BANNOCK CONSULTING

TAILORED SOLUTIONS FOR LASTING CHANGE

Vulnerability of Artisanal and Small Scale Mining to Commodity Price Fluctuation

PAPER 4: An examination of the relationship between the mining sector (large-scale, small-scale and artisanal) and national governments and how external shocks impact that relationship

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Summary

Mining plays an important part in the economic development of many countries. The sector's main contributions consist of employment and income generation, creation of upstream and downstream linkages and generation of foreign exchange. Given the importance of the sector, the objective of the paper is to discuss the relationship that exists between national governments and the mining sector - large-scale and artisanal and small-scale (ASM) with special focus on ASM. The paper also discusses the external factors that influence the relationship and makes suggestions on how mineral wealth can be used for sustainable economic, social and environmental development.

Countries endowed with mineral resources have in place an elaborate set of regulations which large-scale mining companies and ASM players are compelled to comply with. These include licensing requirements, health and safety, environmental and fiscal regulations. Enforcement of regulations is however often problematic for governments mainly due to financial and human resource constraints. On their part, governments provide a wide range of services and support to attract and promote investment in mining. Services provided include generation and dissemination of geological information, registration of mining claims and development of infrastructure like water, electricity, roads, railways, health and education facilities.

The relationship between large-scale mining companies and the ASM sector is characterised by both collaboration and conflict. Collaboration between the sectors takes place through tributer arrangements and provision of training and technical support to ASM by large-scale mining companies. Conflict arises where there is competition for mineral deposits and where ASM operations are considered to be creating an environmental rehabilitation liability for large mining companies. This happens when ASM operations are contiguous to those of large-scale mines.

External shocks that have a strong bearing on mining activities are price fluctuations, wide exchange rate movements, economic booms and busts, economic structural adjustment programmes, cost of investment capital, technological changes and environmental legislations. The more responsive a country is to these shocks, the more vulnerable is its economy, especially for countries where mining contributes 25% or more to GDP.

Mining has strong linkages with other sectors of the economy. On the upstream side, mining provides a large market for suppliers of mining equipment, explosives, clothing and food stuffs, water, power, etc. On the downstream side, mining is a source of raw materials for smelting companies, metal fabricators and manufacturers of consumer durables, among others. Statistics from countries like the USA indicate that large multipliers (as high as 4) exist between employment in the mining sector and in other sectors of the economy.

Possession of mineral wealth is a blessing rather than a curse. The challenge for mineral-rich economies is to manage mineral wealth prudently and thus stimulate wider economic growth and development. This can be done through creation of stabilisation funds, exporting processed rather than raw mineral products and using financial resources generated by mining to invest and expand other sectors of the economy. The paper concludes that mining has great potential to contribute to sustainable economic development and growth. This is the case if financial resources generated by the mining sector are prudently managed, corruption in the sector is checked and there is transparency and accountability in the administration of mining regulations and legislation.

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1 Introduction

Mining plays an important role in the economic and social development of many countries, both developed and developing. In fact, in many developing countries, mining contributes significantly to GDP, export earnings and employment. For example, in Zimbabwe mining contributes about 10% to GDP and 6% of total formal sector employment. Gold, one of the leading minerals produced in the country, is the second single largest foreign exchange earner after tobacco. Prior to the collapse in the international prices of copper in 1974, copper contributed more than 60% of Zambia's export earnings and the copper mining sector was the single largest employer in the country. In Chile ores and metals accounted for 45 % of total merchandise exports in 2000, in Ghana for 19 %, in Guinea for 63 %, in Niger for 67 %, in Papua New Guinea for 51 % and in Peru for 39 % (World Bank, 2002).

Within the mining industry of developing countries, artisanal and small-scale mining (ASM) has attained increasing significance in recent decades. On the African continent major ASM activities are known to occur in 25 countries, providing direct employment for as much as 2.5 million people, and a livelihood for more than 20 million people. The number of people directly and indirectly depending on this activity worldwide is in the order of 100 million.[1, 2] While artisanal mining can reduce poverty and promote sustainable livelihoods, it can also result in a number of harmful effects, including environmental degradation, child labour and poor health and safety standards. Eliminating the undesirable side-effects while exploiting the economic potential is a delicate undertaking, requiring an appropriate institutional and policy framework.

Given the importance of mining in the economic and social development of many countries, studies that attempt to better understand the relationship between governments and the mining sector are therefore particularly relevant. In the context of many developing countries, better understanding has potential to lead to the development and implementation of more relevant policies and programmes that can help to enhance the contribution of the sector to national economic development. This paper is an attempt in this direction.

The principal objective of the paper is to examine the relationship between the mining sector and national governments and how external shocks impact on this relationship, placing special emphasis on ASM. This analysis will be structured in four main sections. The first section following this introduction will look at the relationship between the mining sector and national governments, the second will explore the relationship between ASM and large-scale mining. In the third section an assessment will be offered on how external shocks impact on these relationships. In the final part of the paper intersectoral linkages between mining in general and ASM in particular with the upstream and downstream sectors of the economy will be discussed.

[1] International Labour Organisation. Social and labour issues in small-scale mines. Geneva, 1999.
[2] United Nations Department for Economic and Social Affairs (UNDESA).Poverty Eradication & Sustainable Livelihoods: Focusing on Artisanal Mining Communities. SPPD Project RAF/99/023. Final Report. New York – Geneva, June 2003.

2 Relationship between the mining sector and national governments

2.1 Regulatory framework

The single most important factor that shapes the relationship between the mining sector and the government in the country of operation is the existing regulatory framework. This framework consists of the laws and regulations that are in place to control the scope and type of mining activities permissible in a given country. In practice, the framework is essential in encouraging or discouraging investment and growth in the mining industry and in the country as a whole.

2.1.1 Mining legislation

In almost all countries, governments put in place laws and regulations to direct and control activities and investment in the mining sector. In general, mining legislation establishes the ownership of mineral resources and details the conditions related to the rights to explore, develop and produce minerals. Under this legal framework, the investor is given the right to explore for and mine minerals for specific commitments which are monitored by the mining authorities, and the investor has secure and long-term title to the mineral rights. More specifically, mining legislation usually addresses the following issues, *inter alia*:

- mineral and land ownership;
- who qualifies to exploit a country's mineral resources;
- the procedures to be followed in identification, pegging and registration of a mining claim;
- rights and responsibilities of mine operators, including periodic reporting requirements;
- complaints and conflict resolution;
- benefits and incentives enjoyed by investors in the mining sector;
- penalties incurred if a mining claim is not developed within a given time frame.

2.1.2 Licensing requirements

Licences are granted in order to control mining activities. Licensing procedures, together with minimum work requirements stipulated by the mining law, are used to control the rate of resource extraction over time in the national interest. Typically, it is a requirement in many countries for the prospective miner to produce evidence of possession of a registered mining claim and the sources and amount of capital to be invested before a mining licence is issued. Due to the increasing demand by stakeholders for sustainable mining activities, mining companies are now required to carry out and produce detailed environmental impact assessment (EIA) reports prior to getting mining licences. The measures that the company will take to mitigate any negative environmental impacts of the project have to be explicitly stated in the report. Budgets required for post mining reclamation and rehabilitation also have to be clearly indicated. Where local communities are going to be affected (for example

being displaced by the new mine) the assistance to be given to resettle them in a new area and the compensation to be paid have to be clearly spelt out in the report.

The above requirements are no longer regarded as a burden by mining companies but are actually considered as best practice. Recent cases where the measures have been applied in Zimbabwe include the Marowa diamond mine started by Rio Tinto in 2002 and Unki Platinum that is currently being developed by Anglo American Corporation. In countries where high levels of corruption exist, some companies bribe Ministry of Mines officials in order to side-step EIA requirements. This happens when the bribes paid are far lower than the cost of an EIA. It must also be noted that EIA reports have rarely stopped a mining development from proceeding. Experts hired to carry out EIAs are often known by mining companies and therefore tend to give positive reports to enable mining development to proceed. In some cases, companies bribe Ministry of Mines officials and thus avoid full implementation of environmental mitigation measures recommended in EIAs reports.

The situation is completely different when it comes to ASM. The vast majority of ASM in many developing countries are unregistered and therefore not legally recognised by the authorities. For example, it is estimated that in the SADC region some 80-90 % of small-scale mining activities are informal.[3] As a result, they are considered illegal and therefore undesirable. Since they are unregistered and considered illegal, governments find it difficult, if not impossible, to get ASM to conduct EIAs and implement environmental management plans. For this reason ASM activities often cause environmental damage. The damage includes destruction of vegetation, siltation of rivers in places where alluvial gold panning is carried out and reckless discharge of chemicals such as mercury and cyanide into the environment. These problems could be better addressed if ASM activities are registered and legally recognised and measures (such as training) are implemented. Incentives, such as tax holidays, should also be put in place to encourage the sector to conform with regulations.

