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Universidade Zambeze

The Problems of Artisanal Gold Mining in Manica Province



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Introduction

The artisanal and small scale mining is a generic term that means something different to different people, countries and organizations. In an African perspective, artisanal and small scale mining was defined by Dreschler (2001) as *mining operations carried out by individuals organized into groups (four to eight individuals) or cooperatives of ten or more individuals, which are entirely financed by limited resources and undertaken full-time, using simple techniques and traditional instruments with low level of mechanization.*

Under the legislation in force in Mozambique, artisanal mining operations are those that are characterized by the rudimentary nature of the activity with the use of simple tools and equipment, reduced volume and scale mining operations.

The characteristics of artisanal gold mining in Manica are:

- The artisanal gold mining is the second largest sector in terms of employment after agriculture;
- The sector has little mechanization;
- A heavy manual activity;
- Low levels of geological knowledge, mining and processing of gold techniques;
- Low level of mining and environmental safety;
- Serious public health risks;
- Weak or no knowledge of the laws of the land;
- Major socio-economic, cultural and environmental negative impacts.

1 Objectives and Methodology

Some authors argue that the minerals are considered non-renewable raw materials and at first glance, the mining activity cannot be considered as sustainable and that resources are exhaustible. In fact, the earth's resources are actually finite, but there are arguments that show it is quite possible the development of this activity within the concept of sustainability of mineral resources.

1.1 Purpose

The main aim of this booklet is to share with the public the results of a scientific research in the area of artisanal mining carried out in the last 20 years in Manica Province in central Mozambique.

1.2 Methodology

For the execution of this study, coordinated by the University Zambeze, we used the following procedures:

- Literature search of work carried out in Manica Province in particular and in the country in general;
- Bibliographical research work conducted in the area of artisanal gold mining in the world;
- Field surveys (current mining techniques, their impacts, semi-structured interviews to collect sensitivities of the various stakeholders in the sector);
- Crops television images and radio interviews;
- Discussion groups about the importance, environmental and socio-economic aspects of artisanal gold mining.

Characterization of Manica

2 Brief characterization of Manica Province

Manica Province has a highland tropical climate, with average temperatures between 07-35 degrees C and an average annual rainfall between 800 and 2,000 mm. The oldest rocks in the country occur in Manica *greenstone belt* and in gneissic-granitic complex. It is in these rocks where encrusted gold is found (Muacanhia & Manuel, 1995).

2.1 Physical characterization

The Manica Province has a mountainous vegetation occurring both naturally and anthropogenic. It is rich in water resources, agro-forestry, livestock and minerals (Manuel and Muacanhia, 1995; Muacanhia & Deniasse, 2007). Most rivers in this area are steady. Rivers Púnguè, Revué, Zambuzi, Lussite, Buzi have always turbid water due to transport and accumulation of sediment from areas of artisanal gold mining. Soils in some districts have been disturbed by convicts and gold mining from 1914 to the present, causing environmental degradation that has been very evident since 1990 (Manuel & Muacanhia, 1995).

2.2. Socio-economic

Mozambique's economy is characterized by a limited diversification and high dependence on agro-forestry sector (INE, 2008; UNDP, 2006) because more than 70% of the population is engaged in agriculture. The Manica Province is located in central Mozambique (Figure 1). The province has an area of 61.661km². Mozambique has an estimated population of 23 million people of whom approximately 1.2 million live in the province. The incidence

of poverty in Manica is estimated at 55.1%, or more than 660,000 inhabitants are poor despite the natural wealth that occurs in the region.

2.3. Characterization geological and mining

The region is in the Manica gold-greenstone belt (green belt of rocks) or gold belt that extends into the Zimbabwean territory, about 153km long, 35 km of which occur in Mozambique. It is in this belt of rocks and granitic complex green-gneissic occur the oldest rocks of Mozambique, i.e. rocks of Archaean period. In these formations gold associated with quartz veins is encrusted, called the BIF (banded iron formation), and in the alluvium of the rivers of the region (Manuel & Muacanhia, 1995).



