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Study on Artisanal and Small-Scale Mining in Mali

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Summary

Small-scale mining has become an activity in full expansion in Mali and in many other African countries. Development in this activity has become so important that it has brought international, regional, sub-regional and national interest in it. Several meetings and the implementation of several studies on legal, regulatory and organisational issues are evidence of this.

It appears from the experience of Mali in the area of small-scale mining, a predominance of interest for auriferous minerals. That is the reason why most studies are done in this area, even though the exploitation of construction material is becoming more important. Because of their great value, these minerals can be easily sold even in small quantities. They do not require special transport infrastructures, heavy equipment or the building of storage warehouses. Besides, these minerals do not necessarily require any processing before being sold. In other words, even in a crude form, they can easily be sold. Finally, auriferous minerals can be used as savings in the form of jewels even in a crude form.

Exploitation of these minerals plays an important role in local economy and in Mali contributes to the survival of a steadily growing population estimated at more than 200,000. However, the activity may cause disastrous degradations in the general environment and bring about social scourges particularly during rush periods. In Mali, experience has shown that despite the relatively difficult working conditions, traditional mining plays a substantial role in the global mining production of the country and on local economy. In addition to this, it might be convenient to note the positive contributions of the traditional mining sector at the national, local, family and individual levels.

To initiate the promotion of this sector in the framework of sustainable development, it is clear that optimization activity must be undertaken to tackle the issue of technical weaknesses and move to increased productivity, profitability and to improve security on worksites while minimising the impact on the environment. Attempts to organize this sector show that sector-based and targeted approaches did not achieve expected results.

The issue of traditional mining sector development should be tackled in a much more global way, taking into consideration all specificities of systems, socio-economic groups and especially cultural aspects. The first challenge is to bring artisanal miners to a more legal and formal framework by creating an atmosphere of collaboration and trust. To reach these objectives, Mali has promulgated several new legal and regulatory provisions to give incentives and security, and more efficient institutional practices to ensure supervision and assistance to mining groups. The objective is to enable the progressive passage from traditional mining to formal small-scale mining. The wealth so created should enable the emergence of a network of small entrepreneurs who are well integrated in the local economy and who can significantly contribute to the sustainable development of regions through the balanced development of resources, improvement of living conditions and settlement of miners.

General Points

Role and Importance of Traditional Mining in Mali and in the Sub-region

Traditional mining has been practised in Mali and West Africa for a very long time. Even if we leave aside building materials which were exploited since the beginning of human habitation, traditional gold and iron mining have long formed the basis of wealth and power for many empires and kingdoms in the region. One example among many others is the Kingdom of Mali which supplied Europe and the Middle East with traditionally extracted gold. It is said in oral and written documents that 12,000 camels loaded with salt would arrive in Timbuktu and when they leave, they are loaded with gold!

Since antiquity, southern and eastern Mali was the subject of intensive gold mining using traditional procedures. The rich historical and cultural heritage contains many testimonies about the role played by gold in the expansion of great empires in the region since the 7th century. An illustration of the importance of the auriferous production is the famous pilgrimage to Mecca by the emperor of Mali, Kankan Moussa in 1325, of which mention must be made in any report of the glory and prosperity of the empire of Mali. During this trip to the Holy Land, the emperor brought with him so much gold (about eight tons) that it caused a devaluation in the price of the precious metal on the world market. The most convincing testimonies are provided nowadays by numerous traces left by old traditional gold-mining worksites.

It is impossible to estimate with precision gold production during these distant times. Unlike other countries of the sub-region, gold washing has never been interrupted in Mali. Numerous old records and productions bought by the colonizers, bear evidence to this.

It is also the case in Ghana where gold powder was used as currency in 1471, well before the arrival of the Europeans. It is estimated that from 1471 to 1880, more than 14.4 million ounces, representing than 443 tons were produced. That was why Ghana was given the name 'Gold Coast' by the first explorers. During the colonial period, gold attracted the attention of colonizers who were interested in mechanized mining essentially through placers dredging and continued buying gold produced by the indigenous gold washers.

The gold production during the colonial period (1900–1960) was estimated at ten tons from which 2.5 tons were obtained through dredging and 7.5 tons through gold washing. However, these large-scale traditional mines were slowed down or even stopped production in some parts of the continent during the second half of the 19th century with the collapse of pre-colonial empires and kingdoms. This mining system was replaced by a reorganization of Africa's mining production for the profit of and according to the rules of the new masters. To supply their metropolitan industries with raw material, they were only interested in important deposits, in extremely favourable conditions. Therefore, small-scale mining was relegated to a position of secondary importance. However, shortly after independence for autonomous African States in the 1960s, traditional mining reappeared in many African countries. The phenomenon grew rapidly in importance to such an extent that it became a common interest issue, as we see it today.

In Mali, gold-washing activities increased considerably from the 1980s, following drought conditions, which encouraged deprived populations to rush to this activity. Another factor which favoured the development of small-scale mining is liberalization of trade and the increase in the gold price, discovery of new easily exploitable sources following geological prospecting campaigns. It can be noted here that traditional mining concentrated on placers and eluvial mineralisation. Traditional lodes deposits started being exploited for about 15 years.

Definition and Concept of ‘Small-scale mining’

The term ‘small-scale mining’ is the subject of a great debate in the sub-region. Generally, the main criteria commonly used in the attempts to define the precise content of this expression are:

- The physical size of the deposit and the continuity or not of mining activities.
- The organizational structure of the activity and the management system.
- The importance of investment required and turnover generated.
- The number and level of qualifications of the workers involved in the production unit.
- The kind of equipment, degree of mechanization and the level of technology used.

Specialists do not agree, however, in the choice of these criteria, their relative importance and the combinations that can be made with some of them in this definition. The result is that the significance given to the expression ‘small-scale mining’ on the basis of these criteria is very relative, as it is true that their importance depends on the general economic environment, the development of the mining activity in the country, the degree of technical and technological evolution and finally the nature of the minerals being exploited. This is particularly true for the criteria concerning the physical size of the deposit, the turnover importance, the number of workers and the type of management.

It is because of this conceptual relativity that in many legal and regulatory provisions in countries of the sub-region, reference is frequently made to the limited means and the precariousness of the operational technologies and techniques used in the definition of small-scale mining.

Aware of the importance of small-scale mining, members states of the Liptako-Gourma Authority (ALG), namely Mali Niger and Burkina Faso, held seminars in Ouagadougou, Niamey and Bamako to think about this issue. These seminars recommended among many other things to favour the sharing of experiences and to define a terminology applicable to the concept of small-scale mining.

During the second seminar on the promotion of small-scale mining held in Niamey from 5–9 November 1990, the following definition of the small-scale mining concept was proposed. Traditional mining is exploitation of mineral substances using traditional techniques and before a deposit is revealed. A small mine is small size, permanent mining with a minimum of fixed facilities using state of the art semi-industrial or industrial

techniques and based on a prior revealing of a deposit. The determination of the size should be related to a certain number of interactive parameters like the dimension of the reserve, the level of investment, the rhythm of production, the number of workers, the annual appreciation and the degree of mechanization. In other words, considering the low level of development of ALG member states characterised by a general lack of equipment, limited financial means and a low level of technological evolution as a whole, the expression 'small-scale mining' in these conditions covers all mining operations (traditional, semi-mechanized and semi-industrial) which require neither heavy equipment or investment nor sophisticated technologies.

In summary, these are mining operations which are easily controlled technologically and financially by under-equipped populations with limited means and exploited as individuals, families, associations or cooperatives.

From this consensual approach on the basic terminology, all mining legislations in the ALG three countries after 1990 adopted this definition, adapted it according to local realities, principles and criteria so defined.

By integrating these classification criteria and the traditional character of small-scale mining, Mali mining legislation is based on simplicity of equipment used, technologies implemented on the one hand, and on the other hand, the low level of investment required for the operation and non-qualification of workers. The provisions of the Mali mining legislation identify two important types of activities in the concept of small-scale mining and gives them the following definition. Traditional mining is any operation which consists in extracting and concentrating mineral substances from primary and secondary outcropping or sub-outcropping deposits to recuperate merchandisable products. Manual or traditional methods and procedures are used. Traditional mining includes two notions, namely traditional gold washing which is any activity consisting in recovering precious metals contained in placers and eluvions from primary outcropping and sub-outcropping deposits, using traditional procedures. This activity is still organised by the village community.

