Trends in the small-scale mining of precious minerals in Ghana: a perspective on its environmental impact

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Received 5 December 2001; received in revised form 26 February 2002; accepted 27 February 2002

Abstract

Small-scale mining in Ghana is defined to include both the exploitation of mineral deposits (1) using fairly rudimentary implements and/or (2) at low levels of production with minimal capital investment. While the large-scale mining—of particularly gold—has become predominant, small-scale mining, which predates such operations, has continued to be an important economic activity, particularly within the remote and poorer areas of the country. The environmental impacts of such small operations have, however, varied, depending on methods and the scale of operation. The factors that have contributed to aggravating these environmental impacts are economic, technical, legal, and operational in nature. Although mitigation efforts have had a limited impact, it is expected that the measures now being considered for adoption will improve the efficacy of the Government of Ghana’s drive towards improving environmental management in resident small-scale precious metal mining operations.

This paper examines the environmental impacts of small-scale mining in Ghana—with particular emphasis on precious minerals and metals extraction—and outlines a series of initiatives for improving environmental performance in the industry.

Keywords: Small-scale mining; Ghana; Environmental impacts; Environmental friendliness or soundness; Sustainable development

1. What is small-scale mining?

1.1. Small-scale mining defined

Small-scale (and artisanal) mining has been defined differently around the world. However, as the United Nations (UN) and Intermediate Technology Development Group (ITDG) definitions quoted below show, “small-scale mining” is generally defined in terms of a given production ceiling, or the level of sophistication with which minerals are exploited.

Small-scale mining is any single unit mining operation having an annual production of unprocessed material of 50,000 tonnes, or less as measured at the entrance of the mine [1]; and

Small-scale miners are “poor people; individuals or small groups who depend upon mining for a living; who use rudimentary tools and techniques (e.g. picks, chisels, sluices and pans) to exploit their mineral deposits” [2].

According to the World Bank Group, “Small-scale mining is largely a poverty-driven activity, typically practiced in the poorest and most remote rural areas of a country by a largely itinerant, poorly educated populace with few employment alternatives”. The World Bank also estimates that while some 13 million small-scale miners are operating under harsh and risky conditions with minimal incomes in about 30 countries, as many as 80–100 million individuals depend on the activity for their livelihoods worldwide [3].

In Ghana, small-scale (gold) mining is defined as “…mining (gold) by any method not involving substantial expenditure by an individual or group of persons not exceeding nine in number or by a co-operative society made up of ten or more persons” [4]. The definition therefore includes (1) what has been termed “arti-
1.2. Historical perspective of small-scale mining in Ghana

During pre-colonial times, mainly gold and diamonds were mined on a small scale. In fact, gold was traded with the Moors and the Phoenicians on the trans-Saharan trade routes before the advent of the Portuguese and other European incursions, which began in 1471 [5]. Artisanal mining and processing methods were employed to work both hard rock/lode and alluvial gold deposits. Lode gold was mined by excavating pits to levels where “a dark coloured stone which is interspersed with gold” was reached. The gold was then recovered “by grinding the stone to powder”, and then “washing it” [5]. Alluvial gold was mined by collecting gravel from the beds of streams and washing sediments clean of sand and earth. The Chief whose land was mined for gold was generally entitled to one-third of the gold won, and therefore sought to promote proper organization of the activity [5].

Furthermore, in view of the opulent use of gold in the attire as well as customary practices of the traditional chieftaincy institution, close watch was kept over small-scale gold mines operating within their lands; control and regulation (by Chiefs) of such operations has existed for over two centuries [6]. As a result, artisanal or small-scale mining continued in Ghana even after the introduction of modern exploration and mining methods to the country by the Frenchman Pierre Bonnat and others circa 1870.

Enterprising natives, who had neither the capital nor technical ability to venture into large-scale modern mining, were also compelled to operate at the small-scale artisanal level. In fact, small-scale miners discovered almost all deposits subsequently worked by large-scale operators.

