INDUSTRY SUSTAINABILITY KNOWLEDGE AND PRACTICE TO IMPROVE HEALTH, SAFETY AND ENVIRONMENTAL PERFORMANCE OF ARTISANAL AND SMALL SCALE MINING THROUGH CORPORATE SOCIAL RESPONSIBILITY PRACTICES: CASE STUDIES REVIEW

*A. C. Ribeiro-Duthie¹, L. M. B. Domingos¹, M. F. Oliveira², P. Araujo¹, R. C. J. Alamino¹, R. S. V. Silva¹, and Z. C. Castilhos¹

¹ CETEM-MCTI - Campus UFRJ
Av. Pedro Calmon, 900, Cid. Universitária
Rio de Janeiro, RJ, Brazil, CEP21941-908
(*Corresponding author: aduthie@cetem.gov.br; ribeanacris@gmail.com)

² Nexo Capacitação e Consultoria
Rua Timóteo da Costa 120/401
Rio de Janeiro, RJ, Brazil, CEP 22450-130
INDUSTRY SUSTAINABILITY KNOWLEDGE AND PRACTICE TO IMPROVE HEALTH, SAFETY AND ENVIRONMENTAL PERFORMANCE OF ARTISANAL AND SMALL SCALE MINING THROUGH CORPORATE SOCIAL RESPONSIBILITY PRACTICES: CASE STUDIES REVIEW

ABSTRACT

Mining is an important player to economics of several countries, including Brazil. Despite the major role of Large Scale Mining (LSM) in the minerals sector, Artisanal and Small Scale Mining (ASM) also shares the mining market and has a huge social role, mainly in developing countries. Both LSM and ASM cause environmental and health impacts. In some successful cases as Corporate Social Responsibility (CSR) reports demonstrate, Health, Safety and Environmental (HSE) impacts have been addressed by cooperation between LSM and ASM, what can benefit communities as a whole. While certification has been a drive for the LSM, it constitutes a great challenge to be implemented in the ASM. A question guide of our research is where, when and how artisanal and small scale gold mining certification can be a tool for a win-win game in the minerals sector and for mercury emission reduction as proposed by Minamata Convention. Is Brazilian ASGM certification a market trend that could receive support of LSM towards cleaner technologies and mining industry better practices? To answer that our methodology included a review of mining companies CSR worldwide, whereas the results from LSM and ASM cooperation are classified in regards to types of actions implemented for good practices guidance. The applicability to Brazilian ASGM is analyzed and challenges and opportunities are addressed.

KEYWORDS

Artisanal and Small Scale Mining, ASM, Artisanal and Small Scale Gold Mining, ASGM, Corporate Social Responsibility, CSR, Sustainability, Large Scale Mining, LSM, Minamata Convention

INTRODUCTION

According to official data, from the approximately 68 tons of gold produced annually in Brazil, about 70% comes from three large-scale multinational mining companies operating in the country; and about 13% are produced by small-scale mining enterprises (IBRAM 2012; DNPM, 2014; Ribeiro-Duthie & Castilhos, 2016). With different forms of mineral processing and investment sizes, these companies of different scales coexist and contribute to local, national and international economies. Whether large-scale mining (LSM) has a major role in Brazil as a whole; in Pará State and Mato Grosso State, for example, the artisanal and small-scale mining (ASM) activity accounts for nearly 90% of the state production, given that two of the largest gold mining companies in Brazil are located in Minas Gerais State. This data highlights the fact that in some contexts, ASMs can be the main local players in the gold mining market and this is of relevance when talking about diverse effects of ASM and how to address them.

ASM is a reality with socioeconomic roots and it constitutes a practice very common in developing economies, what includes Brazil. The World Bank (WB) reveals that ASM accounts for 20 % of gold production globally (WB, 2013). This “small” sector has potentially upwards of 20-30 million workers (IIED as cited in WB, 2013) while the LSM employs about 7 million people (WB, 2013). Data related to gold was not available, and one of the reasons can be the seasonality so common in the ASM. In the case of gold, the value of the metal in the stock market is also of influence on the frequency of the
activity. In spite of this known features of ASM activities, “the sector represents an important livelihood and income source for the poverty affected local population” (WB, 2013: p. 1).