Mechanized gold washing is any gold washing activity having a more complex structure than traditional using machines like: hand tools, manual hoists, motorized pumps, electric diaphragm pumps, compressors, mechanical hoists, pneumatic picks and grinders.

Small mines are any small size, permanent mine having a minimum of fixed facilities, using state-of-the-art semi-industrial and industrial procedures and which annual production in cruising power does not exceed a certain tonnage of the merchandisable product (mineral, concentrate or metal). This tonnage is set for each substance by a decree of the minister in charge of mines and is based on the justification of a deposit existence.

For gold, any mining work is considered as a small mine if the capacity of processing is inferior or equal to 150 tons of mine stones a day, and a production capacity inferior to 500kg of gold metal a year on a deposit which has reserves of less than five tons of gold metal.

According to article 1 of law no. 23-07/II-AN related to mining legislation in Burkina Faso, traditional mining is defined as ‘any operation, which consists in extracting and concentrating mineral substances to recover merchant products, using traditional and manual methods and procedures’. Small-scale mining is defined as ‘a small size mining having a minimum of fixed facilities, using state of the art semi-industrial and industrial procedures and which is based on prior revealing of a deposit’.

According to articles 43 and 44 of ordinance no. 93-16 related to the mining law in Niger, traditional mining is extracting and concentrating mine stones to recover the useful substance(s) using traditional methods and procedures. Traditional methods apply to mineralization profiles of some substances which have been mined traditionally, or to deposits for which there is evidence that industrial working would not be not economically profitable.

In Ghana the concept of ‘small-scale mining’ is defined in Mineral and Mining Law 1989 PNDCL 153 as mineral resources mining using methods that do not require heavy investment or the use of sophisticated technologies. In the provisions of ‘the small-scale Gold Mining Law’, this is defined as gold mining by a group of persons fewer than nine or by a cooperative of more than ten people using methods that do not require neither heavy investment nor sophisticated technologies. The other criteria set by the law are: small-scale mining can be done only by Ghanaians; the maximum period for the licence is five year, renewable; the maximum area for the licence is 10 hectares; the use of explosives is forbidden.

Data and Situation of Traditional Mining In Mali

Geology, Location and Number of Traditional Sites

Mali occupies a very favourable geological position in West Africa and underground surveys reveal many deposits of gold, diamond, iron, bauxite, manganese, base metals, uranium, phosphates and many sites of industrial rock (limestone, gypsum, marble, granite).

Please note that while traditional mining covers gold, semi-precious minerals, building materials, in Mali most interest is in auriferous minerals and semi-precious substances. Thus most studies are dealing with these substances, even though building materials exploitation is carried out in big urban centres.

The main auriferous deposits, which are the focus of traditional mining, are located mostly in volcano-sedimentary formations (green rocks) of the Birrimian age which are found in two main zones. The first is in the western Bambouck auriferous district with the Sadiola deposit (about 150 tons exploited by Anglo-American Mining Co since 1997, the Yétala deposit (40 tons exploited since September 2001). Additionally, there are the Loulo deposit (40 tons proved), Médinandi (evidence of four tons of gold), Tabakoto (43 tons), Ségala (40 tons) in various phases of certification and development. The second main zone is in the southern auriferous district of Bouré with deposits in Bagoé, Yanfolila, Kangaba and Syama (with 150 tons of gold) worked since 1990. The gold deposit of Morila located in the same district with reserves estimated at 150 tons of gold started production in February 2001.

These two districts are in then subdivided into gold-washing zones and with two important concentrations (with about 350 areas). One is in the Bambouck, where the Kéniéba zone has about 168 recorded gold-washing deposits. The other is in the Bouré at the Kangaba zone with about 80 gold washing sites, including the Kalana-Yanfolila zone with 84 gold-washing sites and the Bagoé-Kékoro zone with 18 sites recorded.

In these two districts there are also placer, eluvionary deposits and lodes. Placer deposits are located in bare beds, recent and old fluvial terraces within which gold concentrates in gravelly layers, generally smaller than one metre on the bedrock. The gold content is 1–3g/m³ for the mineralised layer, which outcrops in bare beds, but is generally covered by sterile sediments or weakly mineralised ones. In the case of old terraces, this cover can easily reach depths of ten metres.

Eluvionary deposits are where gold is concentrated in a layer formed with angular and nonclassified rubble of laterite, quartz, shale, sandstones, on an altered bedrock sprinkled with quartz lodes and veinlets, sometimes auriferous or sometimes the source of this gold. The strength of these eluvionary layers varies between ten centimetres or so and one metre with variable contents.

It is interesting to note that old mining operations on buried placers and eluvions started from the top of small laterite plates, sometimes across a deep layer of hard laterite cuirass, unlike current projects, which start from lower zones, often in valleys and low lands. The main reason for this change is the lowering of the ground water level, which in the past impeded mining in valleys low lands and obliged gold washers to work on higher ground.

For ten years or so, outcropping or buried deposits are exploited, mainly in the area of Kéniéba. The most-exploited deposits are located in the Médinandi-Tabakoto corridor, a large shearing zone in the north/northeast about 1km wide. Along this corridor, there are several exploited deposits like Medinandi, Bakolobi, Sanoukou, Tabakoto and Baboto. The lode depths vary between a few centimetres to about one metre. Above the ground water level, contents can reach several hundred grams per ton. There are no data about contents under ground water level, but experience and the discovery of macro nuggets sometimes 8kg in weight are evidence of an important enrichment in the super gene zone. There is little systematic data on the lateral and global distribution of gold in these lodes.

Statistics on the Number of Miners Involved in Traditional Mining

Despite the difficulty in getting reliable statistics, the number of artisanal miners seems to have increased considerably in Africa in the past few years, particularly since the economic recession of the late 1980s. The International Labour Organisation estimated this increase at 20 per cent during the last ten years. This sector, still characterised by its non-formal status in most countries, today numbers between two and 2.5 million, with a predominance of interest in auriferous minerals.

In Mali, gold washing has been practised for centuries and remains a primary occupation for a total of 200,000 people working directly in this field or in related activities. This figure

is an estimate calculated on the basis of the average number of inhabitants of villages where gold washing is practised.

In the last ten years, traditional mining has evolved from the individual or family stage into the formal sector through the creation of mining cooperatives, associations and economic interest groups (GIE). Thanks to training, assistance and sensitisation campaigns, led by the PAMPE project, 38 mining cooperatives (comprising between 100 and 120 members) and 12 GIE (numbering between 100 and 120 people) were established in the mining areas of Kangaba and Kéniéba. Despite this move to more formal structures and the introduction of the gold-washers' card, it is still difficult to get reliable statistics on the actual number of miners registered on a given site and on all sites operating in Mali. In any case, the number of registered miners rarely rises above 40 per cent of the total number of gold washers working on a given site, knowing that the average on a big site is about 15,000. To have an idea of official statistics about formally registered gold washers, the National Directorate of Geology and Mines issued 5,568 gold-washers' cards between July 1995 and December 1999.

From 1999, decentralised communities were asked to manage gold-washers' cards and the number of cards issued by these structures is not yet known. The evidence is that the gold-washing sector and small mining remain dominated by non-registered artisans, working in a non-formal framework.

Statistics on Mali's Auriferous Production

According to bank sources, traditional auriferous production is estimated at about two tons, but this figure can rise beyond five tons if we take into account the amount that goes into smuggling and fraud. Table 1 below, gives official statistics about gold in Mali.

Table 1. Official Statistics (in tons of DNGM) on the Total Production of Gold of Mali (including industrial mining)**

Year	Traditional	Kalana	Syama	Sadiola	Morila	Total
1985	4.613	0.595	-	-	-	5.208
1986	4.239	0.402	-	-	-	4.461
1987	4.208	0.446	-	-	-	4.654
1988	4.167	0.350	-	-	-	4.517
1989	2.079	0.288	-	-	-	2.367
1990	2.061	0.200	1.977	-	-	4.238
1991	2.887	0.252	2.465	-	-	5.604
1992	2.862	-	3.298	-	-	6.099
1993	3.323	-	3.038	-	-	5.900
1994	3.514	-	2.903	-	-	6.203
1995	3.219	-	3.996	-	-	7.496
1996	3.200	-	4.329	-	-	7.529
1997	3.100	-	4.106	12.217	-	19.428
1998	2.200	-	4.707	16.489	-	18.700
1999	2.300	-	6.103	17.586	-	25.989
2000	2.500	-	5.667	16.802	4.208	29.177
2001**	1.700	-	1.652	11.606	12.258	27.216

Notes: the information about industrial mines quoted in this table is:

Kalana: exploited between 1985 and 1991 by the Kalana Gold Mines Management Company (SOGEMORK) in the framework of the cooperation between Mali and the former Soviet Union. Production is stopped because of Sogemork liquidation;

Syama: production started in 1990 and the Syama Gold Mines Company (SIMISY) and the Rand-Gold Company exploited the mine. The Syama mine experiences a decline in production and the takeover by new operators is envisaged before 2003

Sadiola: Anglo-Gold and the Sadiola Gold Mine Company (SEMOS) exploit the Sadiola mine since 1997;

Morila: this gold mine started production in February 2001 with the participation of Rand-gold and Anglo-Gold in the framework of a company called the Morila Gold Mines Company.