Various legislation, which prohibited or limited certain small-scale mining activities, stunted the growth of the small-scale gold mining sector vis-à-vis the large-scale sector from about 1910 onwards. This in turn led to the domination of gold mining in Ghana by English-owned large-scale mining companies, and nearly a complete eradication of the small-scale mining sector. In fact, prior to 1989, artisanal activities, together with the marketing of gold from such workings, were considered illegal.

Nevertheless, small-scale gold miners—referred to locally as “galamsey”—had flourished, and winnings were mainly smuggled for sale outside the country through a well-oriented black market. Despite contributing nothing economically, operations caused significant environmental damage. Outputs in turn enriched neighbouring countries, which were found to be exporting gold despite lacking significant gold deposits [7]. The increasing awareness of the fact that the continued marginalization of the small-scale gold mining sector was detrimental to the economy led to a study into the phenomenon, which resulted in its regularization through the enactment of the Small-Scale Gold Mining Law, PNDC L 218, in May 1989. Concurrently, the state agency responsible for marketing diamonds—the Diamond Marketing Corporation (DMC)—had its mandate expanded and was re-named the Precious Minerals Marketing Corporation (PMMC) to provide a ready market for both gold and diamond produced by resident small-scale miners.

Diamonds were first discovered in Ghana in 1919 (at the time, Ghana was known as “The Gold Coast”) within the stream gravels of the Birim River. Additional deposits were later discovered in what is today known as the Birim Diamond Field and the Bonsa Diamond Field. While mechanized diamond winning has taken place in Ghana for some time, the activities of small-scale miners, who use simple hand tools, led to the discovery of the various diamond fields; these operators continue to contribute significantly to Ghanaian diamond output.

In addition to the regularization of small-scale gold mining and implementation of an accompanying marketing framework in 1989, procedures for diamond marketing, which had long been legalized, were streamlined. This combination of changes has enabled the sector to make significant contributions to national mineral exports and foreign exchange earnings. From its regularization in 1989 to 2000, some 870,000 ounces of gold valued at more than US$ 280 million, and some 4.9 million karats of diamonds, valued at more than US$ 110 million and representing 69% of Ghana’s total diamond production, has been mined by Ghanaian small-scale miners. Furthermore, the sector, which is expanding rapidly, has provided a number of native Ghanaians with employment. It is estimated that about 80,000 locals, including women, are currently involved in the small-scale mining of gold and diamonds alone.

Notwithstanding its positive contribution to the economy of Ghana, the small-scale mining of precious minerals has also caused its share of environmental impacts. These are examined more in detail in the next sections of the paper.
2. Contemporary small-scale mining of precious minerals in Ghana

2.1. General introduction

Before examining the key environmental aspects of the industry, it is important to first provide a brief, yet concise, overview of small-scale gold and diamond operations in Ghana. The intensive small-scale mining of precious minerals is concentrated along the northeast–southwest gold belt of the country. Both legal and illegal miners operate along this belt.

Legal workings operate under a license granted by the government of Ghana on concessions registered in their names, and in a majority of cases, are well organized and have access to extension services. The Minerals Commission [8], which is responsible for assisting the Minister of Mines with small-scale licensing procedures and the monitoring of operations, has established seven small-scale mining district centres to facilitate the provision of technical extension services. These centres, which are manned by experienced mining engineers, provide assistance within small-scale mining areas in close proximity to their respective locations in Tarkwa, Asankragwa, Bibiani, Assin Foso, Akim Oda, Dunkwa-on-Offin, and Bolgatanga (as also shown in Fig. 1). The services provided include the sharing of information, the provision of advice, and assistance and training in best practices for mining, processing, marketing, environmental sustainability, health and safety. They also serve as an initial point of contact for any individual or group of individuals wishing to acquire a license for small-scale mining.