It is of note that United Nations Development Programme (UNDP) refers to this subsector as small-scale, not using the term artisanal, and adds a G to form an acronym as follows: SSGM. We must be aware that ASM, however, can be applicable to all minerals. In this sense, ASM of gold mining will be also referred to as ASGM in this work, as we talk about the artisanal and small-scale gold (subsector) of the minerals industry. There is no international consensus on how to define ASM, and we underline UNDP definition, for whom small-scale gold mining (SSGM) is considered “mining with rudimentary methods and limited mine planning, by a workforce that is not formally trained in mining engineering or geology and operates entirely or partly in the informal economy” (UNDP, 2011, p.13). There is a framework for mining companies scales based on production in Brazil: LSM for production >1,000,000 t/y; MSM for production <1,000,000t/y and >100,000 t/y; ASM for production <100,000 and >10,000 t/y. Considering small scale, the production can be <10,000 t/y (CPRM/Geological Service of Brazil, 2000). We add a remark that in case of gold, the unit should be adapted to ounces (oz). Brazilian legislation defines small scale mining according to the area mined and the practices of mineral processing. We will follow Brazilian legislation as a parameter based on the International Council in Mining & Metals (ICMM) observation: “ASM activities occupy a spectrum from small, informal subsistence activities through to organized formal small commercial mining activities” (ICMM, 2010: p. 3). On the other hand, LSM covers a wide variety of enterprises, and what is deemed small to medium-scale mining in one country may be considered large-scale mining in another (ICMM, 2010). Figure 1 highlights views on ASM (or ASGM) of some important agencies.

Figure 1 – Views on Artisanal and Small-Scale Mining from Communities and ASM (n.d.); International Council on Mining & Metals (2010); and United Nations Development Programme (2011). [Photo credit: Ribeiro-Duthie, A.C. 2016]
UNDP highlights some effects of small-scale mining based on a global overview, as such: “SSGM brings important economic gains to individuals and nation states but also causes environmental damage, public health threats, and social problems” (UNDP, 2011: p. 4). It is interesting to reflect in what sense this quotation would be different between ASM and LSM? Perhaps the difference is clear only in the second part of the quotation, when talking about the negative aspects related to ASM, as it follows: “specific negative impacts associated with SSGM include deforestation, Mercury contamination, turbidity of waterways, violence, the uncontrolled spread of malaria, and the spread of Sexually Transmitted Infections - STIs” (UNDP, 2011: 4). Even some of these challenges are also addressed by LSM at some point, especially the ones related to diseases. We know that malaria and STI are still a noticeable concern of LSM globally and it depends on the area where the LSM is located (Ribeiro-Duthie et al, 2014). There are some countries where malaria is still endemic, as for example in the North region of Brazil. On the other hand, STI (Sexually Transmitted Infections) appear on the health actions of LSMs worldwide, commonly associated to commuting workers in the resource industry (Ribeiro-Duthie et al, 2014).

However, what is remarkable on impacts of ASGM is Mercury emissions. According to UNEP (United Nations Environment Programme), ASGM is responsible for 37% of global anthropogenic Mercury emissions (UNEP, 2013). Chemical features of Mercury including toxicity and vapor pressure (ATSDR) – what can spread it across extensive geographical areas – has potential to affect populations globally, despite ASGM being a practice in developing economies. Some studies have adressed Mercury contamination associated to ASGM (Gunson & Veiga, 2004; Castilhos et al, 2006). And “the nature and severity of the toxicity that may result from Mercury exposure are functions of the magnitude and duration of exposure” (ATSDR, 1999, p. 220). Mercury contamination risks are of such concern that a global treaty was assigned among 140 countries in 2013 to reduce Mercury threats to human health: Minamata Convention. This treaty led by United Nations carries this name due to a catastrophic poisoning by Methyl Mercury occurred in Minamata-Japan in the 1950’s.