Figure 1: Districts and main areas of artisanal mining in Manica Province.

Historical background and genesis of mining

3 Historical overview on gold mining in Manica

Gold mining has been known since the Monomotapa Empire in Southern Africa, and the Manica Province was the epicentre of the gold mining within the empire. Other sources, however, maintain that this activity has started before the Bantu migration to the south of the Zambezi River (Torcato, 1941).

The methods used are basically the same as in the ancient times, being used by artisanal miners on the surface today including mining, shafts and galleries. In the Empire of Monomotapa, gold served to *lobolo* (dawary), exchanges in kind and was a symbol of power. The trade with the Arabs increased gold production in Manica. However, gold production decreased due to the sixteenth century Portuguese occupation. The Portuguese banned artisanal gold in the eighteenth century and throughout the colonial period. The artisanal mining was banned for the indigenous people (Muacanhia & Deniasse, 2007), as well as in the years after independence of Mozambique.

3.1. Genesis of artisanal gold mining in Manica District

The company Manica Gold Mines (ALMA: LONRHO) was granted two mining licenses late 80's and this time there was not artisanal mining in Manica District or elsewhere in Mozambique. With the commencement of mining activities in the alluvium, communities started secretly making artisanal mining and sale of gold abroad. Due to management difficulties, ALMA agreed some terms with artisanal miners and sellers for the company. However, it soon sparked up a conflict and artisanal mining was first proliferating in Manica and then the rest of Mozambique, particularly in Tete, Niassa, Sofala, Zambesia and Nampula provinces. Therefore, artisanal mining resumes in the licensed area of the undertaking ALMA concessions (Muacanhia & Deniasse, 2007).

Genesis of artisanal mining

It is thus a conflict arises between the company ALMA and the artisanal miners (Manuel & Muacanhia, 1995; Muacanhia & Deniasse, 2007). This conflict was never properly resolved by the authorities and resulted in the increased number of artisanal miners as well as the expansion of gold mining areas. Due to the genesis of artisanal mining and legal measures taken at the height of its resurgence, the activity became difficult to control until the present day. However, the government took the initiative to mitigate the problem by creating the Mining Development Fund (FFM) that has been promoting the creation of formal associations of artisanal miners of gold and other minerals too.



Figure 2: Ruins of Guta Mukono in Manica



Figure 3: Artisanal gold processing techniques in Empire Monomotapa

Characterization of artisanal miners

4 Characterization of artisanal gold miners

There are two types of artisanal gold miners in Manica Province: informal miners (permanent, seasonal and non-members) and associated artisanal miners which are usually permanent (Manuel, 2011).

4.1. Informal artisanal miners

According to Manuel (2011), informal miners crafts are located in all auriferous areas of Manica Province, operating in the following areas: (1) concessional areas, (2) old surveyed areas, (3) in the fields of local communities (4) farms, (5) conservation areas, (6) urban and (7) other areas not designated for agricultural or farming activities, forestry, mining, conservation or recreation (public areas). It is estimated that the artisanal informal miners are totalling over 25,000 at present in Manica Province. They work in groups of 3 to 10 members from the same community, from different districts or provinces, and, not infrequently, locals and foreigners. These groups are formed based on family, ethnic and, regional affinities. The congregation is based on mutual trust. The informal artisanal miners are now in large numbers relative to the artisanal formal miners (associates). The informal artisanal miners are the major degraders of ore deposits, soils and environment because they are unaccountable to the authorities.

4.2. Associated artisanal miners

The associated artisanal miners (formal) are located in designated areas: (1) research areas with some gold content, (2) abandoned mining areas, (3) areas of informal mining of gold. It is estimated that formal artisanal miners or associates are about 1,500 members.

