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HISTORICAL PERSPECTIVE AND KEY ISSUES OF ARTISANAL MINING

by
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1. INTRODUCTION

Ever since man learned to exploit the wealth of inanimate nature, artisanal mining has been one of the essential human economic activities, providing materials for adornment, tools and shelter. From the dawn of civilization through the beginnings of the industrial revolution, it was the exclusive form of mining. At the end of the 20th century, it still plays a significant role in many parts of the developing world.

Today, artisanal mining is a highly controversial activity, meaning different things to different people. To some it is dirty and dangerous, disturbing and destructive, and frequently on the wrong side of the law. To others it is profitable and productive, and the only means of survival in an environment with few alternatives.

Focusing on these aspects, this paper summarizes the key issues generally related to artisanal mining in developing Countries. Its principal aim is to stimulate discussion in search of solutions. The presentation is structured in three parts. The first section offers a profile of the attributes of artisanal mining as opposes to the rest of the industry. The second addresses the issues typically associated with this activity in developing countries. The third part finally indicates ways and means for sub-sector reform.

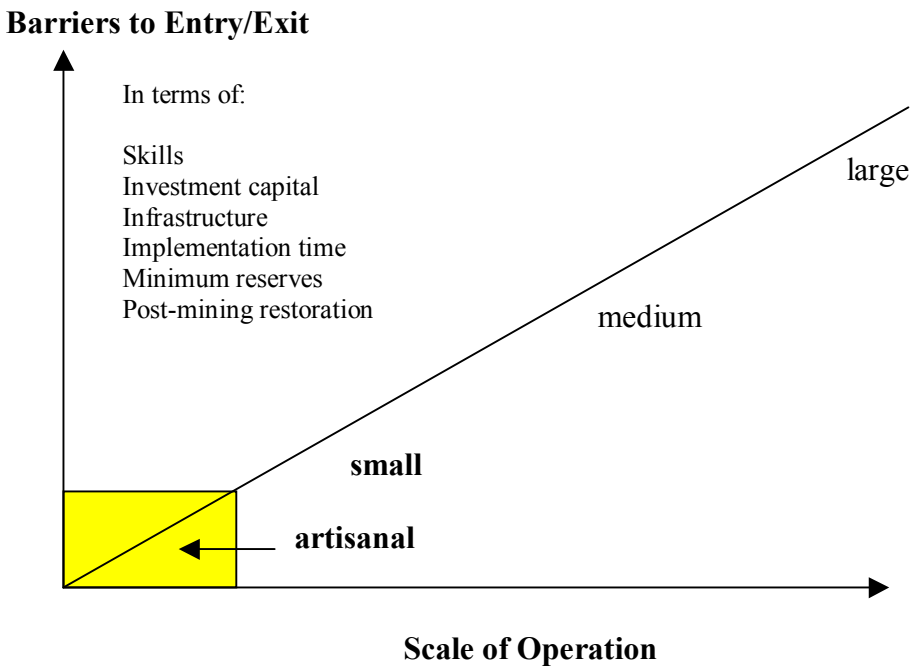
2. PROFILE OF ARTISANAL MINING

2.1. Principal Attributes

To begin with, artisanal mining could be defined as encompassing all non-mechanized, low-output extraction of minerals carried out by individuals and small groups, frequently on an intermittent basis, employing essentially traditional manual techniques. Due to technical limitations, operations are necessarily confined to surface mineralizations and shallow underground workings. Thus, artisanal mining represents the bottom end of the small-scale mining range.

As illustrated in Fig. 1, the most significant attribute of artisanal mining is low barriers to entry. The concept of barriers to entry relates to the basic requirements for the start-up of a new mining operation in terms of skills, investment capital, infrastructure, implementation time and minimum reserves. These requirements are lowest for artisanal mining, growing with increasing scale of operation. Under favorable circumstances, an artisanal operation exploiting placer minerals, can be started immediately, with as little as a pick, a shovel and a pan. The same basic relationship also applies to the barriers to exit, i terms of the extent of post-mining restoration activities, related financial obligations and time requirements.