As Mercury is of large use in small-scale gold mining, the certification system based on fair trade of gold produced by ASGM can be seen among efforts to control its health and environmental impacts. However, there is still many “challenges to bring about a more responsible mining” within ASGM (UNDP, 2013, p.3). This is of relevance specially because gold consumption has peaked worldwide, as well as in Brazil, due to the increased purchasing power of classes C and D, according to the Brazilian Mining Association (Ibram, in Portuguese acronym). “Gold is part of this consumption not only in the form of jewelry, but also as electronics, computer parts, notebooks and tablets, mobile phones, parts for the automotive industry, hospital and dental care industries, as well as construction industry components” (Ibram, 2012, p. 55). Gold is the second mineral in the Brazilian exports ranking (Ibram, 2012). Hence, we see the relevance of certification and its potential for change including sustainability values as protection to health and environment as well as human rights in this subsector of gold mining industry.

In this sense, innovation in the sector perhaps would count for a win-win game? However, how to balance the benefits in both senses is one of the challenges, as per figure 2. Innovation can be promptly associated to cleaner Technologies, but it can also be applied to market practices of innovation in management. As LSM has expertise in following HSE guidelines and show a remarkable trend on attending distinct types of market certification, a question guide of our study was where, when and how ASGM can benefit from LSM support for good practices improvement in the minerals sector? And how both LSM and ASGM can mutually benefit in regards to sustainable market practices; and not simply send the bill of the health and environmental risks from ASGMs to the LSMs. We will see in this paper some examples of socioeconomic actions undertaken in collaboration between LSM and ASGM worldwide that may have impacts on and benefit both, as well as the communities.
METHOD

Retrieve of the corporate social responsibility (CSR) reports of the three largest scale gold mining companies in Brazil. We reviewed a total of 38 CSR reports from 2004 to 2014 both in English and Portuguese and 2 case studies. Sustainability reports, annual reports, integrated reports were included as they also informed on CSR (as per Table 1). Keywords guided search on CSR reports: ASM, ASGM, garimpo, Mercury, health safety and environmental (HSE) practices, Minamata Convention, conflict. Qualitative analysis of CSR reports and case studies released by LSMs and MSM to support ASMs through their CSR published practices, available on their respective webpages. Comparison between findings about LSM support to ASGM in Brazil and another countries; analysis complimented by empirical knowledge from field work within ASGM subsector in Brazil to address possible challenges and opportunities for the improvement of good practices between LSM and ASM in the Brazilian gold mining industry.

Table 1 – LSM and MSM identification, type of reports, and respective years of all reports reviewed

<table>
<thead>
<tr>
<th>LSM A: AngloGold Ashanti</th>
<th>LSM B: Kinross Gold Corporation</th>
<th>LSM C: Yamana</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type or name of Report/Year</td>
<td>Type or name of Report/Year</td>
<td>Type or name of Report/Year</td>
</tr>
</tbody>
</table>
RESULTS

We identified three LSMs operating in Brazil, called LSM A, LSM B, LSM C in the body of this work; for companies identification refer to table 1. And one MSM with CSR reports available, but no actions towards ASM reported, therefore MSM will not figure in the results and discussion sections.

In 2004 and 2005 nothing appears in the CSR reports from LSMs A, B and C about ASM or ASGM. In 2006, LSM B refers to the damage of ASM practices and all the work and expenses required to fix its environmental impacts. In 2007, LSM A states in regards to ASM that it “engages with international advocacy and voluntary bodies, such as the International Council on Mining and Metals (ICMM) and the International Organization for Standardization, to develop standards and best practice.” (LSM A Country Report/Brazil 2007, p.32). It is of notice that from 2007 to 2014 CSR reports, there was no action reported to have been implemented in Brazil. In 2008, LSM A reports a statement in favor of minorities where ASMs were also included.

In 2009 LSM A report, there is an explanation on what ASM is and also information on which LSM A sites are the most affected by ASM operations. They are Siguiri in Guinea, Obuasi and Iduapriem in Ghana, Geita in Tanzania and exploration sites in the Democratic Republic of Congo. No actions towards ASM in Brazil appear (LSM A Sustainability Review 2009, p. 41). In 2010, LSM A reports some possible solutions for coexistence between LSM and ASM. In 2011 LSM A highlights the need of looking for customized solutions according to communities circumstances in regards to ASM. This report lists actions undertaken by LSM A in Tanzânia and Congo, but do not report actions in Brazil despite stating that the company has “Pro-active participation in standard setting on ‘responsible gold’” (LSM A Sustainability Report 2011, p. 16). Still in 2011, LSM B mentions ASM referring to the investments done to recover a riverbed impacted by ASGM operations surrounding the company sites (LSM B CSR Report 2011, p. 14). Only in 2012, actions in Brazil are directly referred by LSM A, however they are not related to ASM (LSM A Sustainability Report 2012, p. 39).