Small-scale gold mining licenses may be granted to Ghanaians 18 years of age and older, and are subject to the following conditions:

- a maximum allocation of 1.2 hectares of land in the case of a grant to any one person or group of persons not exceeding four in number;
- a maximum allocation of 2.0 hectares of land in the case of a grant to any group of persons not exceeding nine in number; and
- a maximum allocation of 10 hectares in the case of a grant to a co-operative society of 10 or more persons and registered companies.

Illegal operators, on the other hand, work without a licence, have no concessions of their own and operate uncontrollably within the concessions of large-scale mining companies or in areas prohibited for mining such as forest reserves. Such miners are highly disorganized and operate in a “hit and run” manner, often initiating confrontations with both state law enforcement agencies and the security personnel of large-scale mining companies.

2.2. Mining methods

Mining methods [9] employed by small-scale miners of precious minerals vary according to the type of deposit being exploited and its location. In view of the poor financial base of small-scale miners, a great majority rely solely on traditional/manual methods of
concentrate. Mercury is added to the concentrate and sluicing of mined material in a sluice box to obtain gold, involves the traditional ore processing method, which usually yields the mineral from ores. In the case of alluvial ores, the longer time these methods need for the recovery of gold, makes them less attractive to the miners of Ghana should they be introduced, because of the high costs they entail. It is also worth mentioning that an increasing number of Ghanaian small-scale miners have, in recent years, received financial and technical support from both foreign and local investors, registered as “Mine Support Service Companies”. This has facilitated a transition from artisanal or traditional mining to semi-mechanized and mechanized mining methods in some mining districts, particularly in the Tarkwa area. Where the deposit is alluvial in nature, mechanized operations commonly feature sizing trommels and Knelson concentrators and sluice boxes, all of which are used to process the material. In hard rock operations, on the other hand, jaw crushers, hammer mills, ball mills and modified corn mills are also used for comminution.

Schematic flow sheets for alluvial precious metal ore processing and hard rock ore processing (at a semi-mechanized level) are presented in Figs. 2 and 3, respectively.

### 3. Environmental impacts of small-scale mining in Ghana

Mining, irrespective of the scale of operation, has some degree of impact on the environment. The extent of damage depends largely on the mining and processing methods being used. Although legalized small-scale mining activities have some negative impacts on the environment, in most cases, they can be minimized through environmental permitting and regular monitoring by field officers. Illegal miners, on the other hand, whose operations by their very furtive and clandestine nature are not amenable to being monitored, are respon-

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2 Mine Support Service companies are companies that have been accorded certain concessions in view of the services they provide exclusively to companies operating in the mining sector of Ghana.
sible for the most significant share of environmental damages in the sector.

In Ghana, environmental problems associated with the small-scale mining of precious minerals can be broadly grouped into three categories.

The first category includes all impacts on the lithosphere. The primary impact, land degradation, is a common phenomenon at many uncontrolled, unmonitored small-scale mining sites. Miners leave behind “moon-like” landscapes consisting of unstable piles of waste, abandoned excavations and vast stretches of barren land. Excavated pits are typically left unfilled and abandoned to become receptacles for water. Such areas become breeding grounds for mosquitoes and potential dangers to both humans and animals. Large tracts of agricultural lands are also destroyed as a result of excessive vegetation removal and disturbance of soil structure. Growth supporting topsoil is usually removed during mining, and the land is rendered virtually incapable of supporting plant growth, in addition to being left exposed to erosion.

The second category includes all impacts on the hydrosphere. The drainage system in many small-scale mining areas is adversely affected by such operations. Rivers and streams are polluted by solid suspensions and mercury, which are commonly discharged into resident water bodies during the sluicing process and amalgamation, respectively. This in turn leads to siltation and coloration of such waters. Improperly disposed tailings also find their way into streams and rivers during heavy rains, creating sedimentation problems and rendering streams unusable for both domestic and industrial purposes. Removal of vegetation also causes soil erosion, which in turn increases the turbidity of runoff surface waters. Drainage of lubricants and other oils into streams also causes problems such as de-oxygenation of water, which threatens aquatic life.