Top of associative

The association began in 1999, with the founding of the first artisanal mining association "Association of Artisanal Miners of Munhena" (Manuel, 2011). Currently, the following associations in Manica Province are:

- Association of Artisanal Miners of Munhena in Manica District;
- Artisanal Miners Association of the District of Bandire Sussundega;
- Artisanal Miners Association of the Tsetsera in Sussundega District;
- Association of Artisanal Miners of Mimosa in Manica District;
- Association AMACOD in Macossa District;
- Association Kumboedza in Barué District.

Importantly, mining associations founded a mining union "Union of Artisanal Miners of Manica" (UNIMA), whose aim is to improve the dialogue between stakeholders, facilitate the rational use of resources and promote environmental management using best practices in mining gold.

The artisanal gold miners' associates (1,500) are fewer in number in relation to the informal artisanal miners (25,000). However, it was observed that some artisanal miners' associates who are well placed in the associative hierarchies go to other not designated areas where artisanal mining is practiced informally and they are also practicing simultaneously informal and formal mining.

Associations and their mining licenses

The gold in Manica is scattered in many areas but in small occurrences (instances marginal) in both the alluvium and the shafts quartz primary areas. These occurrences can be exploited marginal cost-effectively by small groups of individuals.

Associations	2009	2010	2011
Munhena-Manica	0	0	0
Mimosa-Manica	0	39	33
Bandire-Sussundenga	0	0	0
Tsetsera-Sussundenga	0	0	0
Mpatagwenha- Barué	40	0	1
AMACOD- Macossa	5	0	0
Total	45	39	34

Table 1: Mineral licenses by artisanal mining zone.

Licenses, associations and associates

	Type	Total	Active	Expired
1	LPP	128	106	22
2	CM	33	25	8
3	LR	7	5	2
4	Mineral Certification	23	12	11
5	Commercial Licenses	26	16	10
6	Mineral Titles	34	34	-
7	Designed Areas	20	20	-

Table 2: Mining Licenses

No	Associations	members			observations
		H	M	Total	
1	Munhena-Manica	371	24	395	In process Auditing
2	Mimosa-Manica	78	3	81	Operational
3	Bandire-Sussundenga	288	12	300	Operational
4	Tsetsera-Sussundenga	252	12	264	members migrated
5	Mpatagwenha-Barué	269	3	372	Operational
6	AMACOD-Macossa	30	0	30	operators nomads
		1.388	54	1.442	

Table 3: Members and their associations

Legality in mining

5 Legality in artisanal mining

The legal system is based on Mozambique's civil code Germanic-Roman tradition. This system is directly inherited from Portugal. The artisanal gold exploration is guided by geological and mining policy approved by resolution no. 4/98 of 24 February and is regulated by the Mining Law no. 14/2002 of 26 June respectively and its regulations (1) of Regulation Mines Act and (2) Regulation on Security Mining Act.

The geological and mining policy was approved by resolution no. 4/98 of 24 February, Article 2.3 with title in recovery and local industrialization. It states that the government encourages the development of small mining units for the production of minerals that can be processed locally for the development of small industries or for direct use, with a view to further added value, increase export earnings and the number of jobs.

A "mining licence" is the title that the artisanal miner must get to explore gold in the designated areas. The mining title is authorized by the provincial governor and lasts for one year and is renewable. Obtaining the mining title implies that the artisanal miner is Mozambican and does not require that the artisanal miner is an associate to any kind of association.

Davidson (1993) emphasizes that the legal system in developing countries have been modified to accommodate artisanal and small-scale mining of gold. Ayree (2003) gives a concrete example using such initiatives undertaken by the Republic of Ghana in West Africa.

Role of the Development Mining Fund

6 The role of the Development Mining Fund

The **Development Mining Fund** (*Fundo de Fomento Mineiro*: FFM) is a public institution under the Ministry of Mineral Resources, created by the Decree no. 27/88 of 16 February, and updated by the Decree no. 17/2005. The FFM is a legal person for the public law with legal personality, administrative and financial autonomy. The FFM has provided mining associations to support the following:

- Assist in activities aimed at increasing the artisanal mining:
 - Formal mining associations;
 - Training on good mining practices;
- Promotion of forms of association for the development of artisanal mining:
 - Technical training in methods of mining and processing of gold;
 - Supply of production equipment (shovels, picks, hand vans, motor pumps, basins, etc.).
- Promotion of various forms of mitigation:
 - Environmental education;
 - Rehabilitation of mined areas.