**Reference period: June

Statistics on the Production of Diamonds and Garnets in Mali

As indicated earlier, traditional exploitation concerns mainly auriferous minerals, diamonds and semi-precious stones. There is no site typically dedicated to diamond production, and the mineral is usually discovered by chance on auriferous sites; there are no statistics on Mali's diamond production.

As an indication, Kéniéba gold washers have found nice stones and among the most recent discoveries we can quote: a diamond jewel of about 299 carats in 1985; a 230-carat diamond in 1990; and a diamond of about 299 carats in 1998.

Concerning the exploitation of semi-precious stones, there was a rush in the Diakon zone in the western part of Mali between 1994 and 1995. Three thousand people there extracted more than 15 tons of garnet. This uncontrolled production saturated the international market and eventually miners abandoned the sites.

Statistics on Traditional Production in the Sub-region

It is almost impossible to get reliable figures on production related to traditional mining activities because they are largely clandestine. Yet, this activity can play a very important role in African local or even national economies.

On a regional scale, one can cite the example of the Siguiri Basin in High Guinea where almost 50,000 gold washers produce annually between three and five tons of gold. In 1999, this activity injected \$22 million into the local economy, compared to the \$10 million generated by cotton, the only other export product of the region. On a national scale, one can cite the example of the Central African Republic where 80,000 diamond miners produce about 500,000 carats a year. This sector, which is entirely traditional, represents more than 40 per cent of the nation's exports (about 430 million FF in 1994).

Small-scale Mining Contributions and Incomes

In Mali, experience shows that despite the difficult conditions under which it is done, traditional mining nevertheless contributes substantially to mining production nationally and locally. In addition to this, there are other positive contributions made by the traditional mining sector at the local as well as national, family and individual levels.

Nationally, the main contributions are: currency for the state; strengthening of the national bank; reduction in balance-of-trade deficit thanks to more gold exports; diversification of

state income sources; and general increase in national economic activity. On the local level, the economic effects include more intense commercial activity in the regions engaging in these activities. That is why we can see the establishment of numerous businesses like bakeries, shops and jewellers. For example on the Tabakoto site, the commercial activity associated with traditional mining is so developed that the nearby populations do their shopping there. A more important volume of financial transactions also translates into an increase in local business activity, due to traditional gold washing, in the town of Kéniéba.

At the family and individual level, farmers move to traditional mining to supplement resources because of decreasing agricultural incomes due to slumps in sales or to bad crops caused by drought. Traditional mining contributes to improvements in the living standards of many people and increases their incomes. Another illustration of this increase in family and individual incomes can be seen in Kéniéba where many families survive and pay their hospital fees thanks to money obtained by sales of gold. Unfortunately, there are no figures available.

In any case, we can assert that the great number of traders on mining sites tends to add to this impression of income increase. It is also true that traders only move to places where the financial resources of populations enable them to 'do good business'. Rising numbers of motorcycles, bicycles and radio cassettes in these zones is material evidence of this income increase.

Direct Income for Miners and for the State

The Bureau for Geological Research and Mining (BRGM) tried to estimate the traditional gold production in Africa on the basis of the minimum acceptable income for the artisan. From data recently collected in Guinea, Burkina Faso and Cameroon, an extrapolation was done for the entire continent. For a population of about 1.2 million gold washers, average incomes of 7FF/person/day and gold at 'site price' around 44FF/gram, the average person/day production would be 0.16 grams, the average person/year production would be 35 grams and the total African production calculated at 42 tons — or \$300 million.

The marketing of gold is free in Mali and the role of the state in this originally traditional sector has been insignificant until now. This role is still limited to encouragement of initiatives for gold washers to form cooperatives. There is no tax on the gold trade except taxes on profit (45 per cent on big traders) and customs export taxes (that rate is now 3 per cent).

Malian and foreign big traders control about 90 per cent of gold exports. Big traders are regularly informed about the amount, and buy gold on the sites through a complex network of intermediaries and local traders. Smaller local buyers sometimes have 'special' close links with gold washers (loans to buy food) and pay prices which are difficult to control.

For control and fixing of prices to the producer, we have the following examples. On 8 February 1991, when the price on the world market was 31FF/gram, the price paid to the producer was 17.50FF/gram (for gold powder) and 20FF (for nuggets) in the Kiénéba zone. On 31 July 2001, the price of nuggets between 21 and 22 carats was 47FF and gold powder was 44FF on the Kiénéba site, while the ounce was \$266 on the international market. On 20

September 2001, 22-carat powder was selling for between 54 and 55FF on the Kiénéba market, molten gold between 57 and 58FF while the ounce cost \$288 on the international market. During the same period, 22-carat gold and powder cost, respectively, 50 and 37FF on the Kiénéba site.

In Mali state tax on gold is 3 per cent on export for CPS. Fraud is extremely high in this domain as indicated by the Eurostat figures for 1980 and 1981. These figures give the due CPS and the actually received CPS on gold values exported from Mali.

Table 2. Shortfall in income received for 1980 and 1981

Year	Exported gold value	Normal CPS 3%	Received CPS 3%
1980	39,440,000 FF	1,172,850 FF	10,350 FF
1981	78,280,000 FF	2,344,801.20 FF	3,600 FF

Table 2 shows a shortfall in the income received for 1980 and 1981 as more than 3,500,000FF exclusively from tax evasion. More recent or precise data are not available, but the level of fraud is apparently comparable or even more important if we take into account the increase in value of gold exported from Mali (more than 100 million FF in 1990). In order to improve this, some legal and administrative measures were taken in 1996 with the adoption of decree No 96-214 which now regulates the marketing and export of gold throughout all of Mali. The mining administration will be aiming to increase the state revenue and the promotion of small entrepreneurship by better organisation of the marketing system.

Indirect Incomes and Activities Related to Traditional Mining

The socio-economic impact of traditional mining refers to its capacity to create jobs. The number of miners involved in traditional mining is relatively high. When stable, this activity can create jobs in deprived areas, therefore slowing down rural exodus towards big towns.

An example is the Baboto gold mine in the Kiénéba zone which enabled about 20,000 people to earn their livings during its height in 1997. There is also the famous Kondoya mine where probably more than 15,000 are currently involved. There is a lack of statistics on income generated by activities associated with traditional mining, and also no clear-cut distinction between miners and other attracted to mines, like traders, merchants, blacksmiths, cooks and canvassers. Notwithstanding these uncertainties, jobs created by these operations are important and constitute an important outlet for poor families in mining zones. These jobs are more significant when seen from the social impact standpoint, because they integrate the village's spirit of solidarity with the traditional extended family.

Practices and Organization of Gold-washing Sites

Customary Organization

From the outside, gold washing appears to be an unorganized or even anarchic activity. In fact, gold washing follows closely the organizational forms of village community and family

structures. The traditional activity is based on a set of customary prescriptions accepted by everyone. These verbal prescriptions form coherent and original systems. Their originality is deeply marked by the community spirit, which is a vital element for customary rule as a source of law. Sites have their own regulations that all gold washers accept in advance when they come to settle there. Access to sites is open to all, on condition that they respect the regulations in force. Violations are subject to sanction.

Characterized by customary practices, gold washing is so rigorous that any offence committed on the site is mercilessly punished. The following activities are forbidden on working sites: sex and theft; access of shoe-repairers and introduction of dogs; work on sites on Mondays.

Organization of Work

Gold washing follows a well-established model of organizing work. It is done on a seasonal basis respecting customs according to several modes and interveners.