The final category includes all atmospheric impacts. The effect of small-scale precious minerals mining on the atmosphere has generally been considered to be insignificant since operations are carried out in ambient air. Nevertheless, emissions of gaseous pollutants do occur. Small-scale mining operations that involve size reduction of ore generate some dust that could be hazardous to human health since the particles generated from such sources fall within the respirable dust range and are capable of causing dust-related diseases. Furthermore, a common practice of small-scale gold miners in Ghana is the burning of gold amalgam in the open air. This practice produces mercury fumes, which are released into the atmosphere. In some instances, the burning of amalgam is conducted in poorly ventilated rooms, exposing miners to the dangers of mercury con-

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**Fig. 2.** Schematic flow sheet for semi-mechanized alluvial ore processing.
It is important to note that many small-scale miners have rejected the use of a protective apparatus—the amalgam retort—that effectively separates gold from mercury without emitting fumes into the atmosphere.

4. Barriers to implementing sound environmental practices at small-scale precious mineral mining operations in Ghana

A number of factors are preventing implementation of improved environmental practices in the Ghanaian small-scale mining sector. First, a lack of self-generated funding as well as difficulties in securing access to credit facilities are preventing miners from exploring sound environmental management options. These are the major reasons for poor environmental practices being adopted at Ghanaian small-scale mines. The acute shortages of finances in turn leads to a reliance on cheap, haphazard and environmentally unfriendly operational methods. Furthermore, in many instances, the source of financial assistance is the itinerant mineral buyer—legal or illegal—who is only interested in the minerals obtained and not really concerned about the environment. He therefore only provides enough funding for extraction (an activity he may supervise very closely), and not for environmental rehabilitation.

A number of technical factors have also prevented environmental improvement in the industry. There is hardly any systematic exploration over areas in which small-scale mining takes place before exploitation commences. Thus, the majority of miners, as a result of inadequate geological information concerning mineralized areas within their concessions, operate in a “trial and error” manner—a practice that impacts negatively on the environment. Improper or a lack of planning and the consequent failure to incorporate environmental issues at the planning stages of operations results in the creation of substantial environmental liabilities with no effort made to rehabilitate mined areas. Additionally, there is a widespread lack of the knowledge or appreciation of the benefits to adopting appropriate technology, both in terms of improved efficiency of operation and environmental sustainability. This is more acute amongst illegal small-scale miners, who have little or no access to the technical extension support provided to legal miners.

Finally, illegal small-scale miners operating on the concessions of large-scale mining companies also cause a significant amount of environmental damage. For instance, a number of large-scale mining companies, after acquiring prospecting licenses, have been unable to prospect for some time due to financial constraints or other technical hitches. In such instances, the concessions are left at the mercy of illegal miners, since no security measures are in place to prevent encroachment. Even on concessions that are being actively mined by large-scale operators, areas not being immediately worked have been known to be under siege by small-scale miners.

5. Strategies for improving environmental performance in the industry

This section of the paper outlines:

• a number of policy options available to address the environmental impacts of small-scale mining;
• the efforts that have been made to address the environmental impacts of small-scale mining in Ghana—in particular, the measures that have been undertaken to improve the propensity of artisanal precious mineral and metal mining operations to enable sustainable development; and

Sustainable development is defined as "...development that meets the needs of the present without compromising the ability of future generations to meet their own needs." For the purposes of this discussion, environmental sustainability refers to upgrades in both environmental management and performance.
• a series of recommendations for further improvement.

5.1. Policy options

The policy options include:

• moral suasion—which would include using education, publicity and social pressure to bring about a change in behaviour;

• regulation—mainly by enforcement of legal requirements through monitoring and policing. This approach may prove to be an ad hoc measure in ensuring that small-scale mining is conducted in an environmentally sound manner, considering that: (1) a significant number of small-scale miners are illegal and therefore cannot be identified for regulation purposes; and (2) penalties for violation are inadequate to serve as a deterrent;

• manipulation of market forces—to ensure that funding is made available to meet the cost of environmental sustainability. Raising such funds or determining who bears the burden of cost may be addressed in two ways: (1) producer—direct taxes or fees to get the indirect costs incorporated into the production cost function and therefore included in the privately determined price and profit calculations; and (2) all society—through funding with general taxes levied on citizenry;

• investment in assistance to small-scale miners to improve their operations. As a starting point, this policy appears to be the one to be pursued in the small-scale mining sector of Ghana, to be followed up with one or a combination of others.