2.1.3 Health and safety regulations

Governments put in place health and safety regulations to be implemented and observed by mining companies at their mines. This is done to protect the health of workers and minimise accidents and injuries. Health and safety regulations in mining establish standards related to work procedures, including in-mine travel, haulage of mine products, roof support, lighting, blasting and ventilation, storage and use of explosives, as well as protective equipment, among others. The major health problems on mines include dust, poor ventilation in underground mines, exposure to chemicals such as acids and cyanide. Mining companies are required by law to put in place measures to ensure safety of workers against rock fall in underground mines, exposure to acids and dangerous gases.

Many large-scale mines have in place stringent health and safety regulations, sometimes far exceeding those stipulated by governments. They realise that an unhealthy work force is a burden and reduces worker morale and productivity. They also realise that accidents at work are a cost and lead to lost production.

The situation is different, however, when it comes to the ASM sector. In most cases the sector is considered illegal therefore there is no compelling pressure on the part of the sector to develop and implement health and safety regulations and practices. Development and implementation of health and safety policies and regulations represents a cost that the

[3] Drechsler, B. (Editor). Small-scale mining and Sustainable Development in the SADC Region. MMSD/IIED, August 2001.

sector is neither prepared nor able to afford. As a result, health and safety practices in the ASM sector are at best rudimentary. In many cases, they are completely absent. Workers in the sector suffer a wide range of health problems that include excessive exposure to dust, dangerous chemicals and gases, inadequate oxygen supply and unstable pits in places where underground mining is carried out.

Exposure of workers to mercury is a particularly common phenomenon in the small-scale gold mining sector. This includes breathing mercury fumes and poisoning through direct contact with skin. The effects of such poisoning are not immediately observable and often the miners are not even aware of the dangers.

ASM activities are often located in remote areas where health and other social facilities are non-existent. This means that access to treatment in the event of illness or accidents is difficult. Due to poor mining methods and lack of equipment accidents are frequent in the ASM sector. The most common accidents include collapse of mine shafts and underground flooding. Many harrowing stories of miners buried underground have been recorded in countries where small-scale and artisanal mining is prevalent.

2.1.4 Environmental regulations

i) Environmental impact assessment (EIA)

Environmental regulations establish and regulate standards for the maximum permissible emissions related to air, water, noise and vibrations, for mine waste and hazardous waste management, for environmental impact assessment, and for post-mining land reclamation.

In many countries mining companies are now required by law to conduct an EIA before mining developments allowed. The EIA is required to provide detailed information on current and potential environmental impacts of the proposed mining activity and develop a detailed plan on how the impacts will be mitigated. In cases where the establishment of the mine involves displacement of communities the mining company is usually required to develop a plan for resettlement of the displaced and payment of compensation. Good practice under the sustainable development approach demands that the whole process be carried out in a participatory manner with the full involvement of all stakeholders, especially the affected communities. EIA experts are hired to facilitate the process and produce reports. However, if the process is not properly conducted, it can be a difficult and sensitive issue riddled with conflict and often results in communities being dispossessed of their natural assets and therefore their main source of livelihood (Mackay, 2000).

Production of an EIA is a more straightforward exercise than, for example, the implementation of environmental mitigation plans. EIA experts are hired to carry out the assessments. Although the exercise is supposed to be carried out in a participatory manner involving key stakeholders (especially communities), at times this is only done casually.

Implementation and monitoring of the environmental mitigation plan requires large financial and human resources and commitment from mine management. It also requires close monitoring by the Ministry of Mines to ensure full compliance. Governments of many developing countries often fail in this regard due to resource constraints and low administrative capacity. Civil service salaries in most developing countries are poor. The possibility of senior civil servants receiving bribes in return for non-enforcement of environmental mitigation plans becomes real under such conditions.

Conducting and implementing an EIA plan is almost unheard of in the ASM sector. There are no visible and immediate benefits for miners arising from the process and the resources for doing it are not available anyway. Consequently, the environmental impacts of ASM activities are neither monitored nor controlled. In areas with widespread artisanal and small-scale gold mining activities cases of massive siltation of rivers and disposal of dangerous chemicals such as mercury and cyanide into the ecosystem is widespread. The reckless use of mercury in Mozambique, Tanzania and Zimbabwe, for example, has been well documented (Drechsler, 2001). International donor and development agencies have responded to these problems through interventions that include conducting studies to assess the damage (Ashton et al, 2001) and implementing projects that raise awareness and build the capacity of stakeholders to deal with the problems. A good example is the project currently being implemented by UNIDO in Zimbabwe (UNIDO, 2002). The project seeks to conduct detailed research to assess the quantity of mercury that is being discharged by ASM into the ecosystem of the Chakari-Kadoma gold mining belt in Zimbabwe. The project will also develop and implement measures for artisanal and small-scale gold miners to adequately deal with the problem in future to ensure long term sustainability of their activities. The project has potential to be replicated in other parts of the world if the results are favourable.

ii) Post-mining reclamation requirements

As part of the EIA mining companies are required to come up with a plan on mine closure and rehabilitation of the site once mining activities have come to an end. Usually, companies are required to indicate how destroyed vegetation will be rehabilitated, how waste dumps and tailings disposal will be dealt with and how pits and holes will be covered. In order to enhance mining's contribution to sustainable development mining companies develop and implement elaborate post-mining reclamation plans. Ministries of Mines have the responsibility to monitor and supervise implementation of the plans to ensure compliance.

A more recent development in this context is the introduction of financial assurance policies related to post-mining land rehabilitation. This policy requires that prior to issuing a mining permit, a reclamation performance bond must be filed by the applicant as a financial guarantee for the restoration of the mine site. The performance bond can be in the form of a bank guarantee, a letter of credit, cash funds or a pledge of assets, payable to the relevant mining authority. The amount of the bond is based on a reclamation cost estimate usually reflecting the costs at the projected point of maximum reclamation liability. Costs of performance bonds are in the form of fees associated with third party guarantees which are in the order of 1.5 % of the face value of the guarantee. Together with the expenditures for the EIA the reclamation performance bond entails additional costs that have to be borne by all registered mining operations. In jurisdictions where reclamation performance bonds are required by law, they apply to all mining operations, including ASM operations. Enforcement of bonding requirements, however, is only possible where ASM operations are regularised.

2.1.5 Fiscal regime

i) Royalties and compensation

Royalties are payments made to the state as compensation for the depletion of natural resources on federal or state land, and therefore for its sovereign ownership of mineral

wealth. The amount to be paid in an agreed period of time is based on a fixed figure per ton of minerals produced, or as a percentage of the gross value of production or profits. In the context of sustainable development there is debate, but no agreement, as to whether money raised from royalties belongs wholly to the state or a portion should be paid to local communities. It is argued that this would enable local communities to directly benefit from their local resources. On the downside however, this may give local communities undue advantages and create unintended political clout and leverage for such communities. Governments charge royalties as an easy way to raise revenues and to push mining companies to meet minimum set production targets. This ensures that only serious investors get mining concessions in the first place.

In many countries compensation for land taken up for mining purposes is a recognised principle. Payment is made to the landowner to compensate for loss of use or production. The amount to be paid as compensation is usually calculated on the basis of opportunity and replacement cost principles.

Payment of compensation for land taken up for mining activities is often a controversial issue, especially where there are no clearly defined land ownership rights or title. However, there is also evidence of good practice in a number of developing countries. For example, in Fiji and Papua New Guinea (PNG) there are well defined procedures for payment of compensation to land owners and local communities when land is taken up for mining activities (MMSD, 2002). Government and other local stakeholders are usually closely involved in the negotiations to ensure that fair compensation is paid (MMSD, 2002).

As opposed to corporate tax payment royalties are usually based on turnover and, therefore, depress profits, especially during times of falling commodity prices. In the case of loss-making operations royalties increase the magnitude of the loss. High royalties reduce the cash-flow of mining operations available for reinvestment and for exploration expenditures, thus, increasing the vulnerability of the mining sector as a whole and the viability of new mineral development projects. To bring a recent example, it has been observed that "a 10 % royalty payment could be fatal to Zimbabwe's embryonic, and generally rather low-grade, diamond-mining sector".[4]

ii) Taxation

Governments levy taxes on personal income and corporate profits. The principle behind taxation is to ensure that all citizens (personal and corporate) contribute to the provision of social and other services that the state is obliged to provide as part of its governance role. Mining companies therefore make significant contribution to a country's revenues through payment of taxes by employees and on profits made. Incomes earned by employees also make a significant contribution in stimulating local consumption and development of commercial activities in mining areas.

Worldwide, the corporate tax rate payable by mining companies is typically in the range of 30 % to 40 % of annual taxable income. In some countries the rate is kept substantially lower to attract foreign investment. Examples of important mining countries with low corporate tax rates include Botswana, Brazil and Chile, each with a rate of only 15 % in the

[4] Hollaway, J. "Mining in Zimbabwe: there may be a future". *Mining Journal*. London, November 22, 2002.

year 2000 (World Bank, 2002).[5] In a bid to attract more investment in the mining sector Zimbabwe also recently lowered the corporate tax rate to 15%.[6]

iii) Import and export duties

Import and export duties are levied by governments as a means to raise revenues and to meet desired economic development objectives. In the majority of countries import duties are levied on mining equipment to protect or encourage the establishment of local manufacturers of such equipment. Many developing countries however do not have manufacturing plants for such equipment. It is therefore fair to conclude that import duties are levied solely for raising state revenue.