When exploitation is under family-level organization, the head of the family generally retains and manages all income generated. When the organization is by the group then the mine belongs to the whole group and the production is immediately shared at the end of the day among all the members in accordance with rules. This form of organisation imposes discipline and respect for traditional principles and requires honesty among all the members.

Another way to organize is using cooperatives or associations. This form of organization has appeared over the last ten years and gathers together 40 to 50 gold washers of the same village who exploit one site. The main advantage of cooperatives is to unite efforts and capital in order to pay workers more and improve the mine's efficiency. Cooperatives with a formal structure and small exploitation tools, can usually get community money to invest and develop their small mining enterprise.

Some organizations are structured under the form of provision of service. In this case, work is structured around specialized positions and following the three main interveners namely: the owner of the mine who makes all expenditure related to the shaft exploitation and food supply to miners and other service providers who work the shaft for him; the miners/well diggers who are paid by the owner of the mine on the basis of a lump sum depending on production; the washers, who are in charge of drawing the minerals from the bottom of the shaft, transporting it to the processing site, grinding and washing. At most sites, this work is generally done by women who are paid one calabash of mineral for every three extracted.

Despite these different organizations, it should be pointed out that gold washers do not have fixed positions on an active site. Depending on work progress and difficulties encountered on a given site, gold washers can substitute in different positions. Because of this flexibility of positions, it is not possible to give precise statistics on people working exclusively as miners or washers.

Characteristic Socio-economic Groupings

At the structural organization level, traditional gold washing is based on a set of socio-economic groupings comprising:

- Owner of the land (or Dugutigui) who is the heir of the village land.
- Owner of the site (or Damantigui) is the central authority of a gold-washing site. He is drawn from the notables and landowners and takes decisions concerning gold-washing activities inside the village.
- Mine police (or Tomboloma) are a group of young village people. They are in charge of peacekeeping, observing regulations, arbitration of disputes and collaboration with the public administration. The Tomboloma are chosen for their knowledge of customs and integrity. They represent the moral authority of the Damantigui.
- Organizers of ritual sacrifices ensure gold washers have spiritual protection against bad spirits and evil.
- Blacksmith and mechanic, always present on the site, are mostly asked for motor pump maintenance and repair, hoes and other basic tool repair.
- Ambulant trader or gold buyer is the main supplier of the mining site. In this capacity, he patrols at the main gate, he purchases the gold produced on the site and arranges to buy other necessities.

The lack of reliable data does not enable us to estimate the number of people who work on a full time or seasonal basis on mining sites. The rainy season is a major handicap for gold washing when most miners abandon work concentrate on farming. We note that sites are active for 5 to 10 per cent of their lifetime.

Women's Role at Mining Sites

In Mali, women have always played an important role in the social organization of mining sites and their participation rate in traditional mining is above 50 per cent (about 60,000 to 70,000). Their presence on mining sites has several explanations. We can list, among others, impact of drought, traditional family way of life and the prevalence of auriferous exploitation in rural zones. Concerning intervention positions in production circuits, women are present at all levels from mineral drawing to transport and processing. On some sites at Kéniéba or Kangaba for example, women constitute 90 per cent of workers involved drawing and washing of auriferous minerals. Besides these positions directly related to mining production, women also play a major role in annex activities like cooking, petty trade and supplying sites with food and water. Despite these important contributions, the social status of women in traditional mining remains unfavourable. Notwithstanding multiple obligations, they have few rights and receive little benefit.

Children's Role at Mining Sites

Even though their numbers are unknown, children (boys and girls) work on many sites in Mali. The risks and work conditions obviously differ between activities in tunnels, open-pit

mines or in riverbeds. In general, underground work is reserved for men and the traditional mining police forbid boys and girls to work underground. However, some positions on sites are exclusively reserved for young boys and girls. These are mainly minerals transport and processing, water supply and babysitting on sites. Children use their heads or backs to carry the minerals.

Among other activities carried out by children, there are: food preparation and sale; ambulant selling of drinks, cigarettes, cakes; crushing, milling, pounding and sieving of minerals.

Tools and Methods

Exploitation Tools

Artisanal miners exploit any form of profitable occurrence technically accessible and, necessarily, not deep. They are most interested in detrital deposit of the placer type (placer deposit or eluvionary) but also to the supergene part of primary deposits (laterite, saprolite, oxidised zone). These exploitations are characterised today by rudimentary extraction and processing methods and simple tools such as shovels, picks, pickaxes, buckets, calabashes, metal pieces and sawn gas bottles. This basic equipment translates into weakness of material means. With the exception of motor pumps for shaft de-watering, mechanized equipment is very limited (locally manufactured crushers, grinders and jigs). The use of heavy engines for sterile scraping is exceptional. Precariousness of means and technical weaknesses frequently lead to dramatic skimming of deposits causing losses to miners.

Traditional production on a site rarely involves more than half of potential reserves. Losses cumulate progressively and quickly become considerable. In the case of gold, they probably reach 75 per cent of the metal stock for a placer deposit and 90 per cent of a lode. Outputs rarely exceed 2–3m³/person/day and drop to 0.1m³/person/day for heavy jobs like quartz crushing using manual drop forging. Some sites may be returned to later. However, in most cases, the deposit is irremediably damaged in the course of the first phase of work, and so lost. If a traditional production extracts three tons of gold a year, losses caused by the use of traditional methods are estimated to be more than ten tons, which is the equivalent of about \$22 million.

The progressive introduction of a minimum of technology appears inescapable to improve production, it is clear that unreasonable ‘mechanization’, similar to what is done at a large-scale mine, would not be beneficial. It does not improve productivity and miners’ income. One reason for this is organizational. There are no production plans and therefore, materials made available to artisans are sometimes not adapted to the scales required. The use of the material is often too individual, not rational and rarely optimised. Another reason is economic. With a ‘single dollar’ daily income, the artisan obviously lacks the money to invest in heavy equipment. To do so, there must be contact with collectors or traders who will request considerable sums for the service (frequently between 30 and 60 per cent of the total production for a motor pump). Experience on some Kéniéba sites demonstrates that with material rental, the use of a motor pump or a compressor adds up to between 30 and 40 per cent of income losses for the gold washer. Other technical weaknesses include lack

of means, lack of cultural opening, inability to solve problems and to innovate for more productivity, profitability and security.

The most serious problems stem from the fact that preliminary prospecting reports are rare or nonexistent. They are mostly confined to washing tests of gravel collected in rivers. Although a few lodes may be spotted by chance on an outcrop, it is generally from exploitation shafts that new, rich zones are spotted. This brings in its wake two sorts of consequences: artisans exploit a site without knowing it and therefore do not go through an investment process; genuine discoveries are not numerous and artisans regularly come back to the same sites, which become unproductive and deep.

Exploitation Techniques and Methods

Exploitation techniques, despite poor organization on sites, remain suboptimal. Deposits exploited on a logical basis with pre-splitting in panels are rare. Placer deposits do not often present a single working face with a footwall to prevent being forced backwards. For lode exploitation, the technique consists in sinking vertical shafts habitually established following the indications of Tomboloma. The historic exploitation mode in these exploitations is in itself, quite remarkable. It is characterized by an almost perfect alignment of small circular vertical shafts sunk in the leavings.

The mineralised layer is then depleted in depth and access to lodes is done through a system of lateral radiating tunnels, sometimes several hundreds metres long. This method allows quite interesting excavated outputs for relatively poor placers. Some of these exploitations are actually small mines, using timbering and support techniques. Leavings are often rejected outside on not-yet-exploited areas or in neighbouring shafts. The result is incomplete pillar extraction of the mineralised layer. Lode exploitation is often deep under the ground water level. They are therefore obvious de-watering problems. Water control has always been an essential problem for artisans. They are confronted with either insufficient de-watering for mineral extraction, or not enough water during the processing phases.

Women often drain excavations daily, using makeshift tools (buckets, basins, calabashes). This operation costs production time, and can represent almost half the time spent by a team on a shaft. The drainage mode has limited efficiency (evacuation debit rarely over 150litre/minute), and allows resorption of only small infiltrations. When these infiltrations become overwhelming, the shaft has to be abandoned and gravel extracted, that is before the exploitable zone is reached. The use of motor pumps on some sites obviously enables faster draining of several shafts at the same time. Unfortunately, inefficient organization of the use of drainage equipment incurs rapid losses.