5.2. Measures in place

5.2.1. Regulatory initiatives

The Ghanaian government, in 1989, established a legal framework within which small-scale miners register and operate. The framework seeks to streamline and facilitate the licensing and provision of technical support to such workings. Additionally, in recent times, to ensure that environmental impacts are kept at a minimum, small-scale precious mineral miners in Ghana are required to obtain an environmental permit from the Environmental Protection Agency (EPA) as a precondition to receiving a license to mine. The EPA requires as prerequisites for granting the permit, proposed operational methods, a site plan of the area in which mining is to be undertaken, anticipated environmental impacts, proposed mitigation measures, and costs for reclamation proposals. District mining centres serve as stimuli to eschew mining and ore processing practices that are detrimental to the environment through visits and the threat of sanctions.

As noted earlier, illegal small-scale mining has been identified as a major factor militating against sound environmental practices in the small-scale mining industry. At various fora, it has been emphasized that such activity can best be tackled through the collaborative effort of the mining sector institutions, large-scale mining companies, and law enforcement agencies. However, while arresting and prosecuting offenders should serve as a deterrent to other illegal miners, the rather meagre fines imposed for such infractions have proven insufficient.

In summary, the effectiveness of efforts made by the district field officers and the EPA to ensure minimal environmental damage have been limited by the activities of illegal small-scale miners, who operate with very little regard for environmental issues.

Additionally, the Government established the Precious Minerals Marketing Corporation (PMMC) in 1989 to provide a ready market for both gold and diamonds produced by small-scale miners, through the promulgation of the Precious Minerals Marketing Corporation Law, PNDC L 219. The recent introduction of a jewellery-manufacturing wing at PMMC has enabled the Corporation to manufacture jewelry for both local and export markets, thus further contributing to the success of the regularization scheme.

Moves to allow private sector participation in the marketing of such minerals are being broadened to improve competitiveness and transparency in the sector’s operations.

5.2.2. Provision of education and technical support

Another important line of action that is being adopted to help minimize environmental impacts associated with the small-scale mining of precious minerals is education. Operators are being educated and advised to adopt efficient mining and processing methods, and are being encouraged to adopt improved management practices and environmental damage control. Since 2000, training workshops covering environmental damage control, health and safety aspects of operations have been held for small-scale miners, as well as basic bookkeeping and cost calculation seminars. In addition, miners are increasingly being informed in each of the seven small-scale mining districts about pertinent environmental regulations and guidelines.

Education and training of small-scale gold miners on mercury pollution abatement is also an ongoing activity. It is expected that such programmes will help to inform miners of the benefits of adopting environmentally sound practices in their operations. Through its educational and training initiatives, the Government has sought to change the attitudes of miners, with hopes of changing their pre-regularization attitudes, and instilling a belief that small-scale mining activity is a viable economic venture that requires proper planning, organization and execution to achieve desired results.
5.2.3. Cooperation between large- and small-scale miners

Large-scale mining companies can play a constructive role in addressing the adverse environmental impacts of illegal small-scale mining. They can adopt a “tributer system”, which involves the registration of small-scale miners encroaching on their properties, and allocating to them portions of their concession areas considered uneconomical to exploit using large-scale mining methods. Arrangements can be made whereby small-scale operators can sell winnings to the company through special pricing arrangements. Such measures enable large-scale companies to closely monitor and control the small-scale miners on their properties, and help to prevent the latter from causing extensive damage to the environment for which the concession owner is accountable. Despite not being a legal requirement, some resident large-scale mining companies, notably Abosso Goldfields Limited, have, by adopting such a philosophy, largely eliminated clashes between themselves and illegal small-scale miners. To a limited extent, Gold Fields Ghana Limited allowing the Akuon Cooperatives (small-scale miners’ group) to work in a part of its concession for a given period mirrors this philosophy.