Governments charge export duties in order to recover the costs incurred in the promotion of exports by public institutions such as trade promotion organisations. Where a government is keen to promote investment and growth in the mining sector, great care is taken to ensure that export duties charged do not discourage further investment in the sector. If duties charged are considered to be excessive and unfair, there is great temptation for mining companies to engage in duty avoidance and evasion practices or relocate their operations. Evasion measures may include under-invoicing of exports and over-invoicing of imports. Mining companies therefore also have some power and leverage over governments. Governments must therefore strive to strike a balance between revenue and investment and growth promotion objectives.

iv) Tax incentives

Tax incentives are given in order to reduce the initial cost of investment and to increase the net profit available to companies to pass onto investors as dividends. The theory is that higher dividends will make a country more attractive as an investment destination and hence attract capital to accelerate development and growth. The major tax incentives that most governments provide include reduced import and export duties as compared to other sectors. In some cases, payment of such duties is abolished altogether. Mining companies are also offered tax holidays in many countries at least for the first few years after the initial investment. Such incentives are expected to make investment in a country more attractive and thus attract more investment.

Due to the unregularised nature of ASM in many countries, the sector often misses out on tax incentives. One way the sector can be rapidly regularised would therefore be through the extension of tax incentives. Training programmes would have to be conducted to make ASM players aware that there are more benefits rather costs in being legal and recognised.

A tax incentive specific to the extractive industry available in the tax regimes of some countries is depletion allowance. It is a tax allowance that enables the mine operators to recover their investment in depleting mining properties. In practice, depletion allowance is calculated either as percentage or cost depletion. In the case of percentage depletion, a certain percentage, usually between 5 and 20 % of gross income from mining is tax-deductible. In the case of cost depletion, the allowance is determined using a fixed depletion rate (capitalised value of the mineral deposit divided by the reserve tonnage) applied to the

[5] The World Bank. "Tax Policies", in *World Development Indicators*, Washington, D.C., 2002.
[6] Hollaway, J. (2002).

annual production. Depletion allowance can significantly increase the after-tax cash-flow of mining companies, thus, providing funds for exploration of new mines to replace depleting mineral deposits.

2.2 Institutional framework

2.2.1 Geological surveys

One of the biggest contributions that governments make towards the promotion of mining activities is collection and publication of detailed geological information. Countries with mining activities have geological survey departments under the Ministry of Mines to carry out this task. Geological survey reports provide information on the key geological features and formations of a country, the major mineral deposits available and, in rare cases, the estimated reserves. Where accurate geological information is readily available, it helps mining companies to make quick and informed investment decisions.

In many developing countries, governments are weak mainly due to financial and human resource constraints and corruption. Geological information provided by government is therefore often scanty and of poor quality. This creates a cost for mining companies since they have to spend considerable resources to collect and analyse such data for themselves prior to making major investment decisions. This pervasive problem in many developing countries may result in private companies holding more maps and geological information on a country's mineral resources rather the government. Such a situation can give mining companies some political leverage.

Due to limited financial and human capacity ASM relies exclusively on the State for geological information. Consequently, ASM activities are often found in areas that are not attractive to large mining companies or where deposits suitable for large-scale mining have been exhausted. Provision of reliable geological information to ASM by governments is therefore one of the effective ways to promote the growth of the sector.

2.2.2 Mining claims

Once exploitable mineral reserves have been identified in a given area the normal procedure in many countries is to get the deposit registered as a claim. Registration gives ownership to the claim holder. Legislation in many countries puts a limit on the time that a claim can be held. This is done to discourage speculative ownership of claims. In Zambia and Zimbabwe, for example, the maximum period that a claim can be held is five years. Once the period has expired, the claim holder has to submit a new application providing reasons on why a new permit is required. This regulation applies to both large-scale mining and ASM operations. At times government officials receive bribes and end up registering two or more people/companies under one claim. This leads to conflict. Where mineral deposits are found, claims may be hurriedly registered while disregarding the interests of local communities.

2.3 Government services

Services provided by government to the mining sector include development of transport infrastructure, supply of power and water, and development of health and education facilities. Since these are public goods it is more cost effective for governments to provide the services. Provision by government is also critical for attracting the private sector to invest in mining, especially in remote regions where mineral deposits are found. Large

companies often benefit more from government services than ASM due to bias in development of facilities at, or near, large mines. ASM operations are invariably located in remote parts of the country where government is reluctant to commit resources for infrastructure development.

2.3.1 Transport infrastructure

Mineral deposits are usually found in remote regions of a country. In such circumstances mining companies expect government to develop transport infrastructure (road and in some cases railway line) to the proposed new mine. It is the responsibility of government to develop transport infrastructure to the proposed new mine since investment in such infrastructure by a mining company represents a sunk cost in a public good. Government is also expected to invest in infrastructure as a means to attract mining companies to invest in a country.

Due to financial constraints in many developing countries governments often fail to play their role in the provision of transport infrastructure. In such circumstances mining companies end up investing their own resources to develop the infrastructure. This only happens however if the quantity and quality of the mineral deposits is such that they will ensure adequate return to the total investment made. In such instances it is essential that the tenure of the mining title is granted for a period of time sufficiently long to enable the amortisation of the initial investment required for the construction of the infrastructure. However the infrastructure created usually remains after mine closure and this may represent an additional accessibility benefit for local communities and local ASM activities.

2.3.2 Water and power supply

Mining operations generally consume large quantities of water and power in the production and processing of minerals. As part of the effort to attract investment into the mining sector governments are expected to provide water and power in areas where exploitable mineral deposits exist and a mining company keen to invest in the area is available. In many cases however, mining companies end up investing their own resources due to the failure by government to do so. When a mining company invests its own resources to build power transmission lines to a new mining site, negotiations are often made with the power utility for the mining company to enjoy lower tariff rates for electricity for an agreed period of time. Such incentives are critical for encouraging investment by mining companies to promote development in remote regions of a country.

Local communities and ASM benefit from investments in water and power made by large mining companies. When deposits are exhausted and mining activities by large companies cease ASM players take over to exploit dumps and nearby small-scale deposits. Local communities benefit from use of the facilities and also from employment generated by both the large mining company and later by ASM activities.

2.3.3 Health and education facilities

Once a new mine has been established social services, especially health and education facilities, are required for the workers. Again these are public goods that government is expected to provide as its contribution to economic development of remote regions. Practice

however varies across countries. There are cases where governments actually expect mining companies to provide these facilities as part of mining's contribution to the sustainable development of local communities.

The ASM sector and local communities benefit from these facilities since they also have access to them. When large-scale mining operations cease ASM players and local communities continue to enjoy the use of the facilities. Governments often then take over to ensure the continued operation of the facilities.

2.3.4 Government assistance programmes

There are cases when government puts in place assistance programmes to protect mining companies against threats such as sharp decline in commodity prices. This is done to ensure continued viability of mining companies and protect jobs, incomes and foreign exchange earnings generated by the sector. In Zimbabwe, for example, the government has for many years provided gold floor price support to gold producing companies. Under the arrangement, gold mines receive a guaranteed floor price for their gold from the central bank irrespective of fluctuations on the international market price[7]. This is done to ensure viability and sustainability of gold mines. Due to the prevalence of overvalued local currencies in many developing countries mining companies often get a more favourable exchange rate for their export earnings as compared to that applied to the rest of the economy. As a result, mining companies receive more local currency earnings which enhances viability of their operations.

In an effort to promote the growth of the ASM sector governments sometimes provide financial and technical assistance to the sector. In a bid to promote ASM investment in the gold sector, for example, the Government of Zimbabwe set up the Gold Mining Trust in 2001[8]. The Trust manages a revolving fund from which ASM players access funds for development and running of gold mines. The results of the interventions to date are, however, not very encouraging. There have been reports that the funds have largely benefited those politically connected rather than those with viable project proposals.

Governments may also run technical training programmes to enhance the skills of ASM players to develop and run successful mining activities. The Government of Zambia is currently implementing a programme to diversify mining from the traditional copper and cobalt production to other minerals such as gemstones and industrial minerals (MSDP project document, 2001). The mining sector diversification programme, which is being funded by the EC, is putting special emphasis on the role of ASM in the development of gemstone and industrial mineral mining, processing and marketing (MSDP, 2001). It is hoped that this will create a base for mining's sustainable contribution to the generation of sustainable employment, incomes and export earnings.

2.4 Enforcement of legislation and regulations

Even in cases where the most cordial relationships exist between government and mining companies it is still necessary to put in place mechanisms to enforce the regulations. The Ministry of Mines, through the Mines Inspectorate, is ultimately responsible for enforcement of all regulations affecting the mining industry although it can call upon relevant government

[7] Zimbabwe Chamber of Mines, persoanl communication, October 2003.
[8] Zimbabwe Chamber of Mines, October 2003

departments for assistance. They may, for example, work closely with other Ministries such as the Environment and Natural Resources and Health Ministries to monitor and enforce environmental and health regulations. The Ministry also works closely with the Ministry of Finance to ensure that mining companies comply with taxation and royalty payment provisions. The Ministry of Finance is also an important player in ensuring that incentives stipulated for mining companies such as taxation privileges, duty exemptions for import of capital equipment and export incentives are implemented.

