



Principles and criteria of sustainable development for the mineral exploration industry



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ABSTRACT

Mineral exploration has experienced significant growth over the past decade. Characterized by the absence of production revenues, mineral exploration companies rely on investors, who are increasingly concerned about environmental compliance and social acceptability. Although several guidelines have been developed (e.g. e3 Plus, ISO 26000, BNQ 21000), none provides for third-party evaluation and issuing of a certificate of compliance with sustainable development principles. Given the specificities of the mineral exploration industry, a sectorial certification standard would be better suited to frame their activities. This study suggests a set of principles and criteria of sustainable development that could be the basis for developing a sectorial standard for the mineral exploration industry. Available sustainable development guidelines were analyzed in order to obtain a preliminary list of principles and criteria. A Delphi survey involving 44 experts then allowed to obtain a final, consensual list of 8 principles (*Environmental quality, Quality of life, Work environment, Local investment, Business ethics, Transparency and reporting, Innovation, Economic efficiency*) and 27 criteria.

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1. Introduction

Mineral exploration has experienced significant growth over the past decade (Khindanova, 2012; SNL MEG, 2013). Having no

Acronyms: BNQ 21000, BNQ 9700-021 Développement durable, Guide pour l'application des principes dans la gestion des entreprises et des autres organisations; CEPME, Code for Environmental Practice for Mineral Exploration in Western Australia; e3 Plus, e3 Plus: A Framework for Responsible Exploration; ENGO, Environmental non-governmental organization; EO100, Equitable Origin's standard for oil and gas exploration and production; FRM, Framework for Responsible Mining: A Guide to Evolving Standards; FSC, Forest Stewardship Council; GERME, Guidelines for Environmentally Responsible Mineral Exploration & Prospecting in Western Australia; GHG, Greenhouse gases; GLPSD, Guide to Leading Practice Sustainable Development in Mining; GREMT, Guide for Responsible Exploration in Municipal Territories; GRI, Global Reporting Initiative; ICMM, International Council on Mining & Metals; IFC, International Finance Corporation; IISD, International Institute for Sustainable Development; IRMA, Initiative for Responsible Mining Assurance; ISO, International Organization for Standardization; ISO 14000, ISO 14000 – Environmental management Systems; ISO 26000, ISO 26000: 2010, Guidance on social responsibility; MCA, Multi-Criteria Analysis; PDAC, Prospectors & Developers Association of Canada; QMEA, Québec Mineral Exploration Association; TSM, Towards Sustainable Mining.

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production revenues, mineral exploration companies are not financially self-sufficient and have little access to loans (Miranda et al., 2005). They therefore depend on investors, who are increasingly sensitive to the environmental and social impacts of exploration activities (Humphreys, 2001; IIED and WBCSD, 2002; Klassen and McLaughlin, 1996). Mining activities – including mineral exploration – have often been associated with negative environmental impacts and social disruption (Miranda et al., 2005; Prno and Slocombe, 2012). Local communities are now more suspicious given the past behavior of some companies, especially those that have abandoned unrestored mineral exploration sites (Campbell et al., 2012; Lapointe, 2010; Luning, 2012).

To address the concerns of local populations, sustainable development standards have been developed for resource extraction industries such as forestry (e.g. FSC) or oil and gas exploration (e.g. EO100). Sustainable development standards include a certification procedure in which a third party gives written assurance that a product, process or service conforms to specific requirements, based on an audit conducted in accordance with agreed procedures (Grenard, 1996; Merger et al., 2011; Silva-Castaneda, 2012). There is currently no sustainable development standard regulating mineral exploration activities. Because sustainability requirements must be specifically developed for each sector of activity (Azapagic, 2004),

the standards developed for other industries might not be relevant to the mineral exploration context. Although sustainable development guidelines have been developed specifically for the mineral exploration industry (e.g. CEPME, e3 Plus, GERME, GREMT) they do not lead to certification following independent third-party auditing.

Given the particularities of the mineral exploration industry (few employees, lack of production revenues; Miranda et al., 2005; Jébrak and Marcoux, 2008), and given the different expectations of stakeholders regarding mineral exploration and mining (Laurence, 2011), a sectorial standard is needed to address corporate social responsibility and sustainable development challenges specific to mineral exploration. Such a certification standard would encourage better environmental and social practices, reassure investors and promote competitiveness (Bouslah et al., 2006; IIED and WBCSD, 2002). At the basis of the standard development process, principles are fundamental truths, further defined by criteria whose state is measured with indicators (Morin et al., 1996). This study suggests a set of principles and criteria of sustainable development that could be the basis for developing a sectorial standard for the mineral exploration industry.