In addition, large-scale mining companies like Bogoso Gold Limited have ceded portions of their concessions considered inappropriate to beneficially exploit themselves for licensing to small-scale miners. This has made more land available for legal small-scale mining and thereby, with the technical assistance of the small-scale mining district officers, contributed towards reducing the negative environmental impacts of such activities.

However, such approaches have not come without difficulties since there is a tendency for illegal miners to abuse such opportunities when rules and guidelines are not strictly enforced. The provision of alternative sources of viable employment for small-scale miners is expected to facilitate an abandoning of destructive activities, and facilitate a shift towards equally profitable vocations; most large-scale mining companies are therefore involved in some form of alternative livelihood project.

It is important to note, however, that, because of the limited resources available to regulatory and technical supporting agencies, the foregoing activities have been limited in scope and intensity.

5.3. Mitigation measures being considered for adoption

The measures highlighted in the discussion that follows have either been implemented on a pilot scheme basis or are in the process of being investigated, and are therefore being considered for more general application. A number of these measures were investigated using funding from a World Bank Credit (Minning Sector Development and Environment Project, Credit 2743 GH).

The first noteworthy initiative is the pilot reclamation of lands mined by small-scale miners. Under a pilot scheme initiated by the Minerals Commission, funded under the World Bank Credit, three areas of agricultural land totaling 205 hectares that had been devastated by small-scale mining activities were rehabilitated and re-cultivated with economic trees and other indigenous plants. The three areas involved were: (1) Ablorman in the Greater Accra Region, which had been damaged by sand winning; (2) Nueng Forest Reserve in the Western Region that had been degraded by gold mining; and (3) Buadua in the Eastern Region devastated by diamond winning. The objective of the scheme was to demonstrate that after mining, land could, in fact, be properly reclaimed and used for other economic activities, an initiative that could quite conceivably be undertaken by resident communities.

A second worthwhile initiative was pilot provision of improved geological information to small-scale miners. Under the World Bank Credit, a programme was carried out to provide better geological information to small-scale miners through the assistance of geologists working in the field to delineate recoverable ore bodies on small-scale mining concessions. Areas identified to have potential for such workings were delineated for licensing to small-scale miners.

A third promising initiative was the development of improved processing techniques and the testing of processing equipment for small-scale mining. A consortium from Ghana and South America was contracted to develop environmentally friendly processing techniques that would help to increase the productivity and yields of small-scale miners. Various mining and mineral processing equipment procured by the project have been successfully tested by the consultants in major small-scale mining areas in Prestea, Japa and Asankrangwa in the Western Region, and Bonte in the Ashanti Region of Ghana. It is important to clarify that residents of the mining communities in which the tests were carried out have responded positively, and have expressed interests in retaining the equipment within their districts. However, it is highly likely that most concession owners will be unable to purchase the equipment because of limited access to capital.

The local economic development and alternative livelihoods initiatives are also being pursued. If equally profitable alternative economic activities are embraced, small-scale mining would lessen and the overall impact of small-scale mining would be reduced as well. Additionally, it has been estimated that such alternative livelihood or local economic development (LED) projects would help to address some of the socio-economic issues associated with mining communities. A study undertaken by Ghana’s Minerals Commission has identi-
ified a number of such LED projects, which are being operated by mining companies like AGC (Bibiani) Limited, Resolute Amansie Limited, Abosso Goldfields Limited, Bogoso Gold Limited and Satellite Goldfields Limited in their respective communities. The mine-initiated projects provided for members of communities to undertake skills and/or entrepreneurship training programmes (e.g. managing small-scale business enterprises, modern farming techniques in cultivation of food and cash crops, livestock farming, etc.) under the sponsorship of mining companies. A second stage of the project has been initiated to ascertain the feasibility and sustainability of alternatives. It is expected that results will aid in the development of a generalized framework for implementation, which could lead to improved socio-economic and environmental performance in mining communities.

