

## Sustainability indicators for mining projects: assuring a representative diversity of stakeholders and issues. Application to the uranium mines in Arlit (Niger)

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### SUMMARY

Minerals extraction is related to complex sustainable development issues that are subject to international and local controversies. Debates must be based on objective and comparative elements. Defining strong indicators for assessing impacts and performances of mining sites thus appears necessary to inform and support the decision-making process for stakeholders. Recently, many indicator sets have been developed on an international level based on top-down approaches, but they commonly lack legitimacy for stakeholders and adequacy to specific site issues. They thus need to be complemented by the consultation of local actors concerned by such mining activity, in order to define indicators that are closer to the needs and contexts of the specific sites. The question raised by this kind of top-down/bottom-up approach is how to organize and reveal the plurality of values and concerns associated with mining. Based on the principle of representative diversity, the approach undertaken at the Arlit uranium mines in Niger aimed at defining indicators that are understood and accepted by all actors. The aim was to measure the impacts and performances of mining sites in the four sustainable development dimensions, and at local, regional and national scales.

### 1. INTRODUCTION

Exploitation of natural resources is related to crucial sustainability issues. Mineral extraction makes no exception in that it can generate both positive and negative impacts on concerned areas, from site to national levels, notably in rais-

ing the problem of an equitable distribution between costs and benefits for stakeholders. Debates have been raging for many decades about this sector between industrial justifications, NGO pressures, local communities' concerns and new rules imposed by states and international finance organizations. Arguments are still rooted in partisan vision, and the definition of sustainable development in the Bruntland report does not provide a satisfactory basis for defining what is and is not sustainable in the mining sector.

It is thus clear that factual and comparative elements are needed to better appreciate the mining sector's impact, to support decision makers in their strategic choices, to inform stakeholders, and to make the debate more objective. The following research, carried out in collaboration between BRGM and UVSQ, aims at contributing to this reflexion by trying to define solid indicators that are understood and accepted by all stakeholders and adapted to site specificities, in order to assess a mining site's impact and performance from local to national levels in Africa. The first part of this paper presents the theoretical underpinnings of the research work. The second part shows the empirical results drawn from application of this work to the uranium mines of Arlit in Niger.

### 2. THE NEED FOR A DOUBLE TOP-DOWN/BOTTOM-UP APPROACH

Globalization of sustainable development issues requires the use of indicators that are transferable, generic and scientifically valid, to provide relevant information and allow comparisons be-