While it is generally easy for governments to implement and enforce regulations and incentives on large mining companies, it is difficult to do the same for ASM. Because of the frequently informal, clandestine and migrant nature of ASM activities, governments find it difficult and expensive to enforce environmental, processing, marketing, health and safety regulations on the ASM sector. Other factors contributing to the problems in enforcing legislation are the often seasonal and transient character of artisanal mining. Players in the sector are well aware of the constraints and dilemmas faced by governments and may take advantage of the situation. Even if governments had the resources and capacity to enforce the regulations on ASM, it would be difficult for ASM to comply where no obvious economic or financial gain is present. On the other hand, regularisation of ASM is a precondition to eliminating the undesirable side effects and to implementing effective assistance programs aimed at transforming the sub-sector into a sustainable income-generating economic activity. Artisanal miners therefore require information, technical support, training and some incentives to regularise their activities.

It is clearly in the interest of any responsible mining company to ensure that adequate health and safety polices and practices are in place. Healthy workers operating in a safe environment are usually more productive than unhealthy workers operating in an accident-prone environment. In most countries it is the responsibility of the Ministry of Mines to check that adequate health and safety regulations are in place and to set and enforce penalties for non-compliance. Monitoring and enforcement is however often limited due to poor financial and human resources faced by most government departments in developing countries.

In the ASM sector monitoring and enforcement is largely non-existent. Many ASM activities are located in remote areas that are only accessible during the dry season. Since the sector is considered illegal and makes little or no contribution to fiscal revenue monitoring of the sector by government departments is often very low. Financial, human and transport resource constraints faced by government ministries in developing countries further worsen the situation. It is therefore not surprising that regulations are usually flouted in the ASM sector.

3 Relationship between ASM and the large-scale mining sector

The relationship between ASM and large mines is often symbiotic. Large mines benefit from ASM when they enter into mutually beneficial tributer arrangements. This involves a large mine contracting ASM players to produce and supply ore for processing. ASM players sometimes also benefit from technical assistance and training programs run by large mining companies. There are however cases when conflict arises between ASM and large mining companies. Usually, conflict arises over ownership of mineral deposits and environmental damage in areas where ASM and large mining activities are contiguous.

3.1 Tributer arrangements

Large mining companies sometimes find it cheaper to contract ASM players to produce ore for their processing plants rather than to do it themselves. This happens particularly where capital investment and production skill requirements are low and can be easily met by ASM sector. It also happens when large volumes of ore are required to meet the existing processing plant capacity.

In Zimbabwe tributer arrangements have been most widely applied in the chrome ore mining sector. The two large chrome mining companies, Zimbabwe Alloys (ZimAlloys) and Zimbabwe Mining and Smelting Company (ZIMASCO) have well established tributer relationships with artisanal and small-scale chrome ore miners on the Great Dyke. Under the relationship artisanal and small-scale miners supply chrome ore to the two companies at an agreed price. Theoretically, the price is supposed to cover production costs and leave a reasonable profit margin to ensure continued viability and sustainability of mining operations. Artisanal and small-scale miners involved in the relationship however complain that the prices at which they sell the ore are not adequate for medium and long term viability and sustainability. On the other hand the two large mining companies argue that the prices are adequate. In their view, the problem is poor and inefficient mining practices in the ASM sector, which pushes up production costs incurred by artisanal and small-scale miners. The best way to solve this problem is to build the production and business management skills of artisanal miners through training. This would enhance production efficiencies, business management and price negotiation skills.

3.2 Technical assistance and training

In an effort to increase production efficiency and viability of mining operations of the ASM sector, large mining companies sometimes provide technical assistance and training to local miners. Technical assistance often involves hiring out equipment to ASM to increase productivity and output. In a way, mining companies provide this support in order to ensure delivery of adequate ore to meet installed processing capacity. To enhance production skills and capacity training is often provided on mining methods, use of mining equipment and business management. Ultimately, increased output by ASM sector is vital for success and growth of the large companies involved in tributer relationships. Tributer arrangements therefore represent a relationship that has potential to create a win-win outcome between the ASM sector and large mining companies if they are well designed and implemented.

3.3 Conflict between ASM and large mines

The major causes of conflict between ASM and large mining companies are ownership of mining claims and environmental damage arising from mining activities. In areas where large mines and ASM are contiguous conflicts can arise where the mining activities of one party encroach on those of the other. This happens if claims are not properly agreed and demarcated. It can also arise when local communities feel that they were dispossessed of their land to create space for a large mining company to exploit local mineral resources. The feeling of bitterness can be potentially high if local communities feel that they could have exploited the minerals themselves or where little or no compensation is paid.

Governments can sometimes unintentionally help in creating conflict between large mining companies and ASM sector. This happens when out of the desire to attract and promote investment in mining, artisanal and small-scale miners are removed from areas with large mineral deposits to create space for large mining activities. Cases where governments have

evicted artisanal and small-scale miners in order to open mineral deposits to large companies have been reported in many countries including Tanzania and Venezuela (MMSD, 2002, pp324-30). Similarly in Ghana the increased foreign investment in the mining sector in recent years has been accompanied by an increase in land-use disputes between the informal artisanal miners (galamsey) and large-scale mining companies.[9] In an attempt to prevent further land-use conflicts, Gold Fields Ghana Ltd. started to build a mutually beneficial partnership with small-scale miners by awarding certain areas of the land concession containing alluvial gold suitable for small-scale mining to resident small-scale miners. The company is purchasing the gold produced by the small-scale miners at prevailing market prices.

Conflict between ASM and large mining companies can also arise from environmental damage caused by ASM activities. For example, when the two sectors are adjacent to each other, damage to the environment as a result of discharge of mercury and cyanide into the atmosphere and rivers affects everybody. Destruction of vegetation and siltation of rivers from alluvial gold panning activities by ASM affects large mining companies operating in neighbouring areas. Sometimes artisanal and small-scale miners find it cheaper to mine on areas already rehabilitated by large companies. This becomes a source of conflict since the large mining companies will still retain the liability to rehabilitate the area.

It should be possible to minimise conflict between ASM and large mining companies if there is goodwill to co-operate and mutual respect. Relationships can be improved through development of mutually beneficial tributer arrangements between large mining companies and ASM players. Large mining companies can also provide laboratory services and training on proper use of explosives, improved mining methods and on health and safety issues. The benefits arising from such assistance will undoubtedly create mutual trust and goodwill and reduce or eliminate conflict.

Apart from mutually beneficial tributer arrangements as in the case of Ghana and Zimbabwe, successful attempts to eliminate conflicts between foreign large-scale mining companies and local artisanal miners and communities, have also been reported from other parts of the world, including Venezuela and Bolivia. Through a process of dialogue, technical assistance and various forms of co-operation, the previously conflicting parties have found ways of coexistence that benefit both large-scale operators and artisanal miners.[10]

In Venezuela, Placer Dome, a major gold mining company based in Canada, in partnership with a Venezuelan state-owned corporation, was able to establish harmonious relations with local ASM players and surrounding communities in the Las Cristinas gold project, through an extended process of dialogue and technical assistance that improved production and income of the miners. The co-habitation effort initiated by the company, included the organisation and regularisation of the artisanal miners, a training programme focusing on safety and environmental practices, and the improvement of the quality of life.[11] In addition, Placer Dome in co-operation with other stakeholders contributed to the construction of a community health centre serving 12,000 people, which was inaugurated in February 2001.[12] Although Placer Dome sold its stake in the project in August 2001, this corporate effort has

[9] Hilson, G. A Contextual Review of the Ghanaian Small-scale Mining Industry. MMSD/IIED. September 2001.
[10] Hentschel, T., F. Hruschka and M. Priester. Global Report on Artisanal and Small-scale Mining. MMSD/IIED. January, 2002.
[11] Veiga, M.M. et al. Mining with communities. Natural Resources Forum 25 (2001).
[12] DFID. Sustaining a dialogue: building partnerships in Venezuela. www.dfid.gov.uk/Pubs/files/

been recognised internationally as an excellent example of the building of relations between large-scale mining and ASM, which deserves to be replicated elsewhere.

4 Impact of external shocks on mining

External and internal shocks can have a large impact on the activities and viability of both ASM and large mining activities, as well as on their relationship with national governments and among themselves. The major external and internal shocks affecting mining consist of fluctuating commodity prices, exchange rate movements, economic recessions and structural adjustment programmes. Interests rates and technological changes are also important factors affecting mining activities.

Apart from economic or market-related shocks, natural distress situations, such as extended periods of drought affecting agricultural yields have in some countries had a marked impact on the growth of the ASM sub-sector. In Burkina Faso the significance of artisanal mining increased considerably during the droughts of the 1980's. The rural economy severely affected by the droughts adopted gold digging as an alternative source of income and currently 100,000 to 200,000 artisan miners are active in the sector.[13] Also in Mozambique, long droughts in the early 1990's together with the closure of large mines and agricultural companies resulted in artisanal mining becoming one of the main sources of income for local communities.[14] In these cases, people previously dependent on agriculture or employed in large-scale mining affected by external shocks, turned to ASM as a last resort.