2. Methodology

A content analysis was realized on 15 sustainable development guidelines selected for their relevance to mineral exploration, using the 9th version of the NVivo software (QSR International inc., Melbourne, Australia). This led to the identification of the most commonly used themes and the elaboration of a preliminary list of principles and criteria. In order to validate and enhance this preliminary list of principles and criteria, experts were consulted through a Delphi survey (Linstone and Turoff, 1975). In this method, the experts were first asked to individually evaluate the relevance of each criterion. The compiled results of this first round were then presented to each expert in a second round, allowing them to change their rating if they judged it necessary. Additional rounds could be necessary until the ratings settle. The whole process was completed without the experts actually meeting or knowing each other's identity, thus avoiding direct confrontation (Linstone and Turoff, 1975; Steurer, 2011). The aim was not to reach unanimity, but rather to assess the degree of consensus on the rating of each criterion (Ekionea et al., 2011). The Delphi method was preferred to Multi-Criteria Analysis (MCA), an oft-used criteria selection method (Antunes et al., 2006; Platts, 1996). MCA is used when criteria ranking is necessary (Komuro et al., 2006), which was not the case in this study.

A list of experts was elaborated for each stakeholder group (managers and employees of mineral exploration companies, sub-contractors, investors, local and aboriginal communities, environmental non-governmental organizations and governments), based on experience, expertise, reputation, occupation and knowledge of the mineral exploration industry. All experts were familiar with the Quebec and Canadian contexts. Nevertheless, the final list of principles and criteria of sustainable development for the mineral exploration industry will likely be relevant to other countries that share similar contexts.

In the first round of the Delphi survey, a questionnaire was sent to the participants using the SurveyMonkey software, asking them to evaluate the relevance of the preliminary list of criteria using a Likert scale with no central point, to establish a clear distinction between favorable and unfavorable positions (Trochim, 2006). Participants were allowed to add or reformulate certain items if necessary, and were asked to justify their answers or to provide any additional comments to clarify their views on each criterion. When processing the data, the consensus level was evaluated for each

criterion based on the proportion of participants having rated it as “relevant” or “highly relevant”, according to the following decision rule: high (80–100%), moderate (60–79%), low (50–59%) consensus (Ekionea et al., 2011).

In the second round, the experts were asked to reassess their judgment for the criteria that did not reach a high consensus level at the first round (Okoli and Pawlowski, 2004; Steurer, 2011). They were shown their original relevance rating, compared to the compilation of all ratings, and asked to justify whether they chose to maintain their initial rating, or modify it (Slocum, 2006). The experts were also asked to rate new criteria or criteria that were considerably modified after the first round following their recommendations. The Delphi survey ended when stabilization of the consensus levels of all criteria was reached.

3. Results

A preliminary list of eight principles, each comprising 1–6 criteria, was obtained from the analysis of the 15 sustainable development guidelines (Table 1). From the 66 experts that were invited to participate in the Delphi survey, 46 accepted and 44 completed the process: 18 experts involved in the mineral exploration industry (companies, contractors, investors), 19 experts from stakeholder groups affected by the industry (local communities, indigenous communities, ENGOs), and 7 experts from different governmental organizations (Table 2).

Following the first round of the Delphi survey, 20 criteria reached a high level of consensus, six reached a moderate level of consensus, and one required major rewording to clarify its meaning (Table 3). Furthermore, four criteria were added based on experts' suggestions. In the second round, the four new criteria and the reworded criterion reached a high level of consensus. From the six criteria that reached moderate consensus after the first round, four maintained the same consensus level and two reached high consensus after the second round (Table 3). Given that the consensus level was high or stable for all criteria after the second round, a third round was not necessary. The following sections summarize the experts' comments and recommendations for all the assessed criteria. A thorough description of their comments and suggestions is provided in Caron (2014).

3.1. Environmental quality

The *Environmental quality* principle included six criteria. They all reached a high consensus level after the first round and no new criterion was suggested. Regarding the *Efficient use of natural resources* criterion, the experts emphasized that water and waste management are the most important aspects. Some mentioned this criterion was not relevant as few resources are used in mineral exploration. The *Respect of sensitive areas* criterion was judged very relevant by a strong majority of experts, and several emphasized that, beyond the areas protected by law, it is essential to respect sensitive areas indicated by local communities. The *Air quality* criterion achieved a high consensus level, but several experts mentioned that it gains importance as exploration projects progress to advanced stages, when dust management becomes problematic. Experts mentioned the importance of managing dust and air contaminants when people lived nearby exploration operations, but only a few mentioned that impacts on wildlife should also be minimized. The *Water and soil quality* criterion reached perfect consensus. Specific issues were discussed, such as water management at camp sites, impacts of machinery operations on water and soils, wastewater from drilling, impacts of blasting, risks of underground water contamination, management of radioactive waste, as well as site restoration and rehabilitation. The *Wildlife*

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