gypsum | 8 | 14,2 | 86,5 | n/a | 42 | 55,4 | 46,3 | 59,1 | 21,2 |
| Limestone | 553,4 | 990,5 | n/a | n/a | 1 062 | 1 200 | 1 282 | 1 181 | 1 241 |
| Mineral production Value (% of GDP) | 1,40 | 1,90 | 1,40 | 1,60 | 1,30 | 1,10 | 1,20 | 1,50 | |

*Production in '000 tonnes unless otherwise stated.*
*Source: Economist Intelligence Unit, 1997c, 2000d.*

Table I.5. Production of selected minerals in Kenya

| | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|
| Soda Ash | 218,5 | 223 | 257,6 | 242,9 | 245,7 |
| Fluorspar | 74,2 | 83 | 68,7 | 60,9 | 93,6 |
| Salt | 73,5 | 41 | 6,3 | 21,7 | 44,9 |
| Limestone products (excluding for cement) | 29,6 | 31,9 | 32,7 | 32 | 32 |
| Others | 70,9 | 60,8 | 10,6 | 80,7 | 345,9 |
| Mineral production Value (% of GDP) | 0,2 | 0,2 | 0,2 | 0,14 | 0,14 |

*Source: Economist Intelligence Unit, 1996b, 1997d, 1998, 1999c, 2000e*