4.1 Price fluctuations

It is now generally agreed that prices of mineral and other primary commodities are more volatile than those of manufactured goods and services, especially in the short term. As a result of this volatility it is more difficult for developing countries to forecast revenues and make sound expenditure decisions. In a similar vein, volatile prices make it difficult for mining companies to forecast profits and this dampens investment in the mining sector. When mineral prices fall revenues received by both the mining companies and governments also fall thereby affecting public and private investment and economic growth.

Large short and medium-term price movements are, however, not typical with all mineral commodities. Substantial price fluctuations of more than 100 % around the mean level are frequently observed with metals, notably base metals, such as copper, zinc and lead. With other groups of minerals, including industrial minerals and construction minerals, price fluctuations are less pronounced, although with industrial minerals large quality-related differences in prices can exist. As a result, mines extracting metal ores are generally hit harder by price movements than those producing non-metallic minerals.

A sharp decline in commodity prices has adverse economic effects in various ways. It means that low-grade or otherwise marginal reserves become sub-economic thus reducing the quantity of reserves available for extraction and decreasing the lifetime of mines. It also means that marginal mines, i.e. operations with the highest operating costs, start making a loss. In the case of severe price drops, mining companies are forced to cut costs in order to avoid life-threatening losses. Cost cutting measures are usually associated with the

[13] Gueye, D. Small-Scale Mining in Burkina Faso. MMSD/IIED. October 2001.
[14] Drechsler, B. (Editor). Mozambique. In: Small-scale mining and Sustainable Development in the SADC Region. MMSD/IIED, August 2001.

temporary or permanent closure of loss-making operations and with layoffs of non-essential labour. This adds to unemployment, frequently in rural areas where unemployment rates are already high in many developing countries. In an attempt to make a living, retrenched workers often have no choice but to join the informal ASM community. This increases the demand for land to carry out mining activities and thereby raise the potential of conflicts between large-scale mining companies and ASM players.

Lower government revenue from taxation of mining companies due to downward commodity price movements also adversely affects government resources required to provide public services in mining communities and to maintain an adequate institutional framework, including efficient geological survey departments and functioning mines inspectorates. This, in turn, limits government ability to regularise informal ASM activities, to implement assistance programmes to eliminate the harmful effects of the sector and to reduce the vulnerability of artisanal and small-scale mining communities to shocks.

It should, however, be noted that not all sectors of the economy suffer in the event of a decline in commodity prices. Downstream industries which purchase and process minerals or consume processed minerals in manufacturing of goods, actually benefit from a decline in commodity prices, resulting in higher profits and increasing government tax revenue from these industries. Therefore, the overall effect of a drop in commodity prices depends on the structure of industry in an economy, i.e. the relative GDP share of mining on the one hand and industries using mineral commodities in manufacturing on the other. While economies which are major exporters of metal concentrates and minerals are adversely affected by price drops, countries with a strong manufacturing sector consuming processed mineral materials benefit from a decline in mineral prices.

In further assessing the impact of downward price movements on ASM and large–scale operations it is also important to examine the cost structure typical for these two sub-sectors of the industry. Large-scale mines are generally capital-intensive, frequently with a significant share of debt financing and associated periodic debt servicing obligations, irrespective of the momentary financial situation. The high capital-intensity causes a correspondingly elevated level of fixed costs, which cannot be influenced by management in the short run. This contributes to the vulnerability of large mines in times of declining commodity prices. Particularly vulnerable are mining companies with a large debt burden in their balance sheet, while firms with a high portion of equity are more resilient. By contrast, in ASM activities capital investment is usually very low, resulting in a low level of fixed costs. Given the low share of fixed costs and the absence of debt repayment obligations, ASM are in a better position to endure periods of low commodity prices.

Zambia provides a classic example of the negative impact of fluctuating prices for mineral commodities on economic development and growth. Until 1974 Zambia experienced significant economic growth as a result of booming copper prices on international markets.[15] The country's economic fortunes suffered a downturn in 1974 as a result of a combination of falling copper and rising oil prices. The year 1974 marked the country's long road to economic decline. Although significant efforts have been made to diversify and expand the economy since the early 1990s little progress had been made and huge structural problems still remain. The privatisation of copper mines has not achieved the expected results – stimulation of growth and increasing employment and export earnings. Anglo American recently sold the Konkola copper mines that it had acquired in the wake of the privatisation

[15] Personal communication with Ministry of Mines and Minerals Development (MMMD), October 2003

wave of the 1990s. The reason for selling was declining quality of copper ore reserves amid high production costs.[16]

When prices for mineral commodities are low over a considerable period of time, some governments put in place schemes to subsidise mining companies and keep them in operation. This is done to protect employment and export earnings generated by the mining sector. Examples of such schemes include the gold floor support price that is administered by the central bank in Zimbabwe.

4.2 Exchange rate movements

When local currency appreciates against foreign currencies imports get cheaper while exports get more expensive. Cheaper imports encourage higher domestic consumption which exerts pressure on a country's foreign currency reserves and trade balance. Expensive exports become uncompetitive leading to a decline in exports and export earnings.

Overvalued local currencies exert a particularly heavy burden on economies dependent on the production and export of mineral commodities. Since the prices of minerals are largely determined on international markets such as the London Metal Exchange there is little room for mining companies to sell at above world prices and realise a profit. In the absence of exchange rate adjustment or subsidy from government minerals are sold at a loss. When this happens viability is eroded and investment and sustainability are undermined. Where an overvalued local currency leads to the emergence of a parallel foreign currency market the incentive to smuggle minerals out of a country is increased. This is often not difficult given the existence of long and porous borders between many developing countries. Smuggling, however, represents a loss of direct tax income for countries affected. Where the problem is widespread relations between government and artisanal and small-scale miners are strained. The government becomes more determined to abolish illegal ASM activities. On the other hand, artisanal and small-scale miners become more determined to smuggle their minerals out of the country as long as higher prices can be received externally.

On the upside, an overvalued local currency can help mining companies to import capital equipment cheaply and thus encourage investment in the mining sector. The point emerging from this analysis is that governments must take great care to manage the exchange rate in order to promote exports while not unrealistically compressing essential consumer and capital goods imports.

Ghana and Zimbabwe provide illustrative examples on how the maintenance of official exchange rates and the imposition of foreign currency restrictions affect ASM activities. In the 1980s Ghana experienced a rapid increase in unauthorised artisanal exploitation of gold and diamonds mainly due to an artificial foreign exchange rate and foreign currency restrictions.[17] At that time all of the gold mined by artisanal (galamsey) operators was marketed illegally, and about 70 % of the diamonds produced by licensed diamond diggers were sold illegally. In 1989 the government started to regularise artisanal mining through appropriate legislation and the establishment of an adequate institutional framework. A total of eight small-scale district mining centres were set up by the Minerals Commission in all high-density artisanal mining areas assisting ASM in the regularisation process. Through the extension work provided by the small-scale district mining centres there has been a reduction in the environmental, safety and health hazards in ASM communities. Following

[16] Personal communication with MMMD, October 2003
[17] Mackay & Schnellmann Ltd. Regularisation of Small Scale Gold and Diamond Mining in Ghana. Report prepared for the Minerals Commission. April, 1987.

this initiative and the liberalisation of the foreign exchange market, the contribution of ASM to foreign exchange earnings increased substantially.[18] In spite of the success of the regularisation effort, a considerable volume of illegal mining (galamsey) still exists in Ghana.[19]

In Zimbabwe gold production has reportedly slumped because gold producers have to sell their product to the government (central bank) at the official exchange rate which is only a fraction of the estimated "parallel" (market) exchange rate. This fall in formal gold output has been accompanied by a boom in panning and small-scale mining of gold which is sold outside the official market at the black-market (parallel) exchange rate.[20] In the year 2002 the official exchange rate was at 56 Z$/US$, while the "parallel" exchange rate was estimated at 1,000 Z$/US$. A discrepancy of this magnitude is a powerful incentive to sell gold through illegal channels. It is estimated that 10 t/year of gold is leaving the country this way. This clearly demonstrates that the maintenance of a fixed exchange rate which substantially deviates from the market exchange rate severely damages the mining industry and at the same time harms the national economy. The experience of Ghana and Zimbabwe suggests that illicit marketing of precious minerals can only be eliminated if official prices in local currency largely reflect world market prices.[21] Establishing a realistic foreign exchange rate is, therefore, the most effective way to achieve this goal.[22]

4.3 Economic recessions

During periods of economic recession prices of commodities generally fall and this puts stress on producers and exporters of commodities. Mineral commodities are particularly sensitive to economic recessions due to the close relationship between economic growth and the demand and consumption of minerals. Global economic recessions generally depress demand for minerals in the rich industrialised countries. As a result of low demand and consumption stocks build up leading to a decline in mineral commodity prices.

The stress and decline experienced by the Zambian economy starting in 1974 is largely the result of the steep fall in the prices for copper on the London Metal Exchange. In addition, production costs in the country remained relatively higher compared to other producers and this eroded the viability of the copper mines. State revenues and export earnings from copper fell precipitously. The role of copper as the mainstay of the economy has never been restored. This explains current efforts by the Government of Zambia to diversify the economy through promotion of small-scale mining and other sectors (MSDP project document, 2001).