In 2013, actions on training of ASM miners in Colombia for subsequent hiring are stated by LSM A, as well as efforts in regards to the coexistence between the LSM and ASM in Tanzania plant (LSM A Sustainability Report 2013, p. 54); no actions related to Brazilian mine sites appear. Finally in 2014, it appears again a more mature information on ASGM – when compared to the statements from 2007 abovementioned – as for instance in the following quotation: “Our policy is driven by the appreciation that minerals have a role to play in transforming communities. We therefore support formalisation of the sector, and regulation of those aspects of ASM activity which pose risks – either to employees, community
members or our operations” (LSM A Sustainable Development Report 2014, p. 24). Perhaps ASGM in Brazil do not pose risks to LSM and for this reason they are misconsidered?

Still in 2013, actions to formalize ASGM activities in Ecuador are reported by LSM B. In 2014 report, the focus of LSM B was on their compliance to the Conflict Free Gold Standard, and Brazilian gold mine sites are not considered as areas of conflict according to the criteria adopted (Heidelberg Conflict Barometer), hence they have no actions towards ASGM in Brazil (LSM B Conflict Free Report 2014).

LSM C reported only in 2011 a first straightforward action towards ASGM in Brazil. This is a sole example of local cooperation agreement. The CSR report says: “(LSM C) signed an agreement with the environmental protection agency to support artisanal mining cooperatives” (LSM C 2011 Report, p. 60). And it continues in the same document: “(LSM C) offers professional training to artisanal and small scale miners” ” (LSM C 2011 CSR Report, p. 60). However, what type of training is not stated except for 2012, when LSM C refers to the possibility of hiring the ASM miners trained. In 2013, the report states: “there were no conflicts with artisanal miners” in that year (LSM C 2013 CSR Report, p. 68).

Figure 3 – LSM practices towards ASGM worldwide

ECUADOR: worked with authorities to help formalize artisanal miners concessions. 17 local artisanal groups signed contracts and applied to the government to form an association to pursue Fairtrade certification

TANZANIA 1: training in safer methods of mining, mercury-free gold processing and other approaches that are more efficient, safer and environmentally friendly

COLOMBIA: establishing alternative livelihoods, initiative for the formalisation of the ASM activities; improvement of technology for artisanal extraction of gold with lower impact on the environment

TANZANIA 2: multi-stakeholder partnership with national government and World Bank, establishing an advisory group whose aim is the formalisation of the ASM sector as a long-term sustainable solution

CONGO: conflict management with 3000 ASM miners; a committee was formed to facilitate creation of a buffer zone around LSM site operation

LSM actions towards ASGM
It is of note the data appearing repeatedly from 2011 to 2014, with no new data being added, no results presented, no information if there was any former ASG miner hired, for example. For our analysis it matters that ASM employs around 20-30 million people globally and LSM employs 1/3 of that, i.e., around 7 million workers. This single data demonstrates that ASM miner’s training in regards to potential hiring by LSMs is a limited action in addressing the socioeconomic aspects of ASGM. Anyway, this was actually a rare finding from a LSM settled in Brazil addressing Brazilian ASGM. As per results listed above, almost all data collected are related to comments or information on ASGM in general, but not actually applied as a practice implemented in Brazil. This shows contrast with practices from the same LSM in other countries, where actions tend to be more robust, as it can be seen in figure 3 and table 2.

These findings were followed by a basic question: given that ASGM is an old and overly spread activity in the Brazilian territory; with legal enterprises occupying around 350,883 hectares (Alamino, Silva & Castilhos, 2016); and estimated by DNPM (2014) to involve hundreds of thousands of ASM miners – why there is no CSR reporting practices (at least between 2004 and 2014) towards collaboration between LSM and ASGMs in the country? Analysis of case studies from LSM practices in other countries demonstrate similar conditions to those found in Brazil, and we use this comparison to point out opportunities to improve LSM and ASGM cooperation in the Brazilian mining set, as per table 2.