The establishment of the delegation of the FFM in Manica created synergies that allowed a certain discipline in the mining and sale of gold because the gold began to be channelled into the formal market.

Women and artisanal mining

7 Women's participation in the activities of artisanal gold mining



Women participate actively in artisanal gold mining in Manica Province. So, women represent a ratio of 1 woman to 10 men, as women perform all the primary activities of gold mining and gold amalgamation with the exception of underground mining activities because it is generally very heavy work. It was also noted that women still do not realize the underground activities due to taboos and traditional beliefs. Women also actively collaborate in support activities for mining activity or craft employed as owners of stalls for sale of food, beverages, clothing and other services. Some women own farms with traditional practices of informal gold mining. They receive from the informal miners a percentage which varies between 25 and 50% by volume of gold ore.

Figure 4: An artisanal miner. Formal grind gold ore in Mimosa

Child and artisanal mining

8 Children's participation in the activities of artisanal gold mining

Children are also actively involved in artisanal gold mining. They rely mainly as protective mothers of younger siblings. There are also orphans working in informal gold mining for their livelihood and younger siblings, their dependents. Children perform basically the following mining activities:



- Transport of gold ore extraction sites for local processing and washing;
- Processing the gold ore in the washing process of gold and in some cases milling and sieving the gold ore;
- Extraction of alluvial goldfields in shafts and tunnels.

Children were also found working independently in gold mining debris or waste from the tailings. The children observed were between 06-18 years. Most children attend school. However, a portion is dedicated exclusively to informal artisanal mining of gold thereby undermining their prospects for the future training (Manuel and Muacanhia, 1995; Manuel 2011).

Figure 5: A child with artisanal mining in Rift Basin, District of Manica

Impacts of artisanal gold mining

9 Impacts of artisanal gold mining in Manica

The artisanal gold mining in Manica Province has positive and negative impacts (Manuel & Muacanhia 1995; Muacanhia & Deniasse, 2007; Manuel, 2011). The impacts can be divided into socio-economic and environmental.

9.1 Positive socio-economic impacts of artisanal mining

The positive impacts are:

- The sector employs more manpower after agriculture, livestock and forestry;
- Greatly increases the family income thus reducing the levels of absolute poverty in the region.
- Increments socio-economic infra-structures (houses, tents, access roads, small bridges among others);
- Increments of basic general services;

- Increases the opportunities for fun, entertainment and socialization among others;
- Contributes to the balance of payments;
- Contributes to the development of the local economy.

9.2 Negative socio-economic impacts of artisanal mining

The artisanal gold mining in Manica Province has negative socio-economic impacts and the most relevant are:

- Promotion of illegal immigration, crime and tax evasion;
- Conflict agricultural production versus artisanal gold mining;
- Cultural degradation;
- Excessive use of alcohol and drugs;
- Increased prostitution and increased sexually transmitted diseases (STDs and HIV / AIDS);
- Precariousness of public health due to poor sanitation (cholera, malaria, diarrheal diseases among others);
- Use of child labour.

Examples



Figure 6: alluvial gold in Manica.



Figure 7: Market and village in the Rift illegal

9.3 Negative environmental impacts of artisanal gold mining

The artisanal gold mining has negative environmental impacts and the most notorious are the following:



Figure 8: Impact of artisanal mining on soil (erosion).

- Deforestation and wildfires;
- Soil degradation (erosion and destruction of ore deposits);
- Pollution of rivers and dams;
- Siltation of riverbeds, dams and lakes;
- Poor sanitation in camps and informal miners in the vicinity of mining areas;
- Inappropriate use of mercury in gold amalgamation process;
- Insecurity of men and animals due to the wells, open pits and abandoned galleries.
- Invasion of conservation areas or protected areas (reserves, national parks, game reserves, historical and cultural sites).