Economic recessions adversely affect the producing sector's ability to pay taxes and thus government income. This results in reduced public investment notably in infrastructure and government services. Economic recessions are also usually associated with a decline in the domestic demand for construction materials, including sand and gravel, crushed stone,

[18] MIME Consult Ltd. Ghana. Poverty Eradication & Sustainable Livelihoods: Focusing on Artisanal Mining Communities. Study prepared for UNDP/UNDESA. October 2002.
[19] Hilson, G. A Contextual Review of the Ghanaian Small-scale Mining Industry. MMSD/IIED. September 2001.
[20] Hollaway, J. Mining in Zimbabwe: there may be a future. Mining Journal. London, November 22, 2002.
[21] Noetstaller, R. Small-scale Mining: Practices, Policies, Perspectives. In: Ghose, A.K. (Editor). Small-scale Mining. A Global Overview. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 1994.
[22] Noetstaller, R. Historical perspectives and key issues of artisanal mining. Keynote speech at the International Roundtable on Artisanal Mining organised by The World Bank, Washington, D.C. May 17-19, 1995. www.casmsite.org/db/index/asp.

cement and steel products as both private and public construction projects are postponed into the future until the economic outlook is more favourable. Hence, mining companies producing construction minerals and metal ores suffer most in periods of economic recessions. Operations producing industrial minerals for consumer goods are generally less affected by economic recessions and, thus, less vulnerable.

4.4 Structural adjustment programmes

A wave of structural adjustment programmes swept across many developing countries during the 1980s and 1990s. The broad objective behind structural adjustment programmes is to correct structural rigidities in an economy and create conditions for sustainable economic development and growth. Typically, structural adjustment programmes require governments to liberalise trade, reduce the civil service, reduce budget deficits to less than 3% of GDP, embark on reforms to liberalise and deepen the financial sector and promote the rapid growth of exports.

Structural adjustment programmes seek to reduce public expenditure and release resources to the private sector. Reduction of public expenditure may impact negatively on investment in critical areas such as transport, power and water which are required in mining areas. In this respect, structural adjustment programmes have potential to reduce investment in mining and reduce economic growth.

Cases where structural adjustment programmes compressed public investment and reduced economic growth abound, especially in Sub-Saharan Africa. Zimbabwe's economy, for example, shrank by an average of 2% per year during the period 1990-95 when it implemented the programme.[23] During periods of economic decline, profits of mining companies shrink. Similarly, state revenues arising from royalties and taxation of profits also fall.

In Zimbabwe, the economic structural adjustment programme adopted in 1990 led to massive retrenchments of workers in all sectors of the economy as the industries streamlined their operations for a free market system. The situation was aggravated by the incidence of severe regional droughts in the early 1990's. Many of the retrenched workers and the farmers affected by the droughts turned to artisanal and small-scale mining as a means of survival. Virtually all of the more than 300,000 artisanal gold miners in Zimbabwe are a result of a combination of these distress situations.[24]

Likewise, in Tanzania the number of people involved in artisanal mining increased from an estimated 100,000 in 1989 to 300,000 in 1992 and to 500,000 in 1996.[25] Much of this increase is attributable to the structural adjustment programme implemented during this period in which many workers lost their jobs and had to find a new source of income.

4.5 Cost of capital

Capital is one of the most important inputs in the production process. It follows that if the cost of capital rises the amount that mining companies can borrow is reduced. It also means

[23] Reserve Bank of Zimbabwe, Economic Review, various issues, 1991-95.
[24] Drechsler, B. (Editor). Zimbabwe. In: Small-scale mining and Sustainable Development in the SADC Region. MMSD/IIED, August 2001.
[25] Tan Discovery. Baseline Survey and Preparation of Development Strategy for Small Scale and Artisanal Mining Program. Final report prepared for the Ministry of Energy and Minerals. Tanzania, November, 1996.

that interest paid increases. Given that mining is generally capital-intensive investment prospects in the mining sector of a country are depressed when the cost of capital goes up.

Mining companies are reluctant to make new investment or expand existing operations during periods of high interest rates since expected returns are drastically reduced. Returns in mining are frequently lower than those in other sectors and this is worsened when the cost of capital goes up.

ASM activities are not affected by an increase in the cost of capital to the same extent as large mining companies. As opposed to modern medium and large-scale mining, artisanal mining is labour-intensive applying mining and processing techniques with a low degree of mechanisation, requiring only a small amount of fixed assets. In addition, most ASM players have limited access to financial markets. Given the limited capital requirements typical for ASM, an increase in the cost of capital therefore has little effect on their incomes or investment and production decisions and activities. They usually rely on their own resources.

4.6 Technological changes

Rapid change in the technologies used by mining companies creates two impacts, one positive and the other negative. On the positive side, new and more efficient technologies reduce exploration, production and processing costs and thus increase the viability of mining. Mineral deposits that were considered unprofitable for mining in the past twenty years have been brought under mining thanks to improvements in mining technologies. Improved technologies therefore increase the area of deposits that can be mined, increase the quantity of minerals that can be recovered from ore and thus increase the profits of mining companies. Higher profits for mining companies lead to higher revenues for the state from taxation of profits. Technological changes can therefore improve the relationships between governments and mining companies.

On the negative side, new technologies can increase the gap between large and small mining companies. Companies that can afford the new technologies become more productive and efficient while those that cannot afford are become less efficient and are left behind. The long term effect could be the consolidation of mining activities among a few large companies. This could reduce competition in the supply of minerals and increase prices for consumers.

Technological changes often leave the ASM community worse off. The sector has limited financial resources and its capacity to purchase new technologies is therefore low. Consequently productivity in the ASM sector lags behind that in the large-scale mining sector. In order to increase productivity and viability of the ASM sector there is a need to develop efficient technologies that are affordable and suitable to meet the needs of the ASM community.

4.7 Environmental legislation

Implementation of environmental laws and regulations is a cost on mining companies. Governments and mining companies however agree that this cost is necessary in order to enhance mining's contribution to sustainable development. Mineral wealth must be exploited and enjoyed without compromising the ability of future generations to do the same.

Before starting mining operations governments require that a detailed EIA be carried out to assess actual and potential environmental impacts and to put in place an environmental

management plan. Before a new mine is approved mining companies have to show how they will deal with large volumes of waste such as overburden, waste rock, tailings and heap leach spent ore. They must also produce a plan on how to deal with acid drainage and how to rehabilitate the environment when mining has ended. As part of the sustainable development approach mining companies are now also expected to develop and implement a plan on how they will use some of the revenues generated during the life of the mine to develop the region and ensure sustainable livelihoods of local communities when the mine has closed down.

The situation is different when it comes to ASM. With no immediate tangible benefit arising from conducting and implementing the findings of EIAs the vast majority of artisanal and small-scale miners consider EIAs unnecessary and unaffordable. Because ASM is considered informal and illegal in many countries governments have neither the resources nor the will power to enforce environmental legislation and regulation on the sector. As a result, the environmental damages caused by the ASM sector are largely not monitored and addressed in many countries.

5 Cross-sectoral linkages

Strong upstream and downstream linkages exist between mining and other sectors of an economy. Mining relies on suppliers of mining equipment, food, electricity, chemicals, clothing, etc. to be able to sustain operations. These represent the upstream linkages. Mining also relies on consumers of mineral products to provide a market. These consist of smelters, refineries, fabricators of metals, manufacturing companies, etc. Such consumers constitute the downstream linkages. This section briefly discusses the importance of linkages in enhancing mining's contribution to economic development and building a cordial relationship with governments.

5.1 Upstream linkages

Mining has contributed immensely to the development of countries and regions of countries in many parts of the world. Antofagasta in northern Chile has depended on mining of copper and nitrates over the last 150 years (Eggert, 2001) Australia and Canada are two countries that owe much of their development to mining. Even today several regions of these countries derive a significant part of their wealth from mining. In the United States silver and gold mining stimulated settlement and development in the Rocky Mountains region. Johannesburg, the financial and commercial capital of South Africa, owes its position to gold and diamond mining. Copper mining has dominated the Zambian economy to the extent that the country's economic fortunes have been closely tied to the performance of the copper mining sector and prices of copper on international markets (Eggert, 2001, p18).

When a mine has been set up in a region of a country it stimulates demand for products and services within the region and country. To carry out prospecting, production and processing activities a mine requires capital equipment, chemicals, electricity and clothing and food for workers among other things. This demand creates strong linkages with agriculture and manufacturing. Mining can stimulate creation and growth of these sectors. Mining therefore contributes to economic development directly - through jobs, incomes and taxes and royalties related to mining operations. It contributes to economic development indirectly through linkages it creates with other sectors where the demand of the mining sector for goods and services creates jobs and income at the operations of first, second and third level suppliers. Important first level suppliers are manufacturers of mining machinery and

equipment, as well as producers of consumables, such as roof bolts, explosives, fuel and energy. Second level suppliers are those providing metals and materials to mining equipment manufacturers, and chemicals to explosive producers.