The few pumps are in great demand and frequently stopped before completely draining a shaft, to be transferred to other shafts. Draining then has to be completed manually. As there are no dedicated evacuation channels, the water discarded near shafts infiltrates very rapidly into the ground water and almost immediately floods back. For primary or eluvionary types deposits located on interfluves, however, it is the lack of surface water, which generally hampers mineral processing. It is frequent to see on the same site while some miners are draining water, others are buying it for processing.

Processing Methods

Processing methods are always crude, elaborated with makeshift means. Recuperations are often bad and final products have poor commercial quality. When it is unmechanized, processing remains traditionally the domain of women.

Crushing of quartz mineral, still carried out manually, is the main activity on most lode gold-mining sites. This operation, the heaviest in the processing, is generally carried out in very insalubrious working conditions, saturated in silicon dust. Auriferous quartz is classically crushed in sawn gas bottles, pounded with a steel bar and then laminated, if necessary, on stone grinding wheels. Outputs during crushing are very small, rarely more than 50kg /person/day.

Without knowing the release mesh of gold, grinding is done totally blindly, by successive steps, until apparent exhaustion of the mineralised powder. Even so, an important quantity of fine gold still trapped in the dirt is actually lost. Losses incurred by grinding operations are estimated at between 10 and 30 per cent of the metal stock according to which mineral is being ground. Some worksites of Kiénéba are equipped with small grinding engines. They are typically grain grinders transformed into grinding wheels. The original hammers are replaced with slotted metal discs. These machines, though not very high performing, can improve productivity by up to 200kg per hour.

Concentration of auriferous mineral (gravels or ground lode) is systematically carried out manually using gravimetric techniques. Argillaceous products are first cleaned by mixing them in calabashes or basins. According to the volume to be processed, the mineral can be concentrated ahead of time on small, locally made washing tables (sluices), or directly concentrated in calabashes. Here again, outputs are low (around 150kg per pan). In some cases, concentrates obtained by panning are amalgamated or washed with acid. Efficiency of these methods depends obviously on the technique used by the operator. Poor control can cause enormous losses.

Generally speaking, recovery rates seem acceptable for relatively crude gold (grains $>400\mu\text{m}$), but almost nil for fine gold (grains $<100\mu\text{m}$) which tend to float.

The most striking facts during the past ten years have been: demarcation of gold-washing corridors and geological studies of them by the Department of Mines, enabling the settling of diggers on some sites for a long period; the progressive introduction of motor pumps, grinders and compressors on some sites through joint venture contracts negotiated by some cooperatives and foreign partners; the introduction of sluices by Ghanaian diggers, to replace traditional calabashes, improved mineral-washing techniques and gold recuperation on Kiénéba sites.

Negative Impacts of Traditional Exploitation

Health, Hygiene and Security Problems on Sites

Miners settle in temporary villages near extraction sites. They shelter under branches and straw huts, which offer no comfort and barely protect them against the weather. These shelters have no water or sanitation and are particularly vulnerable to fire. Extraction sites are generally isolated in the bush and not near health centres or medical personnel. Injured or ill people must walk far in difficult conditions to reach a health centre. To avoid 'losing heart', young and adult diggers use alcohol, amphetamines, other drugs or sometimes inhale glue. In addition, the massive flow of people on sites motivated by easy and rapid enrichment often leads to a rapid degradation of morals. Prostitution, drugs, delinquency, swindling and crime also tend to develop.

One direct consequence is the prevalence of AIDS, which according to a survey conducted by AMPPF in 1994 on some Kiénéba sites, is 20 per cent. Other sexually transmitted diseases (STDs) affect two diggers out of five.

As mentioned earlier, painful working conditions constitute risk factors for the propagation and proliferation of disease on mining sites. According to recent health statistics in the Kiénéba zone, the most common diseases recorded in 1999 were malaria, acute respiratory infection, trauma, diarrhoea, dermatitis and STDs. The food of miners is based on cereals like millet, sorghum, *fonio* (a local cereal) or rice. These foodstuffs are generally poor in trace elements and not very nutritious. Meagre lunches eaten in unhygienic conditions on sites do not compensate enough for the intensive working patterns of diggers during the day. Added to this, there is high consumption of low-quality tinned food. For obvious reasons malnutrition is prevalent on mining sites.

Child Labour on Mining Sites

The health hazards are important for these children who are asked to pound and wash minerals for hours in a day. Apart from their mothers' presence on the sites, babies are exposed very young to dust and noise caused by pestles. Among other physical risks and constraints endured by children on sites, a list should include:

- Respiratory infections and silicosis caused by fine dust.
- Dumbness risk caused by permanent noise from pestles and hammers.
- Fatigue from hard manual labour to crush and grind minerals.
- Injury risk from flying stone fragments.
- Ocular and various dermatological afflictions.
- Child prostitution.

The precarious state of some of children's nutritional situation constitutes another risk factor on mining sites. In many cases, miners have only a small breakfast before going to

sites, while lunch is generally insufficient in nutritional terms to compensate the energy needs of the day.

On the subject of education, miners are frequently early school leavers and children are the first victims of 'gold fever'. Generally, children who live in mining villages do not go to school and the rare educational structures around sites are often short lived. Sites are by their nature impermanent, and groups of miners migrate often following new discoveries or rumours. Children leave school because they have to work with their parents who take them with them when they move. In other cases, children decide themselves to leave school to try to earn their living like their friends — who buy bicycles and radios thanks to gold. Parents who spend their time searching for gold leave children to themselves. Families at sites are characterised by weakened or disturbed structure and authority. Under these conditions, some children suffer from a family atmosphere of conflict, alcoholism and violence.

Environmental Impact

In Mali, like elsewhere in the sub-region, the impact of traditional mining on the environment varies according to geographical context, exploited substances and methods used. In traditional gold-washing techniques, risks and dangers to the physical environment include: tree cutting, destruction of vegetation and soil, water pollution through the use of chemicals during processing. High concentrations of hundreds or even thousands of diggers on the same site mean aggressive deforestation demanded by work, housing and fires.

Destruction of vegetation is reinforced by the search for nuggets, which are believed to be between the roots of trees. The result is soil degradation, which can make it unsuitable for agriculture. Because diggers move frequently in search of richer sites, hundreds of shafts and mining works eventually get abandoned, leaving the soil unprotected against channelling and erosion, which leads to loss of topsoil. This imbalance can cause aggradation of valleys and, finally, asphyxia. These processes are almost irreversible and can become catastrophic in a few generations. In the case of production based on processing of minerals extracted through dredging, the use of chemical products like mercury may pollute rare water resources and this is a permanent danger. This risk is very high, as dredge users untrained in controlling or avoiding ground water pollution. Because of lack of supervision or sensitisation of artisans about concepts of environmental protection, traditional exploitation leads very often to ecological destruction that should not be minimised.

In conclusion, there are severe environmental-damage issues related to traditional mining in Mali. 'Orphan' work sites represent a real danger to human beings and animals' movement. Old sites generally abandoned without any protection, can be extensive, possibly very deep excavations (say, 50–60m), often camouflaged by stagnant water or secondary vegetation. As an example, one of these sites in the Kangaba zone covers 55,000km², and has ruined 15 to 20 per cent of it.

There are other negative effects left by artisanal mining. Alluvium exploitation, frequently accompanied with river bank destruction and massive sedimentation, can locally perturb a

river's balance. Turbidity and water contamination by mud can kill off aquatic fauna and limit fishery projects. Primary deposit mining under the hydrostatic layer can cause ground water levels to fall due to excessive pumping. This can be a serious problem on sites which lack water resources. Amalgamation techniques, including distillation in the final phase, are generally carried out in short cycles. During the operation, around 40 per cent of mercury can escape in the form of metal balls or steam (two grams of mercury 'evaporate' for each gram of gold recuperated). Rejected mercury can be drawn into rivers and settle in sediments where bacterial action transforms it into methyl mercury — an organic component with great bioavailability, which can easily enter the food chain. Chronic exposure to the product does not affect only direct users who inhale steam, but also indirectly the whole population living and eating in the contaminated zone. Studies on this issue have just begun and no reliable data are available to assess all the ecological impact related to the use of mercury or other chemical products. Finally, in common with other human agglomerations, traditional mining sites leave behind environmental pollution by waste, organic substances and large accumulations of detritus and batteries.

Assistance to the Traditional Mining Sector

Examples of Positive Changes Brought by Assistance Projects

In Mali, despite the importance and secular character of traditional mining, this sector has received limited assistance in the last few years. The following pages deal with some examples of assistance projects which have contributed to positive changes in the subsector.