Some examples of negative impacts



Figure 9: Dry material auriferous (river Revué).



Figure 10: Partial view of turbidity in the river Revué Messica.

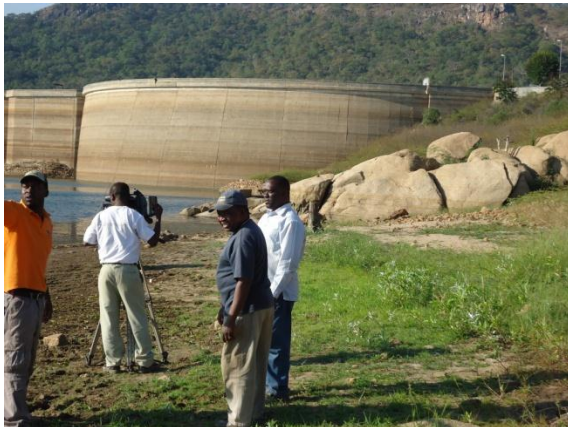


Figure 11: Technical team observes the current state of Albufeira Chicamba.



Figure 12: Depth of Albufeira Chicamba seriously affected.

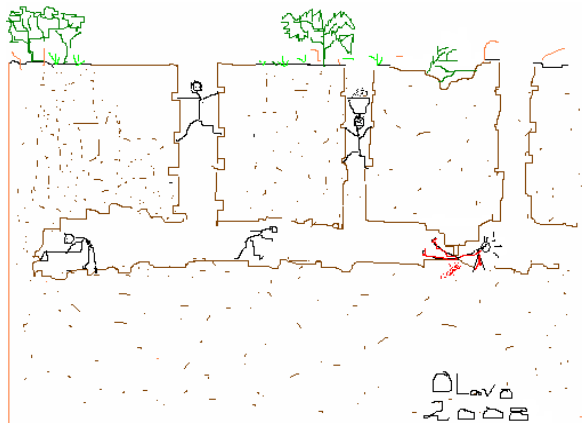


Figure 13 Technical mining by shafts and tunnels.



Figure 14: Partial view of a well in Chua, Manica district.

Discussion

10 Discussion

The analysis of scientific work in the last 20 years clearly shows that there are socio-economic, cultural and environmental impacts due to artisanal gold mining in Manica.

The activity of artisanal gold in Manica began in the 90s and tends to increase exponentially relegating agriculture to the background because the artisanal gold mining is more lucrative than agriculture itself. The informal mining came before the formal mining because the latter appeared as a way to regulate informal mining. However, the formal mining is still far from solving the problem of informal mining. The vast majority of operators known as artisanal craft is informal and illegal. The activities of these informal artisanal miners have negative impacts on ore deposits, arable land, water, environment, public health and safety. Also some formal operators contribute in negative impacts mentioned because they practice both informal mining in other areas beyond the areas they have been licensed.

Despite efforts by the government to establish legal instruments to regulate the activity of artisanal gold and mitigate the negative impacts are still far from the internationally accepted parameters.

Current legislation does not require the miners with mining license to belong to an association but cannot mine outside of designated areas. Designated auriferous areas in Manica Province are few and some have very low levels of gold or gold appears in great depths. On the other hand, there are areas designated that have never been surveyed which hinders the formal mining rationally exploit the deposits for the formal mining to explore gold and trusting entirely to chance their luck. On the other hand, no artisanal miner can operate alone (without being a member of an association) and outside of existing designated areas. This limits and induces artisanal miners operating illegally in other areas not designated.