While modern large-scale mines operating in developing countries usually use sophisticated imported mining and processing equipment, ASM creates demand for simple tools and machinery that can be manufactured locally. Equipment used by artisanal miners, such as picks, hammers, shovels and wheelbarrows can be made in workshops frequently available at the village level. In Mozambique, for example, sluice boxes and wooden pans used in gold processing by artisanal miners are manufactured by local craftsmen.[26] In Tanzania, workshops reportedly exist throughout the country that can handle most small-scale mining needs.[27]

Apart from the demand for mining equipment and supplies, mining camps need basic consumer goods that are usually supplied by entrepreneurs from nearby villages and towns. In Tanzania, for example, women are mainly involved in meeting the essential consumption needs of miners in ASM communities selling food stuff, clothing and water.[28] While no statistical data are available on the economic effects of these linkages, obvious signs of a new prosperity, such as purchases of cars and the building of modern homes in villages supplying ASM communities in Tanzania provide evidence on the economic benefits arising from the presence of ASM activities.[29]

It must also be noted that widespread negative social effects can develop in areas where ASM activities are concentrated. This is particularly the case if large numbers of new migrants move into a new mining area in search of instant wealth. Vices such as prostitution, production and consumption of illicit and toxic brews and theft can become rampant in areas where ASM activities are concentrated.

An important indicator measuring the effects of linkages with other sectors is the employment multiplier, which measures the direct, indirect and induced employment resulting from the original mining activity. The direct value refers to the employment created in the principal producing industry, i.e. mining, the indirect value refers to economic activity created by sales of goods and services by second, third and fourth-level suppliers to the mining industry. The induced value finally identifies changes in employment in the economy resulting from increased consumer spending of incomes earned by workers producing the direct and indirect output. Total employment multipliers are calculated from the ratio of the direct, indirect and induced employment effect to direct employment.

Although data on employment multipliers related to the mining industry in developing countries are not available, the respective values estimated for a number of states with an important mining industry in the U.S.A. in the 1970s may provide an indication. Employment multipliers were determined to be in the range of 3 to 5, meaning that for every job created in the mining sector up to 4 persons find employment in the sectors in which second, third and fourth-level suppliers work to produce goods and services used in the mining industry,

[26] Drechsler, B. (Editor). Mozambique. In: Small-scale mining and Sustainable Development in the SADC Region. MMSD/IIED, August 2001.

[27] Mutagwabe, W.K., R. Mwaipopo-Ako and A.L. Mlaki. The Impact of Technology on Poverty Alleviation. A Study of Artisanal Mining in Tanzania. July 1997.

[28] Mutagwabe, W.K., R. Mwaipopo-Ako and A.L. Mlaki. The Impact of Technology on Poverty Alleviation. A Study of Artisanal Mining in Tanzania. July 1997.

[29] Tan Discovery, Baseline Survey and Preparation of Development Strategy for Small Scale and Artisanal Mining Program. Final report prepared for the Ministry of Energy and Minerals. Tanzania, November, 1996.

and in the consumer products sector where the workers in the mining and mining supply industry spend their incomes.[30]

5.2 Downstream linkages

Once minerals have been produced they are bought and consumed by many players. These include smelters, refineries, metal semi-fabricators and fabricators and manufacturers. Demand and consumption of minerals therefore creates strong downstream linkages for the mining sector. As with upstream linkages this helps to stimulate economic growth and create jobs and incomes. In countries where strong downstream linkages are created mining can act as a powerful stimulus for industrialisation and economic development and growth. Countries that have taken full advantage of the mining sector to create strong upstream and downstream linkages in their economies include Canada and Australia. The two countries have established robust manufacturing industries (automobile manufacture, for example) based on the ready availability of steel and other materials from mining. Unfortunately, many developing countries have failed to take full advantage of their mineral resources by creating strong downstream linkages. They continue to depend on production and export of raw minerals. Instead of exporting copper cables, for example, Zambia largely continues to produce and export copper metal. That most developing countries have largely remained producers and exporters of mineral commodities helps explain their greater vulnerability to commodity price fluctuations. Their economic fortunes are closely tied to world supply and demand trends for commodities.

Major consuming industries of processed mineral materials are construction, durable goods manufacturers and some non-durable goods manufacturers, including the paper, paint, plastics, ceramics and fertiliser industries. Particularly close linkages exist with the construction industry, for which mining acts as a supplier of building materials, including sand and gravel, crushed stone, dimension stone, structural clay, gypsum, and raw materials for cement. These materials are essential in the development of basic infrastructure, including roads, railroads and public buildings. A strong correlation, therefore, exists between economic growth and the demand for construction minerals throughout the process of industrialisation. Compared with metals and industrial minerals, construction minerals are used in much larger quantities annually. On a mass basis, some 70 % of the minerals consumed world-wide are construction minerals, about 20 % are fossil fuels and the remaining 10 % are metals and industrial minerals. The downstream processing of domestic construction minerals and their use creates employment and growth opportunities in construction and related sectors of the economy.

The role of mining and minerals in the downstream sectors of the economy can be illustrated using the U.S.A. for which detailed data are available as an example. In the year 2002, the value of domestic mineral raw materials from mining amounted to US$ 38 billion, and the value of recycled metal and minerals products used in the country was US$ 6 billion, totalling US$ 44 billion in material inputs from mining and recycling. After processing to intermediate products, such as aluminium, brick, cement, copper, fertilisers, steel, etc., the value of mineral materials processed domestically went up to US$ 370 billion. In the final stage, the value added to gross domestic product by major industries that consume processed mineral materials amounted to US$ 1,700 billion.[31] In other words, out of every one-dollar of minerals, $8.5 worth of processed mineral materials and $38.6 worth of value

[30] U.S. Bureau of Mines. An assessment of factors affecting small mining and custom milling and smelting operations in the Western United States. Washington, D.C., 1982.
[31] U.S. Geological Survey. The role of non-fuel minerals in the U.S. Economy. In: Mineral Commodity Summaries 2003. U.S. Government Printing Office. Washington, D.C., 2003.

added in industries that consume processed mineral materials are created in the U.S. economy. The value added to GDP by major industries that consume processed mineral materials amounted to more than 16 %.of the total GDP in 2002.

6 Management of mineral wealth

6.1 Dealing with commodity price fluctuations

Given that fluctuation of commodity prices is common, how should countries deal with the problem in order to enhance their development prospects? There is no consensus on this question but some best practices are emerging. It is generally agreed that countries that heavily depend on production and export of commodities should do one or more of the following:

- First, annual expenditure plans should be based on conservative rather than optimistic forecasts of mineral and other commodity revenues. It is easier to adjust expenditure upwards if revenues turn out to be higher than anticipated than to adjust downwards if they are lower than anticipated.
- Second, countries dependent on production and export of mineral commodities should strive to remain on the technological front and reduce mining costs. This will increase productivity and increase profits.
- Finally, countries dependent on commodity exports subject to volatility should consider setting up a stabilisation fund that accumulates funds during commodity price and revenue booms and disburse funds when commodity prices and revenues are low. A number of developing countries that include Botswana, Chile and PNG have established and managed such funds with good success (Eggert, 2001).

6.2 Global supply and demand trends

Understanding global supply and demand trends for mineral commodities is critical for a country to forecast its revenue prospects from mining activities. It is now well known that prices of mineral commodities are more responsive than those of manufactures to changes in world supply and demand conditions.[32] Consequently, revenues from commodities are also more volatile.

Supply and demand for minerals on the world market is determined by many factors. Factors influencing supply include production costs, technological changes, number of producers, country and political risk and demand on markets. On the demand side factors at work include prices for mineral commodities, economic performance, especially in the large consumer nations, growth of incomes (which influences demand for manufactures) and development of substitutes for products manufactured from metals.

Global supply and demand trends are difficult to track. However, countries that rely on production and export of commodities such as minerals must make an effort to understand and keep track of the trends if they are to derive maximum economic benefit. During periods of falling prices for minerals, revenues and profits for mining companies fall.

[32] World Bank (2000a), "Managing the recent commodity price cycle" in *Global Economic Prospects and the Developing Countries*, The World Bank, Washington D.C.

Similarly, revenues that the state receives from royalties and taxes on profits also fall. This reduces a country's capacity to fulfil its development objectives.

Since output and sales from the ASM sector are usually too small to make any impact on global demand and supply trends ASM players are price takers in both periods of glut and shortage. They do, however, realise higher revenues during periods of shortage given their low overhead and borrowing costs.

6.3 Value addition and diversification

It is now well known that prices of mineral commodities are more volatile than those of manufacturing and services. It is also well known that moving an economy from dependence on exporting one or two commodities offers the best chance for economic stability. One way of moving an economy from dependence on one or two commodities is through adding value to minerals. This enables a country to export value-added products instead of primary commodities. In countries where one mineral dominates mining activities the danger is that all investment is channelled into that mineral at the expense of diversification. This compromises long term economic growth and development.