The Department of Mines and Geology funded and carried out geological surveys in 1997 to determine the mining potential in five zones earmarked for traditional mining. These zones were allocated to mining groups, sensitised on issues like security, hygiene and environment. The impact of the project was mainly the settlement of five villages of gold diggers around the identified sites.

Funded by the World Bank, the Project for Technical Assistance to the Mining Sector (PATSM) in 1998 organised seminars and training workshops for the small mining operators of Kiénéba and Kangaba. Thanks to these training programmes, several mining cooperatives acquired formal mining titles for themselves and are searching for partners and joint ventures.

The National Union of Mining Operators (UNOMIN), created in 1994 is a professional organization for all mining groups who operate in Mali. It has three regional subgroups, which organize sensitization campaigns, counselling and support for local mining groups. UNOMIN undertook to create a chamber of mines in Mali. Documents are being finalised. Thanks to this action, 38 mining cooperatives and 12 IEG received their affiliation and official registration.

Between 1988 to 1994, the Liptako Gourma Authority, a sub-regional institution, organized several seminars in its members' countries, namely Mali, Niger and Burkina Faso, on

development and promotion of traditional mining, to harmonize regulations in these three countries.

The elaboration of typical legislation related to small-scale mining is a positive result reached by these countries. The Economic Commission for Africa (ECA) carried out several thematic studies on legal, regulatory and organizational aspects in the Liptako Gourma Authority member countries. In 1992 this institution also carried out a diagnostic study of the sector and proposed a development strategy of the subsector. The impact of the assistance of ECA was the constitution of a documentary base on traditional mining sector in Africa and an electronic data file on national experts working in this area.

The Promotion of Traditional mining and Environment Protection Project was launched in 1997 between the UNDP and the government of Mali for an orientation and basic data-collection phase. With an initial budget of about \$300,000, this project had the following objectives:

- To reinforce capacities of institutions, through the implementation of legal and regulatory mechanisms aimed at mining environment protection in general;
- To promote the development of gold washing and small mining through supervision and organization of artisanal miners.
- To organize traditional mining as an instrument of fight against poverty by integrating it in the formal productive network, on the basis of local communities organizational capacities.

From 1998 to 2000, the project implemented several studies and led field activities on the main mining sites of Mali, including: socio-economic studies to identify income-generating activities on mining sites; identification of equipment and materials to improve production and productivity; sensitization and supervision on security and rehabilitation of mining sites; and search for partners for acquisition of materials and mining cooperatives funding.

Positive changes brought about by this project, include the following examples: organization and reassembling of Kiénéba and Kangaba diggers in formal mining cooperatives (38); reassembling of women miners of Kiénéba and Kangaba in associations and EIG (12) enabling them to have easier access to local NGOs or to other decentralised development groups; initiation of income-generating activities like market gardening, dyeing, beekeeping and arboriculture; implementation of an environmental directive on Kangaba and Kiénéba pilot sites, to integrate the environmental dimension in traditional mining and encourage the rehabilitation of abandoned sites; and popularisation and use of retort by five dredge operators on the Niger River and Falémé. This user-friendly instrument will enable dredge operators to control completely gold extraction with mercury, while avoiding pollution risk to ground water levels and rivers.

In 2001, the project successfully completed the formulation of an important project document worth about \$1.8 million, and finalised by UN experts. This project is in search of partners for resource mobilization to implement operational activities on the field.

In May 2001, the UN Department for Economic and Social Affairs in collaboration with the International Labour Bureau (ILB) launched a regional project entitled Project RAF /99/023: Poverty Eradication and Development of Sustainable Existence Means in Traditional Mining Communities. This UN-funded project included the implementation of participative surveys in communities, case studies and an analytical report in four African countries namely Ghana, Ethiopia, Mali and Guinea.

The objective of this project is to revitalize sponsors' interest for the traditional mining sector in a broad framework, and thereby contribute to poverty alleviation in rural mining zones, in order to achieve sustainable development.

In June 2001, the Small Subsidies Programme of the World Environment Fund (PPS/FEM), through a local NGO, funded a rehabilitation project of gold-washing sites on the Kiénéba site. The total cost is projected to be about \$45,000, and has the following objectives: to stimulate diggers' awareness of how to integrate an environmental dimension in mineral resources exploitation; and how to contribute to the protection of biodiversity and to mining sites' rehabilitation

Between 1998 and 1999 the IPEC/BIT project of the International Labour Bureau, in collaboration with the Department of Mines, led sensitization and information sessions at Mali's main mining sites to survey children's work on them. Work was done on the following:

- A diagnostic study on the situation of children working on Kangaba, Kiénéba and Yanfolila mining sites.
- Production of a sensitization sketch and video on the situation of working children.
- Set up a multidisciplinary team and mobilize opinion-makers to create an information and listening centre to improve the living conditions of children working in mining.

Several positive changes were brought about by this project. One is the acceptance of parents and the traditional mining police to withdraw children work in mining. Another is bringing in pay in compensation for any child working for a mining group other than his own parents'. The formal prohibition of work forms considered the most intolerable for children: namely, work in shafts, drifts and tunnels. There is also a move to forbid and severely punish child prostitution on sites.

Reflections on the Failure of Some Assistance Projects

In Mali and in the sub-region, many assistance projects targeted at traditional mining do not generally lead to the creation of viable enterprises. These failures have several reasons:

- Links between traditional mining activities and local social and economic opportunities were not taken into account. Because minerals are non-renewable resources, their exploitation should have been supported by an integrated approach to stimulate and serve as a cornerstone for the development of other sustainable productive activities.

- Most assistance projects emphasize technical aspects at the expense of the vital needs of communities and populations in mining zones. Experience shows that traditional mining is primarily due to poverty. In such a context, there is no doubt that future development must concern not only services or technical assistance, but also ways of sustainable subsistence.
- Non-reinforcement of organizational capacities of local communities for long-term development of the traditional mining sector, and the integration of mining potential into the formal economy. Most assistance projects aimed at small-scale mining have generally been designed by technicians of mining, without the involvement of other specialists or local NGOs which could have given new sustainable development dynamics to this sector.
- At the macroeconomic level, small-scale mining rarely reaches all its potential. The acknowledged capacity of small mining operators to find mineral resources of great value is one thing; the possibility to exploit these resources fully is another.

We note that small-scale mining productivity is much lower than it should have been. Its economic profitability could be much higher if there were adequate pricing regimes, appropriate tax and regulatory provisions — and these were respected. Complicated procedures have led to illegal practices and smuggling.

These clandestine practices explain why the sector suffers from a lack of information and reliable statistics. Specific policies and strategies destined to promote small-scale mining are not bold enough and the main problems governments confront are a lack of well-trained staff, and insufficient material and financial resources. No external assistance to the traditional mining sector can have lasting effects without the active support and participation of governments. Unfortunately, in many countries small-scale mining occupies a low position on any list of governmental priorities. Generally, governments intervene in this sector either to improve receipts or after a disaster to improve the worst security and health problems. Unproductive miners, without the means to make their activity less dangerous, will suffer long-term detriment to their own health and that of their environment.

Institutional Legal and Regulatory Aspects in Mali

Institutional Framework

The Ministry of Mines, Energy and Water Resources is the line ministry in charge with the mining sector management in Mali. There are several technical advisers and various administrative and technical structures support this cabinet namely:

- The National Directorate for Geology and Mines (DNGM) is the implementation instrument of control and legislation. It is in charge of elaborating the national policy in the research, development, exploitation and processing of underground resources, and ensures coordination between services — public and private — working to this end. To fulfil its mission, DNGM incorporates three divisions: the division of cartography and geological prospecting; the divisions of hydrocarbons; and the division of mineral

substances and classified establishments. DNGM is provided with a documentation centre to manage all existing cartographic documents and research reports.

- The Programme for Mineral Resources Development (PDRM) is a service attached to the PNGM and set up by UNDP to provide services in various areas of geological and mining research such as geology, geophysics, geochemistry, mining drilling, cartography, laboratory analyses for gold and other minerals.
- The Project for the Promotion of traditional Mining and Environment Protection (PAMPE) is a technical structure attached to the DNGM. It is the first structure in charge of supervising and assisting the traditional mining sector and small-scale mining in Mali. It was initiated by UNDP and the government of Mali to support the promotion of traditional mining and integrate the fight against poverty with environmental aspects in mineral resources exploitation.