Perpetuating a pattern of improved environmental performance in this sector is dependent upon the continuous undertaking of research studies that seek to examine and understand key environmental issues. It is therefore imperative that findings are disseminated through publication, which helps to facilitate change. Where aspects of mining are found to be inefficient and/or unsustainable, studies can be carried out to inform policies thereon. The publication of pertinent results of such studies would help to disseminate knowledge, and help to ensure that mining is conducted in an environmentally friendly and sustainable manner. A case in point is the mercury abatement project, under which with UNIDO assistance, the Minerals Commission carried out Phase 1 of a mercury study (US/GHA/99/128—Assistance in Assessing and Reducing Mercury Pollution Emanating from Artisanal Gold Mining in Ghana), in a “galamsey” village in the Western Region. “Galamsey” operators, local residents, and various components of the surrounding environment (soil, water, etc.) were proved to contain elevated levels of mercury. These findings in turn have prompted a request for a follow-up project for UNIDO to possibly assist with detoxification.

In the short term, mercury retorts have been introduced to small-scale gold miners to help capture the mercury fumes. Although the adoption of the retort has not been as widespread as expected, Government policy is being redesigned in 2002 to make the possession of a mercury retort a requirement for securing small-scale gold mining licenses. Over a longer term, the implementation of a 5-year EU SYSMIN project, beginning in 2003, is expected to assist with identifying and adopting alternatives to the amalgamation and evaporation methods of processing gold by small-scale miners.

Finally, a proposal is being considered for adoption under the Ghana Poverty Reduction Programme of the country’s HIPC initiative. Specifically, the aim of the proposal is “…to improve the performance of small-scale miners” through implementing the following activities.

1. Identifying land areas with suitable mineral deposits for small-scale gold and diamond mining: this will entail (i) a review of reports submitted by exploration companies to Government over the years; (ii) selecting areas with potential for small-scale mining; (iii) undertaking further exploration to better establish location and size of reserves; and (iv) permitting small-scale mining in demarcated areas.

2. Improved training: once regularized, the approximately 300 small-scale mining concessionaires will require training, production equipment and raw materials to be able to operate as required. The intensification of the provision of technical support and monitoring in these areas should improve the performance of small-scale mining overall.

The resultant improved assurance and ease of “making money” (compared to the current “trial and error, hit and run” mode of operation) should:

- attract small-scale miners (both legal and illegal) to regularize;
- enable a reasonably commensurate processing fee to be levied; and
- enable/facilitate monitoring and policing to ensure technically and economically efficient as well as environmentally sustainable operations.

Ultimately, resources must be allocated to enable proper streamlining and implementation of the aforementioned initiatives, and to facilitate the adoption of newer and more efficient measures. However, to sustain any such schemes, a framework must be put in place. Thus, the goal of the Government, as far as the small-scale mining of gold and precious minerals is concerned, is to pursue more vigorously the above-mentioned measures that are being implemented and/or considered. These are key to achieving a more environmentally sound, yet development-oriented, small-scale mining industry in Ghana.

6. Conclusion

The small-scale mining of precious minerals predates the advent of mechanized mining in Ghana. While the implements used in such mining activities have continued to be largely rudimentary, the recent trend has been the gradual upgrading of both equipment and methods of operation.

Varying degrees of environmental damage, which
have been associated with such operations, have been a source of concern to Government. However, given the potential socio-economic benefits of the activity, the Government of Ghana has initiated measures to mitigate these negative environmental impacts. Such measures include field extension services, training programmes and the development of other supporting infrastructure. It is expected that the implementation of these measures will help to promote environmentally sustainable development in Ghana’s small-scale precious minerals mining sector.

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