According to Nooten (2007), the principle of sustainable development in the context of mineral resources may seem a contradiction when seen in a uni-dimensional perspective. To meet the global demand for mineral resources without compromising the needs of future generations is imperative to use one via holistic system of exploitation of mineral resources taking into account all factors relating to the complexity of the interaction between humans and mineral resources of which depends on the man and always depend. The mining development should be considered in the context of sustainable development if mining is done to reduce the negative impacts, equitable distribution of benefits, use of capital obtained in the areas of education, health and other social services while they are developing appropriate technologies for the rehabilitation of mined areas. Therefore, the artisanal gold mining can be done in a holistic context. The disparity of data on mercury levels refers to the need of reassessment and updating of data on the matter, taking into account the various works that were carried out sensitization. Moreover, a possible implementation of a programme of substance use alternatives like Barax can help minimize the use of mercury for mining communities.

Conclusions

11 Conclusions

The artisanal gold mining in Manica Province is already an essential activity because it has demonstrated that it is more profitable in deposits with high gold content than farming the same areas.

The two types of artisanal gold mining (formal and informal) are degrading forests, ore deposits, soils, water and the environment in general. The informal artisanal gold mining causes major negative that formal artisanal mining. The formal sector can run the risk of being reabsorbed by the informal sector due to behavioural duplicity of some formal miners.

Most artisanal miners in Manica Province, for lack of scientific and technological knowledge, do not use appropriate methods of research, mining and processing. As a consequence, there is little knowledge of reserves and mining feasibility and consequent low productivity and increased environmental degradation.

The positive impacts of artisanal gold mining may, in the medium and long term, be unsustainable if no action is appropriate mitigation measures in time. These measures should be legal, socio-economic, cultural and environmental.

The artisanal mining legislation contains some gaps that must be seized and filled to allow artisanal mining activity to become healthy and environmentally "sustainable".

The way the artisanal gold mining is being developed may not be "sustainable" at the right time due to the continuous increase in informal and illegal artisanal mining, high negative impacts, little knowledge of its reserves and mining feasibility, low level of organizational capacity and management, inadequate legislation, interactive and weak capacity to enforce the legislation at the local level.

The absence of a guiding strategy specific craft is one factor that contributes to the spread of environmental problems of artisanal mining.

Recommendations

12 Recommendations

It should strengthen coordination and exchange of experiences between the various stakeholders of the private sector, government and civil society at local, provincial and national levels through joint actions and acting that can minimize negative impacts.

The state should give greater emphasis to research mining, research and application of methods of mining and processing appropriate to each situation.

One should upgrade and reform the artisanal mining specific legislation taking into account the actual conditions of the areas of gold mining.

Pilot projects on various fronts, including methods of mining, processing, environmental management and marketing of gold that have been successful should be replicated so that they can cover most of the mining population both in Manica in Mozambique and elsewhere.

One should continue the training program of artisanal miners with adequate scientific and technological packages relating to methods of mining and mineral processing, environmental management, mine safety, general management and leadership.

The artisanal gold mining in Manica and across the country should be done in a holistic context to be sustainable through specific strategies.

The artisanal mining with licences are not required to belong to an association and cannot mine outside of designated areas. Experience shows that mining associations are very useful in the propagation of appropriate techniques of mining, mine safety. However, one should think of individual license to facilitate the activity without the artisanal miner belongs to an association.

The designated auriferous areas in Manica are few and some have very low levels of gold or gold appears in great depths causing the abandonment of formal artisanal mining site, thus seeking other auriferous zones outside the designated areas. The government should increase the designated areas. These areas should be the product of intense research and hold minimum reserves of gold before being delivered to a mining association as a way to ensure its long life.

The informal artisanal mining is very dynamic, as it appears where gold is discovered and sometimes reaches situations like true "gold fever" in which it is necessary to involve the police or military intervention. One must wonder how effectively they can control these situations using local structures and community leaders.

Given that only the governor is authorizing the allocation of mining licenses, it is recommended to introduce a local authority with the power to issue mining titles while supporting the surveillance and monitoring of artisanal mining. Perhaps this might encourage more informal and illegal miners to become formal. This raises the need for greater flexibility, decentralization and involvement of all *stakeholders*.

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