Infrastructure, Human and Technical Capacities

Concerning cartographic documents, Mali is entirely covered geologically at a scale of 1:1,500,000 and for about 60 per cent at a scale of 1:500,000. The cartographic cover at this scale essentially concerns districts, which are considered metallogenically interesting and covers entirely zones where traditional mining is practised. Maps at the scale of 1:200,000 cover entirely small mines sites and about 60 per cent of the national territory. In addition to purely geological documents, there are geochemical, aero-magnetic and radiometric maps of some potential mineral-rich zones. Finally, a map of mineral deposits, done in 1978, was completed and updated in 1997.

Thanks to the National College for Engineers (ENI) and the Central College for Industry, Commerce and Administration (ECICA), both with geology and mines departments, Mali has succeeded in training many engineers and junior staff in the area of geological and mining research, even though they are not numerous enough to cover the current needs of the many mining companies working in the country.

Concerning technical capacities, the Programme for Mineral Resources Development (PDRM) has a modern laboratory for chemical mineralogical analyses (for gold and minerals) and a complete workshop for mining drills. Finally, a computerized data bank on all available information on the mining sector is being progressively set up in the new documentation centre created in 1997.

History and Evolution of Laws and Regulations

With the independence of Mali in 1960, the legislator inherited mining activity essentially based on customary law. From 1960 to 1989, gold-washing activities were not regulated and existing texts were about timid regulatory provisions. Among legal instruments related to traditional mining and to small-scale mining, we note that the mining code or ordinance no. 34/CMLN of 1970 in article 8 stipulates: 'Rural communities organised in cooperatives can exploit mineral substances.' This article includes provisions to set up a regulatory framework to determine the creation, supervision, administration and control of mining cooperatives and define substances they were allowed to search or to exploit. This

regulation was never done and cooperatives were never organized. The individual gold washer was completely forgotten in the application field of this code.

A ministerial order of 15 July 1985 expressly refers to gold washing and stipulated that: 'gold washing activities were suspended on the entire territory of the Republic of Mali during the cultivation period from 1 June to 30 November of each year'. This order then authorizes gold-washing activities from 1 December to 31 May. During this period, small-scale mining activities remain free from state intervention.

Following the recommendation of the national seminar on gold washing, held in Bamako in 1989, the profession of gold washer was regulated by a special legislation namely ordinance no. 90-09/P-RM of 13 April and its enforcement decree no. 90-186/P-RM of 2 May 1990. The objectives of these texts were on the one hand to legalize gold-washing activities, and on the other to promote small-scale mining of auriferous lodes which are impossible to exploit with large-scale industrial methods and heavy investment. The provisions of this law differentiated between traditional and mechanized gold washing.

Traditional gold washing can be done by anyone with a gold-washer's card (costing \$7). This amount is for the public treasury and represents an authorization to carry out gold washing. The card is valid for one year and is issued by the National Director of Geology and Mines to Malians, and to nationals other countries which provide reciprocal measures. It is valid throughout Mali.

A licence issued by the ministry in charge of mines gives conditions for mechanized gold washing. The holder of the licence is qualified as an enterprise allowed doing gold washing. It is issued only to Malian enterprises, totally controlled by nationals. In practice and despite vast sensitization campaigns, these rules could not be suitably reinforced for the following reasons:

- For traditional gold washing, operators could not pay for the card in advance. The mining administration did not receive proper means to enforce these rules.
- For mining enterprises the procedures were too complex and discouraged many candidates. Also non-Malian investors could not have this licence, although they are the ones who have the money.

Between 1991 and 1999, traditional mining activities and small exploitations were regulated in several ways. Ordinance no. 91-065/P-CTSP of 19 September 1991 and its enforcement rules included legal provisions related to small-scale mining. Through this regulation, the legislator wanted to correct the weaknesses of former texts and give some importance to small-scale mining. The legislator also specified the parameters to be taken into consideration in classifications.

Decree no. 96-214/PM-RM of 16 August 1996 regulating the collection, processing and marketing of gold. Marketing and export of gold were organized around the following principles:

- Gold collection, processing and marketing in Mali are carried out by gold collectors as well as purchase and export agencies.
- People may not practise this activity unless they have a professional collector's card issued by the Economic Affairs National Director
- Getting a card requires the payment of stamp charges set at \$150. It is valid for three years, renewable.
- When exported, gold should be presented in the extracted ingot.

Interdepartmental order no. 97-1579/MFC-MMEH of 16 September 1999 defines the formation of the joint committee in charge of establishing rules for gold exportation. According to this law, a committee drawn from government and banks decides gold export tax amounts periodically.

Order no. 091-065/P-CPST of 19 September 1991, and regulating research, development, ownership, transport, processing and marketing of mineral matters of fossils and quarries, was the legal text regulating the small-scale mining sector and mining industry. It was replaced in 1999 by the decree no. 099-032/P-RM on mining in Mali on the one hand, and its application decrees no. 99-255 and 99-256 on the other hand, which constitute the statutes in force. This new mining law, which integrates and supplements old texts on traditional gold washing, small-scale mining and quarries, defines the different mining titles for carry out these activities as well as related duties and taxes.

State of Current Legislation

The collection, processing, and marketing of gold and other precious metals or fossils, imported or produced on the national territory by gold washers and other miners, are regulated by order no. 099-032 on mining laws in Mali. Mining titles applicable to small-scale mining are of the various kinds depending on whether they are at the research stage or rather at development stage. These include: a traditional development licence; exploration licence; a prospecting licence; and a small-scale mining development licence.

Mining exploration requires a mining title referred to as an exploration licence which includes the following features:

- The exploration licence is issued by the Director of Mines, who decides on the maximum area, depending on matters and regions, to the first applicant, be it an individual or a corporate body, so long he has required technical and financial capacities;
- The exploration licence may not be issued when an area is covered by another mining title and provides exclusive rights for exploring a set of substances;
- The exploration licence period of validity is three months, renewable once for the duration, depending on work carried out;
- During all the period of validity of the exploration licence, no mining title may be issued for the area covered by it.

- At the expiration of the exploration licence and within a period of three months, its holder has a right to request a research or prospecting licence for the set of substances covered by this licence. At the end of the period of validity of the exploration licence, the holder shall provide to the Director of Mines a report on work carried out.
- An exploration licence may be issued exceptionally to a person who applied for small-scale mining development licence to enable him to fulfil certification task for drafting a feasibility report.
- The exploration licence does not grant to the holder any fiscal or customs duties facility. It is neither transferable, nor transmissible and cannot be leased.

The research title, which enables access to small-scale mining, is first and foremost the prospecting licence, which grants to the holder, within his limited area and without limitation regarding depth, the exclusive right to prospect for substances belonging to the group for which it has been issued. The prospecting licence is issued through an Order of the Minister of Mines who defines its maximum area, depending on substances and regions, to any individual of Malian right, including at least one Malian shareholder.

The period of validity of the prospecting licence is three years and can be renewed only once, with a reduced area. The renewal is de facto if the holder fulfils the obligations defined in the mining law. The short time length is meant to enable supplementary certification work so as to outline feasibility study on a deposit identified before. The prospecting licence is coupled with an establishment convention signed between the state and holder.

If a substance belonging to another group is discovered, the holder may request an extension of the licence to encompass this. The prospecting licence is issued to the first applicant with the required technical and financial capacities to carry out prospecting work successfully, and meet obligations with regard to environment, hygiene, security and public health. The holder of exploration licence has first and foremost the right to acquire prospecting licence. This right is limited in time and cannot exceed a period of three years.

Pursuant to mining law provisions and the enforcement decree no. 099-255, traditional development of gold or traditional gold washing is carried out by holders of the traditional mining development licence. Generally referred to as Gold Washer Card, the traditional mining development licence controlled and issued by territorial communities to Malians or other nationals which ensure reciprocity to Malians. The traditional mining development licence may be issued on strictly private capacity or to associations of traditional miners with a one-year period of validity renewable. Specific areas referred to as 'gold washing corridors' are earmarked for traditional gold washing and are defined by a joint order by the minister in charge of mines and the minister in charge of territorial communities.

Small-scale mining and mechanized gold washing are conditional on the acquisition of a mining title referred to as a 'small-scale mining development licence'. It may be issued to a research or prospecting licence holder who can document, through a feasibility report the existence of a deposit that can be developed in the area of small-scale mining or mechanized gold washing. However, it may be issued directly to an exploration licence holder. In this

case, the licence will be to the first applicant who, in addition to documenting the existence of a deposit, can present a feasibility report.