Fig.1.: Barriers to Entry/Exit vs. Scale of Operation



Due to the limited barriers to entry, artisanal mining has reached significant proportions in a number of developing countries. Moreover, as an essentially non-mechanized activity, it is highly labor-intensive, providing employment for a substantial number of people, particularly in remote rural areas, where alternative job opportunities are scare and low paying. This is confirmed by Table 1 which presents a summary of the estimated number of persons engaged in artisanal and small-scale mining in selected developing countries.

Table 1. Artisanal and Small-scale Mining Employment

Country	Estimated Employment	Data Source
China	3,000.000	Jennings, 1993
Brazil	1,000.000	Davidson, 1990
India	500.000	Chakravorty, 1989
Zaire	500.000	Jennings, 1994
Indonesia	465.000	ILO,1990
Philippines	200.000	ILO 1990
Tanzania	100.000	Authors estimate, 1994
Mali	100.000	World Bank,1992
Sierra Leone	100.000	World Bank,1992
Burkina Faso	60.000	World Bank,1992
Guinea	60.000	World Bank,1992
Ghana	30.000	World Bank,1992
Angola	30.000	World Bank,1992
Zambia	30.000	World Bank,1992
Zimbabwe	30.000	World Bank,1992
Peru	20.000	ILO,1990
World Total	> 6,000.000	Jennings, 1993

Given the lack of reliable data attributable to the extent of informal operations, figures indicated represent conservative order-of-magnitude estimates. In total, the number of persons active in the sub-sector worldwide exceeds 6 million, equivalent to more than 20 % of global mining industry employment. Most of this employment is in artisanal mining. Assuming an average of only four family members per worker, at least 30 million people directly depend on the sub-sector for a living.

Most of the workforce consists of unskilled laborers with little or no formal education. Despite the typically low level of skills, average incomes earned in artisanal mining are usually well above minimum wage levels and frequently above comparative incomes paid in formal employment in other sectors of the economy.

In view of the large number of people involved, substantial purchasing power Becomes available in artisanal mining districts. Most of the income generated is immediately Spent on consumption, thereby stimulating economic activities and employment in other sectors of the local economy, and significantly contributing to rural development.

As opposed to medium- and large-scale mining, artisanal operations, moreover, primarily use inexpensive domestic inputs in the form of locally manufactured simple equipment and tools. Demand for local inputs both promotes the evolution of a domestic manufacturing sector and contributes to save scarce foreign exchange. Equally important is the fact that the use of inexpensive local inputs instead of more costly foreign equipment results in a higher national value added per unit output. Considering all aspects, it is apparent that owing to the intimate linkages with the domestic market, small operations are an important force in regional economic development.

Finally, the preferred targets of artisanal miners are prospects of low-volume high unit-value commodities, notably gold and gemstones. These precious minerals are luxury goods, for which there is essentially no market in developing countries. Artisanal mining, therefore, is an export-oriented economic activity, contributing significantly to the foreign exchange earnings of developing countries. According to a recent estimate, the value of the annual artisanal gold and gemstone production in sub-Saharan Africa alone exceeds 1.0 billion US$. The value of gold produced by the small prospectors in the rain forests of Brazil reportedly exceeds 2.0 billion US$ per year.

2.2. Key Issues and Constraints

On the other hand, extensive evidence is available that apart from the significant beneficial impact of the sub-sector discussed, uncontrolled artisanal mining can cause serious negative effects in various ways. Areas of particular concern include unacceptable environmental practices, poor social, health and safety conditions, illegal mining and marketing, as well as a waste of resources.

Environmental effects are generally related to the destruction of the vegetation and the degradation of substantial areas of land, as mined out properties are usually abandoned without post-mining land restoration. Waste piles and unsecured pits and trenches left by artisanal miners, moreover, can pose a grave safety hazard to people and livestock, potentially resulting in injury from accidental falls.

An environmental and health problem specific to gold mining is the possibility of mercury contamination and poisoning. Metallic mercury is extensively and liberally used by artisanal miners throughout the world in the final recovery process of gold by amalgamation. It is estimated that worldwide 300 to 500 tons of mercury per year are used in artisanal and small-scale gold mining, a large portion of which is introduced into the ecosystem.

Safety hazards are particularly serious in artisanal underground mining. Caving of the ground due to inadequate roof support, as well as a lack of lighting and ventilation, are the most frequent causes of accidents. As an example, in Tanzania government officials estimate a 5 % fatality rate per year in artisanal gold mining, with an injury rate that is substantially higher. In many cases, health problems also stem from a lack of sanitation facilities and safe drinking water in the provisional mining camps and villages rapidly put up near new mining sites.