Table 2 – Practices of LSM towards ASGM in other countries and features of ASGM in Brazil

<table>
<thead>
<tr>
<th>LSMs Practices in another countries</th>
<th>ASGMs Features found in BRAZIL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Practices in place by LSM A for ASGM in CONGO</strong></td>
<td></td>
</tr>
<tr>
<td>LSM A support started during exploration phase of mine life cycle. Successful negotiation with 3,000 ASM miners to create an exclusion zone (a buffer zone around LSM A mine sites) to avoid conflict. Since September 2012, 70 former artisanal miners have been supplying LSM A with gravel and sand for construction. The value of material provided to date is US$90,000.</td>
<td>Not found reports of conflicts and types of negotiation addressed in Brazil. ASGMs in Mato Grosso and Amapá have activities in place and projects for their living expenses after mine sites depletion, but no support to their parallel initiatives on farm, agriculture, pisciculture, reforestation, grass plantation to feed cattle, horticulture.</td>
</tr>
<tr>
<td><strong>Practices in place by LSM A for ASGM in TANZANIA</strong></td>
<td></td>
</tr>
<tr>
<td>LSM A supported efforts for formalisation of ASMs through agreements with government. Government has long history of success with formalisation in the region but actions need to be expanded. LSM A spent US$4.4m in water upgrade project to provide clean water to the burgeoning population.</td>
<td>Formalised ASGMs are found, but there are smaller ASM miners who struggle in the paths to formalisation and legalization of ASGM activities. Government support is not always available for orientation in formalisation or legalization steps. Great part of mine sites do not have clean water so they use alternative methods as carrying water from rivers and have chloride added to turn water drinkable.</td>
</tr>
<tr>
<td><strong>Practices in place by LSM A for ASGM in COLOMBIA</strong></td>
<td></td>
</tr>
<tr>
<td>LSM A discussed alternative livelihoods with 153 ASM miners mining around LSM A concession. Those who were interested in building their own business were trained in rural entrepreneurship. Action undertaken with a Colombian foundation devoted to such work. Over the course of 2013, business</td>
<td>ASGM in Mato Grosso expressed interest in developing alternative livelihoods. An example being agriculture. Barriers to success include lack of agriculture knowledge and expertise, while they have been practising mining for long years, almost their entire life.</td>
</tr>
</tbody>
</table>
ideas were generated, plans developed and rigorously tested to start new cooperatives. Action also involved local and regional governments.

<table>
<thead>
<tr>
<th>Practices in place by LSM B for ASGM in ECUADOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSM B helped to formalise ASGM activities. Seventeen local artisanal groups have signed contracts and have applied to the government to form an association that would allow them to pursue international fair trade certification.</td>
</tr>
<tr>
<td>There are ASGMs in the country willing to apply for gold fairtrade certification. They have potential to attend Standard but need support to understand requirements and implement necessary changes.</td>
</tr>
</tbody>
</table>

**DISCUSSION**

Results show that actions of cooperation between LSMS and ASGMs in Brazil are scarce. Why good practices between LSM and ASGM in Brazil were not found is our main issue to discuss. Perhaps LSMS are driven to address ASGMs challenges only in case they bring risks to their operations. As publications on this challenging issue progresses, maybe other answers can be found. In table 1 a comparison between LSMS actions globally and features of ASGMs in Brazil is demonstrated. Opportunities of good practices are pointed out by remarking some ASGM conditions found in Brazil.

UNDP has also captured the opportunities on ASGM highlighting “existing best practices in the region, the availability of mercury free and mercury recycling techniques, and both governments and miners associations that are motivated to change the SSGM sector into a more environmentally and socially responsible sector” (UNEP, 2011, p. 4). The conclusion from table 2 is another question: what is missing in Brazilian ASGM sector to have more effective practices set, as per comparison with those countries where the same LSMS operating in Brazil have reported the implementation of actions? Further research could attempt to answer the reason why actions of cooperation between LSM and ASGM in Brazil are scarce or poor in terms of impacts (Ribeiro-Duthie & Castilhos, 2016) when compared to those examples of actions reported by the same LSM companies in other countries. We have for now some brief hypothesis.