The minimum area of small-scale mining development licence is 10 square metres. It is issued for a period of four years, renewable every four years while stocks last. It is transferable, can be leased, transmissible, but not divided.

Small-scale mining development licence is a property right for a limited period, different from land property, and may be mortgaged or serve as guarantee, provided that fund borrowed and guaranteed are used for development activities.

The holder of a small-scale mining development licence shall, as soon as starting development, inform the Mining Department about possible changes made in the feasibility report main parameters. The small-scale mining development licence lapses if it is waived by the holder or invalidated or withdrawn by order of the Minister of Mines.

Provisions on Environmental Protection, Hygiene and Security

Any small-scale mining development licence holder shall respect legislation and regulations on environment and cultural and archaeological heritage in force in Mali. To satisfy obligations related to these provisions the holder shall give to the Department of Mining a note on the impact on the environment including:

- A statement on the environment, in accordance with specified guidelines;
- A statement on archaeological heritage before the work;
- Measures to alleviate any disastrous effects on the environment of the development activity;
- A projected programme for rehabilitation and restoring of sites.

Besides, within a period of three months from the date of issuing, any small-scale mining development licence holder shall: mark the boundary of the area granted; establish a protection line around open-cast working, workshops and processing factories.

Before the end of mining development work, any small-scale mining development licence holder shall: rehabilitate the site and make sure that, after closure, it complies with directives related to site rehabilitation; ensure a good ending of the site rehabilitation and securing work.

Small-scale mining development licence holders and their sub-contractors shall observe minimum security and hygiene rules applicable to research and mining development work. They shall also observe both provisions related to health hazards resulting from mining development and security rules linked to transport, storage and use of explosives. In this respect, they shall define and apply regulations related to protection and prevention measures, in accordance with approved international standards for such work.

Provisions on Radioactive Substances Resulting from Craft Work

Minerals substances deemed to radioactive matters are uranium and thorium as well as their lineage. The possession, handling, and marketing as well as related operations are subjected to regulations in force and / or international rules on radioactive matters. Any traditional or small-scale mining development licence holder having radioactive matters or products shall declare them at the Department of Mines and the state reserves pre-emptive right to these radioactive mineral matters or products. Only the Minister of Mines can issue radioactive matter a product export licence.

Relationships between Traditional Miners and Mining Companies

Mining industry is an activity carried out on village soils recognized by official legislation. Provisions in article 50 and following mining law and the demarcation of mining corridors are meant to deal with land issues and regulate relationships between mining title holders and landowners. Thus, no research or development right pertaining to mining titles is valid without landowners' agreement concerning activities involving surface area or having impact on it. A mining titleholder shall repair any damage resulting from the work on owners of land titles, occupation titles and people covered by customary law. Or the licence holder can pay an appropriate amount corresponding to the damage.

Large-scale mining licence holders generally tolerate the practice of traditional mining development, especially at exploration stage when ongoing work does not present any danger or risk for gold washers. This authorization may be explained by the fact that traces left by gold washers have always been mineralization indicators for prospectors and geologists. All industrial mines under development now in Mali have been guided by gold-washing traces. In the case of the Sadiola gold mine, the development of the quarry brought about expropriation and transfer of two villages that were resettled on new sites.

This village transfer occurred in 1998, pursuant to the World Bank guidelines and the Anglo Gold Co for gold-washing promotion supported the people involved. Activities carried out under this assistance included:

- Creation of the Sadiola Gold-washers Cooperative.
- Demarcation and study on mineral potentialities of a gold-washing site.
- Test, purchase and delivery of gold-mine processing equipment.
- Sensitization and training of traditional miners on semi-mechanized development techniques, hygiene, security and environment protection.
- Education and sensitization of gold washers in order to invest part of their income in sustainable activities.

This successful experience of Anglo Gold Company and Sadiola gold washers, the first in the region, has used as an example to the United Nations and BIT Team in drawing up the regional project for promoting mining industry and eradicating poverty in rural areas.

Economic Provisions

During the period of validity of the small-scale mining development licence, mining law provides economic, financial, fiscal facilities for holders of titles. Some of these provisions are dealt with in the following pages.

Economic System

During the period of validity of the mining title, no measure may be taken to restrict terms under which the legislation in force at the date of delivery of the title provides such as:

- Freedom of choice concerning suppliers and sub-contractors for purchasing goods and services.
- Freedom of importation as regarding goods, materials, material, machines, equipment, spare parts and foods, in compliance with customs law.
- Freedom of movement of materials, as well as all matters and products resulting from research and development activities.
- The right to import any equipment, spare part, stock, supplies and drink connected with activities in Mali, although they may not be directly useful for research or prospecting work, development or processing of extracted products.
- Freedom to export extracted, produced or processed matter and freedom of marketing.
- Contracts execution provided that these have been concluded at a reasonable market price.

Financial System

Subject to mining law provisions, the state provides mining title holders, their supplies and sub-contractors with:

- Free conversion and free transfer of fund for payment of all debts in currency to creditors and foreign suppliers
- Free conversion and free transfer of net profit to be distributed to non-Malian associates and any fund allocated for the repayment of financing obtained from non-Malian institutions and companies affiliated to mining title holders, after payment of all taxes provided by the Malian legislation.
- Free conversion and free transfer by expatriate staff employed by mining title holders of savings from their salary or resulting from the liquidation of investments in Mali or the sale of their personal effects and objects, after payment of taxes stipulated by legislation.

Notwithstanding provisions mentioned above, mining titles holders as well as their suppliers and sub-contractors are subject to exchange regulation provisions in force in Mali as regarding the execution of their operations abroad. In this respect, they are compelled to

repatriate their mining development product, in accordance with Article 11 provisions, from annex 2 to rule N0R09/98/CM/UEMOA of 20 December 1998 on external financial relations of the West African Economic and Monetary Union (WAEMU) member states.

Comments

Salient points characterizing legislative and regulatory reforms applicable to mining sector are:

- The global revision of the fiscal system is meant to increase the level of current income, while becoming more attractive for national and international investors.
- Fiscal and customs systems take into consideration a number of constraints linked with the specific context of Mali, namely the policy of the country, its economic and social objectives, the specificity of the traditional mining sector and the integration of the country in a free trade zone (WAEMU).

The new mining legislation recommends a strategy for developing and promoting traditional mining sector that should be integrated into other development strategies of the country. It should also contribute towards poverty reduction. It should promote and enhance the role of women in this sector. It should also oppose child labour in mining sites.

Consideration for the environment is now a necessity for the mining sector. In fact, since minerals are non-renewable resources, reduction and exhaustion these resources shall be compensated by sustainable income- and employment-generating activities.

Conclusion and Future Development of the Traditional Mining Sector

Traditional mining development has considerable impact on the economy of African countries and it contributes, in Mali, to the survival of an increasing population estimated at over 200,000. Notwithstanding its tremendous importance, the sector does not fully achieve the expected results. Indeed, in most countries of the sub-region, in addition to the lack of financial resources and technical means faced by this sector; there are organizational legislative and fiscal constraints. Attempts to reorganize the mining sector should be made in order to get better financial results.

Furthermore, since large parts of small-scale mining are developed secretly, governments do not get from them their rightful income. Since one of the main drawbacks of small-scale mining development is low production, compared to the physical effort made, the first challenge to face is how to set up of a more legal and official instrument for miners by creating a positive environment for assistance, cooperation and confidence. Assistance provided to small miners has made them realize the best ways to proceed in terms of health, income and sustainability.

To promote this sector in the context of sustainable development, solutions are needed for the numerous technical and organizational problems and it appears also indispensable to focus on productivity, profitability and especially security on sites.

One promising solution is to integrate small-scale mining into the formal sector, by means of participatory and integrated approach through guidelines such as:

- Consider the fight against poverty a priority in national policies on traditional mining development sector.
- Promote, alongside with small-scale mining production, other supplementary productive activities, with mining activities serving as a focus.
- Lay more emphasis on mining communities' basic needs and not only on purely technical aspects, in order to initiate actions for deprived people and strengthen their basic organizational capacity.
- Encourage support not only from government and donors to create local businesses and structured mining cooperatives.

This approach will generate wealth, and foster the creation of business network well integrated into the local economic fabric and able to contribute to the sustainable development of mining areas. If this objective is achieved, small-scale mining development will flourish on a long-term basis in the region as a whole.