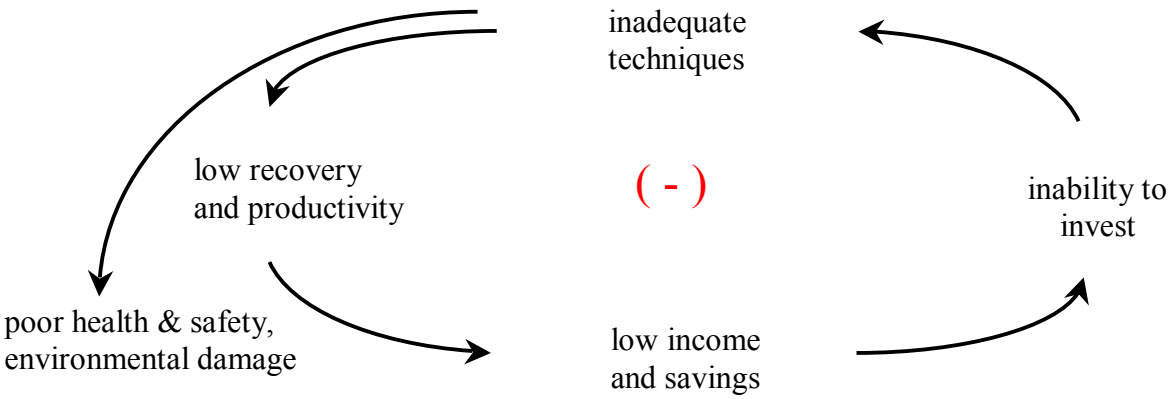
In many of the high-density artisanal mining districts, between 10 % and 50 % of the workforce are female. Women engaged in the activity usually work as ore and concentrate carriers, as panners, ore sorters and gang cooks. Most of them carry the double burden of working long hours at the mines and raising a family, a socially undesirable situation. Entirely unacceptable from a social perspective is the use of child labor, likewise a widespread practice in artisanal mining.

An equally serious concern finally is the extent of illegal mining and marketing typical for the sub-sector. It is estimated that in sub-Saharan Africa only 20 % of artisanal gold and gemstone production, valued at US$ 1,000million per year, is included in formal exports. One of the principal effects of illicit trading is the loss of tax revenues. The other is that the potential to increase national value added through further downstream processing of the minerals, cannot be utilized.

Illicit marketing is primarily related to inadequate government policies. A black market usually develops, whenever official prices offered by government buying agencies are fixed below world market prices. An overvalued currency together with a high rate of inflation also has the effect of underpricing. The traditional strong ties established by illegal traders through a mechanism of pre-financing the operations of small producers lacking adequate working capital, frequently is another important factor.

Most of the harmful effects of artisanal mining are directly related to the technical and financial limitations typical for the sub-sector. As illustrated in Fig. 3, artisanal miners are usually trapped in a negative cycle of cause and effect that acts as a powerful constraint. Due to the use of inadequate mining and processing techniques and equipment, productivity of artisanal operations and recovery of valuable minerals is generally very low. Low productivity and mineral recovery results in low income and the inability to save and accumulate funds for investment. The inability to invest into improved mining and processing techniques closes the negative cycle, perpetuating this unfortunate situation.