i) LSM targets GRI directions, as its topic MR8 states "Number (and percentage) of company operating sites where ASM takes place on, or adjacent to, the site; the associated risks and the actions taken to manage and mitigate these risks" (Company A Sustainability Report, 2013, p. 53). Whether Brazilian LSM mine sites scape from this target, actions are not addressed in the country. Hence, the location of ASGMs surrounding LSMS facilities in the country could be mapped and analysed in further studies.

ii) the nature of conflicts in Brazilian mine sites are not detected by the Heidelberg Conflict Barometer, so actions towards ASM would be misregarded in the country as some LSMS justify their actions considering this barometer. Further research could analyse closely those “conflict barometer” criteria.

iii) actions between LSM or MSM are underreported, as we actually found on field work some larger companies with practices of coexistence with ASGM in Brazil. Further analysis could better inform the actual scale of these companies and the nature of these relations.

In some cases, there is the comprehensive risk to the LSM operations and the proximity with facilities that may turn the actions towards ASGM a high priority in some localities. However, would that encompass everything? Further research perhaps could clarify these initial hypothesis. Examples of what is practiced worldwide work as guidance on what can be done, but the context of each country must always be considered. We believe that the single comparison in table 2 can demonstrate similarities and opportunities for good practices that could improve relations between LSMS and ASMS in Brazilian gold
mining industry. And we know that, in a globalized economy, good practices surpass geographical frontiers and have a spill-over effect.

CONCLUSIONS

Beyond the reasons for the scarcity of practices between LSM and ASM in Brazil demonstrated through our methodological approach, it is clear that there is room to improve on actions and good practices in the Brazilian gold mining industry, and published international examples are perhaps a guide to start changes. What matters from our findings in this initial research is the fact that there are ASGMs in Brazil interested in doing right despite the rare support they count upon to attend requirements for better HSE performance and legal compliance. There are actions undertaken in other countries that could also benefit the Brazilian small-scale gold sector and therefore address the health-safety-environmental and socioeconomic impacts caused by ASGM. Practices related to Brazilian ASGMs was limited, but what did not appear through reports was found through field work. Thus, it would be worth to make a further comparison between larger and medium-sized companies practices towards ASGM including the empirical component.

We saw in field research that there is not much in clean technology available to the small scale subsector of the gold mining in Brazil, even when there are some ASGM miners interested in stop being the ‘villains’ of the environment. UNEP and the Artisanal Gold Council (AGC) already published potential Mercury free methods for gold mining. According to UNEP and AGC, concentration methods applicable to ASGM are for example panning; sluicing; shaking tables; spiral concentrators; vortex concentrators; centrifuges (UNEP & AGC, 2012). In the case of Brazil, some of the equipments were seen in use and they were developed almost artisanally by former ASGM miners, but there was no monitoring in place to assess its efficacy; or a systematic surveillance to tackle barriers for the effective use of new technology when available (Souza, Castilhos & Araujo, 2015). By approaching the sector challenges, opportunities to develop better practices may appear. CETEM (Brazilian Center for Mineral Technology) has already addressed some technological challenges of the small-scale gold mining subsector and programs need support for continued development.

In conclusion, it was seen through field work that there is motivation to embrace sustainability practices in this subsector and what also needs to be assessed is whether there is interest in having successful partnership with ASGMs. Sometimes one case of success can go a long way to bring about changes of behaviour, organisational culture and market practices.

ACKNOWLEDGEMENTS

The first author would like to thank CNPq for the funding for research through the PCI-CETEM, and Dr. Fernando Lins, Director of Cetem, for suggestions on this paper. We thank Cetem staff for support in all stages of this work. We thank the Inter-American Development Bank through Alliance for Responsible Mining-ARM for funding research on ASGM in Brazil. The first author would like to thank SMI-UQ for setting her basic knowledge and training on research in the minerals industry.

REFERENCES


Ribeiro-Duthie, A.C., Castilhos, Z.C. (2016, May). Relações entre a mineração de ouro de grande e de pequena escala no Brasil [Relationships between large and small-scale gold mining in Brazil]. Poster session presented at Simpósio Brasileiro de Exploração Mineral [Brazilian Symposium of Mining Exploration], Ouro Preto, MG, Brazil.