Zambia offers a classic example of the impact of dependence on one or two commodities for export earnings and government revenue. From the attainment of independence in 1964 until the early 1990s copper was the mainstay of the economy and both private and public investment was channelled into copper mining. Rising production costs and the drop in the world prices for copper in the mid-1970s brought the economy into serious difficulties. Although copper mines were privatised in the mid 1990s in a bid to revamp productivity and output Zambia's position as a world leading producer and exporter of copper and copper products has never been restored. Exploitation of sub-economic deposits and lack of resources to purchase and use new but expensive technologies have combined to make it difficult for Zambia copper mines to compete with low-cost producers like Chile.[33]

Realising the declining importance of copper as a source of revenue and export earnings in 2001 Zambia embarked on a major initiative to promote production and export of other minerals, especially gemstones and industrial minerals. With support from the EC the country is currently implementing a mining sector diversification programme MSDP project document, 2001). The core objective of the programme is to diversify the economy and alleviate poverty through creation of sustainable jobs and incomes in the non-copper mining sector.

6.4 Development of other sectors

The objective of any government should be to reduce dependence on single commodities for its revenues and export earnings. One way this can be achieved is to take advantage of revenues generated from a booming commodity to diversify the economy by moving into the development of other sectors such as agriculture, manufacturing and services. Obvious as this appears as a sustainable development strategy many developing countries have been found wanting on this aspect. Zambia, for example, continued to devote enormous resources to the copper mining sector throughout the 1970s and 80s even when it was abundantly clear that the country would find it increasingly difficult to compete with low cost producers like Chile. Nigeria currently receives 99% of its export earnings from oil (Eggert, 2001, p15)

[33] Personal communication with MMMD, October 2003.

yet there is no effort to use the revenues to develop other sectors and diversify the economy.

Development of other sectors of the economy is critical since it ensures that mineral wealth is used to expand the economy and create assets that will endure long after mineral resources have been exhausted. Mineral wealth should also be invested wisely to build a country's physical and human assets. These assets are critical for development and growth of other sectors of the economy and for sustainable development.

6.5 Transparency and rent maximisation

One of the most topical issues in developing countries is corruption in both private and public sectors. Conditions and regulations in developing countries tend to promote corruption. They also make it particularly difficult to fight corruption. In a situation where earnings of civil servants can barely take them through a month the temptation to accept bribes is great. Laws and regulations that have to be observed by mining companies in many developing countries are numerous and complex. This creates an opportunity for civil servants to delay making critical decisions in order to force mining companies to pay bribes.

Mining companies sometimes also play a part in encouraging corruption. They may, for example, offer bribes to officials as a way to obtain licences and permits, to acquire monopolistic power and thwart competition, or to get access to areas with proven high value mineral deposits.[34]

Corruption appears to be particularly pervasive and serious in countries with a large mining sector. There are a number of factors explaining why this is the case. First, mining is highly capital-intensive. Investment that a new mine brings into a country can be so large to the extent that it tempts underpaid officials to demand bribes in order to overlook some regulations. Where corruption is widespread, enforcement of legislation and regulations on EIAs and environmental management plans is to a large extent non-existent.[35]

Second, laws and regulations on mining are extensive in many countries while the capacity to administer them is weak. This exposes officials responsible for their implementation to great temptation to be corrupt especially when they know that the chances to be exposed are slim.

Finally, mining is determined by geology and is therefore confined to selected locations. Unlike other economic activities which give companies greater room to move from hostile to more investor friendly countries mining companies have less choice. Faced with an environment where payment of bribes is the way to get things done they may have no choice but to comply.

The important point coming out of this analysis is that corruption can be a great source of conflict between governments and mining companies. Corruption also undermines a country's economic development and growth prospects since it misallocates revenues that a government should invest in development of critical assets such as physical and human capital. It also encourages mining companies to engage in activities like transfer pricing that drain countries of much-needed capital.

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[34] Marshall, I E (2001), "A survey of corruption issues in the mining and minerals sector, Paper prepared for MMSD.
[35] Ibid.

To make progress in the fight against corruption both governments and mining companies have a role to play. Governments should streamline and simplify mining laws and regulations in order to reduce the temptation by officials to abuse them. Mining companies should not fall into the temptation of offering bribes in order to get favours or to circumvent rules and regulations. Dialogue to change laws and regulations that are considered inhibiting and cumbersome should be the way to go. Any government keen to promote investment and development should be willing to engage in such dialogue.

6.6 Social and environmental responsibilities

Governments and mining companies broadly agree on the need to use mineral wealth to build infrastructure and investment in mining areas to develop sustainable livelihoods. Many large mining companies also now take full responsibility for carrying out EIAs and implementing their findings and recommendations with close supervision from government and other stakeholders. Many governments and mining companies believe that this is the way to go in order to enhance the contribution of the mining sector to sustainable development.[36]

There is still no consensus as to whether ASM can meaningfully contribute to sustainable development given that in many countries it is considered illegal. The legal status of the sector therefore needs to be reconsidered. Resources in the sector are also limited and its ability to conduct EIAs and apply their findings is severely constrained. In order to mitigate the environmental impacts of ASM activities governments and development agencies should focus on building the capacity of the sector through training. The training should focus on conducting and applying the results of EIAs, adoption of more environment-friendly mining methods, adoption of more efficient technologies to improve mining efficiencies, and implementation of improved health and safety practices. Incentives to reward those that excel in the ASM sector should be developed. Ultimately, it is such measures, and not coercion, that will enhance the sector's contribution to sustainable development.

7 Summary and conclusions

This paper set out to discuss the relationships that exist between mining companies, the ASM sector and national governments. The paper discussed the nature of the relationship and the many factors that influence that relationship. The relationship is determined by mining laws, health and safety regulations, environmental regulations, the fiscal regime, the related institutional framework, as well as government services provided to the mining industry. External shocks impacting on this relationship include commodity price fluctuations, exchange rates, economic recessions, structural adjustment programmes, natural disasters, cost of capital and technological changes.

Declining commodity prices negatively affect mining operations of all scales. Capital-intensive large-scale mining companies with a high level of fixed costs and a large share of debt financing are more vulnerable than ASM operations, which usually have negligible fixed costs. Downward commodity price movements also result in lower tax revenues from mining going to the state. This affects public investment in infrastructure essential for the mining industry and government ability to control and assist ASM communities. Official exchange rates that substantially deviate from market exchange rates have been identified as a major

[36] MMSD Global Conference deliberations, Toronto, Canada, May 2002.

cause of smuggling, especially in gold and diamond mining. Distorted exchange rates therefore damage the mining industry and hurt the national economy.

Economic recessions lead to a decline in the demand for minerals thus leading to a price slump. Falling commodity prices negatively affect the profitability of the mining sector. Structural adjustment programmes together with extended periods of drought affecting agricultural yields have caused a dramatic increase in the numbers of artisanal miners in a number of African countries as retrenched workers and starving farmers join the ASM sector as a survival strategy. Increasing interest rates reduce the profitability of large-scale mines, notably those with a large share of debt financing thus negatively influencing their ability to invest in exploration and development of new deposits to replace depleting reserves in old mines.

The mining industry, including ASM, has strong linkages with other sectors of the economy, both upstream and downstream. On the demand side, mining creates employment in industries manufacturing mining machinery and consumables. The ASM sub-sector provides opportunities for local entrepreneurs supplying tools, foodstuffs and other essential consumer goods. Using data from the U.S.A. indications are that for every job in the mining industry four jobs are created in upstream sectors. On the downstream side, mining provides the material basis for a sequence of processing and manufacturing activities in the economy. The example of the U.S.A. demonstrates that for every US $1 of domestic minerals produced between US $30 and $40 of value added are created in industries that consume processed mineral materials. In developing countries particularly close linkages exist with the construction industry which uses domestic minerals in large quantities and plays an essential role in economic development.

Contribution of ASM to employment is perhaps the most compelling reason why the sector deserves government support. Studies from many countries around the world indicate that at least 6 million people are employed in the sector globally (Noeststaller, 1995). In the vast majority of cases people employed in the sector receive wages that are higher than minimum wage levels.

The negative impacts of ASM (pollution of watercourses, rampant use of dangerous chemicals such as mercury, poor health and safety practices, environmental damages, etc.) can only be reduced or eliminated through regularisation of the sector. Regularisation of the sector is only possible if it is accompanied by powerful incentives that outweigh the costs of compliance. Compliance entails payment of taxes and implementing health, safety and environmental regulations, among other things. Support that governments and other development agencies can provide to increase compliance includes research into technology to improve productivity, output and mineral recovery. It also includes training in improved mining methods, business management and marketing. Such support can help to increase income for the ASM sector. Increased income is the most important incentive for the sector to comply with rules and regulations.

Widespread corruption in the mining sector retards growth of mining activities, especially in developing countries. Governments and mining companies can help to reduce conflict between themselves by fighting corruption and investing revenue from minerals wisely. This will ensure development of a country's capital assets and thus create conditions for sustainable economic development and growth.

The recommendations emerging from the paper are fairly straightforward. Mineral wealth is a blessing to countries if used wisely. It can however be a curse and a source of great conflict between governments, mining companies, ASM sector and communities if it is

wasted through mismanagement, an unattractive investment climate and pervasive corruption. Governments, mining companies and ASM communities should work together to enhance the contribution of mining to sustainable development.

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