Fig.2. Dilemma of Artisanal Miners



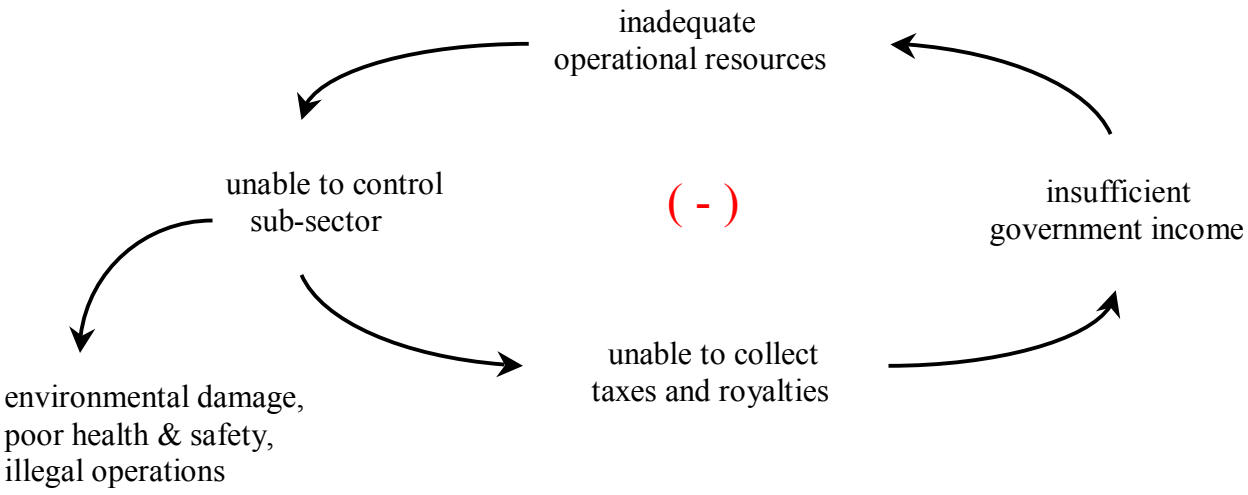
The dilemma of artisanal mining is probably most conspicuous in hard rock gold mining. In purely manual operations, the greatest barriers to productivity are usually encountered in ore extraction and in the crushing and grinding process. Moreover, given the crude processing techniques typically employed in artisanal mining, much of the gold in the fine fraction is lost in the tailings. Gravity plants in use usually recover only about 50 % of the valuable minerals. The activity, thus frequently contributes to a waste of non-renewable resources.

The inability of the mining authorities in many developing countries to effectively control artisanal mining activities, can be considered the second major cause of the problems associated with the sub-sector. This inability is partly due to inadequate resources, partly to the organizational characteristics of the activity. Artisanal mining is frequently conducted as an informal spontaneous economic activity without a legal title to the property worked, and less often as a formal operation on registered claims.

Miners include subsistence farmers and their families working on a seasonal basis, as well as individuals and groups joining on an ad hoc basis for a limited period of time. A large portion of artisanal miners are migrant workers. Although work among miners is usually well organized, a typical feature of artisanal operations is the absence of a permanent legal entity, such as a formally registered enterprise. This together with the seasonal and migrating character of the activity creates an accountability problem and makes the administration and control of the sub-sector extremely difficult.

Fig. 3 demonstrates how mining authorities are likewise caught in a paralyzing cycle of causality that contributes to aggrevate the problem. Lack of operational resources is the primary cause of the inability of mining authorities in many developing countries to control artisanal mining activities. Inadequate sub-sector control results in environmentally harmful mining and processing practices, poor health and safety standards and illegal operations. It also means an inability to collect taxes and royalties due to the government. This, in turn, results in inadequate government income which restricts the capacity of the government to allocate the necessary resources to its agencies.

Fig.3. Dilemma of Mining Authorities



A typical situation in developing countries is that mines inspectors are unable to visit artisanal operations on a regular schedule, because of the lack of transport vehicles and travel budgets. It is obvious that without regular inspection visits, it is impossible to enforce safety regulations and acceptable environmental practices.

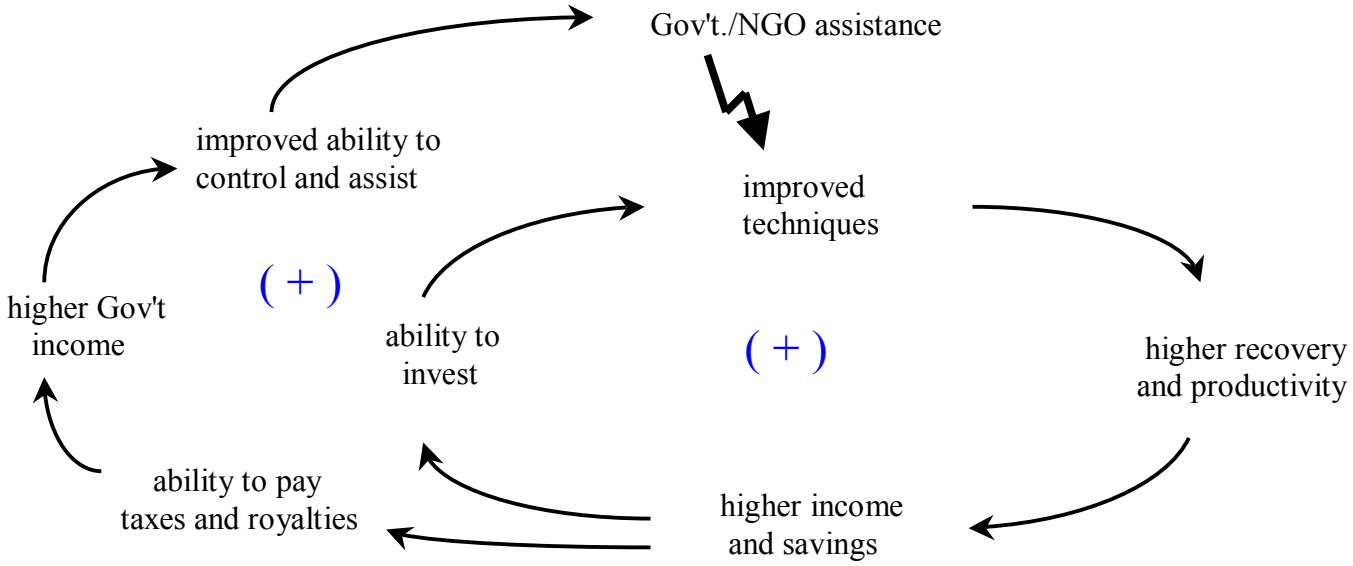
3. WAYS AND MEANS

What are the options available to eliminate the undesirable consequences of artisanal mining while still maintaining its beneficial effects? As illustrated in Fig.4, the strategy of reform must be designed to remove the constraints by breaking the negative cycles of causality affecting both miners and mining authorities alike.

The key components of this process of change are the strengthening of the mining authorities and the use of more efficient mining and processing techniques. The mining authorities will have to act as the main driving force in this process. The most decisive impulse will, however, come from the introduction and dissemination of appropriate equipment in combination with adequate training. Both are essential prerequisites to improving productivity and mineral recovery. Increasing productivity and recovery results in higher income for the miners and the possibility to accumulate funds through savings. This will improve the ability to invest into more efficient mining and processing equipment, thus closing the first positive cycle.

On a national level, increasing mineral recovery means the more efficient use of non-renewable resources and the maximization of sub-sector income over time. Increasing income of the miners, moreover, improves their ability and willingness to pay royalties and taxes, leading to higher government income from the sector. Increasing public income enables the government to provide adequate operational resources to the mining authorities, placing them in a position to control and assist the sub-sector more effectively. This concludes the second positive cycle. Finally, a financially more profitable sub-sector offers better prospects for the adoption of environmentally responsible mining and processing practices and the introduction of adequate health and safety standards.

Fig.4: Breaking the Dilemma



While the structure of this strategy is simple and plausible, its implementation in practice can be difficult for several reasons. First, due to the large number of miners involved, their mobility and their remote locations, reaching the target group with assistance programs will require special organizational arrangements. The best option in this context appears to be to actively promote the formation of regional miners associations in all high – density mining districts, which can act as focal points for implementing assistance programs.

Second, artisanal miners are generally reluctant to change their traditional ways of mining and processing. In order to overcome this resistance it will be instrumental to convincingly demonstrate that the introduction of a new equipment and techniques will rapidly result in higher income. And third, informal miners may not be willing to become licensed operators unless the benefits to be expected from legalization outweigh the possible costs, which may include payments of royalties and taxes, as well as the necessity of observing health, safety and environmental regulations. To provide the required incentive for legalization, the mining authorities will have to make it clear, that technical assistance will only be made available to licensed miners, and that unlicensed operations will eventually be forced to close.

In the particularly sensitive area of product marketing, only the establishment of fair prices in a transparent and free market system, including a realistic foreign exchange rate policy, offers reasonable prospects to achieve the dual objective of maximizing both sub-sector output and sales through official channels. This will necessitate a radical change in marketing mechanisms, whereby private licensed traders should replace government buying agencies.

Finally, it is important to note that international experience with strategies designed to transform artisanal mining in developing countries in line with national economic, social and environmental objectives, is limited. In the absence of universally tried and tested solutions, the quality of promotional strategies can only be examined and verified on an experimental basis.