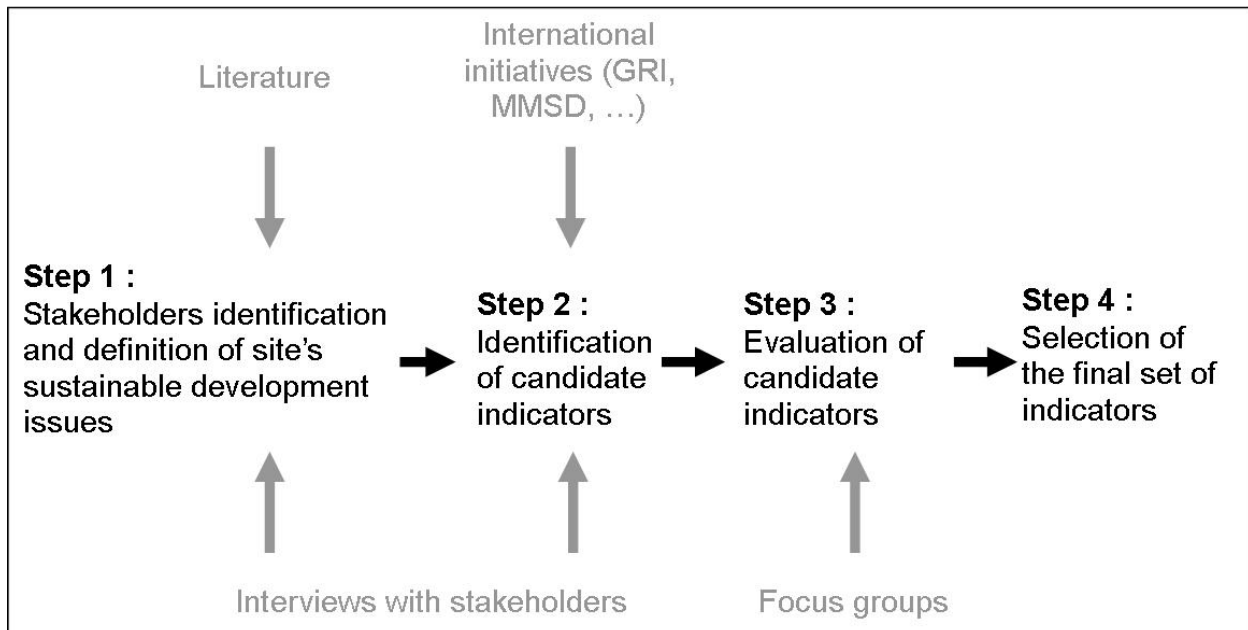


Figure 1: The 4 steps for indicators' selection.

tween entities (e.g. between mining sites, regions, states). However, such indicators, generally defined by experts at high levels, miss legitimacy for stakeholders and do not respond to the specific needs of a site.

It is however fully accepted that indicators are only relevant and useful if they fit the user's needs (Bouni, 1998). A participatory (or 'bottom-up') approach not only answers the needs for information and management tools of the actors implied in the activity, but also enhances the legitimacy of such indicators. Thus, expected benefits lie not only in the results, i.e. the indicators, but also in the means, i.e. the participatory process that increases the stakeholders' adhesion to results (Faucheux and Nicolai, 2004).

Furthermore, it is obvious that each mining site will present different features (geographical location, exploitation type, extracted substance, mine cycle phase, etc.) that invalidate the idea of a 'one-fits-all' indicator set.

In combining international framework contributions and participative processes, the top-down/bottom-up approach is a way to confront indicators that are scientifically valid and generic (top-down) with stakeholder needs on specific sites (bottom-up).

### 3. APPLICATION TO THE URANIUM MINES OF ARLIT

The uranium mines are located at Arlit, in the desert region of Aïr in northern Niger. Two companies are exploiting the mines: Société des Mines de l'Aïr (SOMAÏR) for the open-pit mine and Compagnie des Mines d'Akokan (COMINAK) for the underground mine, whose majority shareholders are the French company AREVA and the Nigerian state (ONAREM).

Initiated in the 1970's, the mining activity has contributed to national development programs in Niger, notably during the 1980's when uranium prices were high. But, whereas today Niger is the fourth uranium producer in the world with 12% of global production (Nuclear information centre, 2005), it is still considered as the last country in terms of the Human Development Index (United Nations Development Programme (UNDP), 2005).

The objective of our study in Niger was to evaluate uranium mining's contributions to and impacts on the region and the country, with indicators that fit the stakeholders' needs and interests. As shown in Figure 1, our approach consists of four steps, enriched by both top-down and bottom-up elements. The following sections provide more details about the work undertaken on site.

### 3.1 Step 1: Identifying stakeholders and defining sustainable development issues of the extraction site

The objective of this first phase was to define and conceptualize the framework for a better understanding and analysis of issues. Different elements had to be taken into account in this analysis: stakeholder identification, understanding of site issues and articulation of the different scales.

#### 3.1.1 Stakeholder identification

The first point was to identify actors that are affected by the activity and, thereby, have to be implied in the process. We based our identification on the typology proposed by Faucheux and Nicolai (2004) that gives supplementary of analysis in separating four main stakeholder groups for firms:

- *Internal stakeholders* that have direct interests in companies: they include management, employees, unions, and shareholders.
- *Traditional external stakeholders* identified as the firm's partners, that all have a direct commercial importance for the company, such as suppliers, customers, banks, and insurers.
- *Enlarged external stakeholders*, identified as dialogue partners that have an interest or requirements concerning the performances of a plant, a company or an industrial sector, and have a direct incidence on commercial success, such as local population, NGOs, associations, and partner firms.
- *Coordinating authorities*: government, local authorities, and professional associations.

Based on this typology, on studies on mine stakeholders (Östensson, 2000; Azapagic, 2004) and on local knowledge of Nigerian companies, a list of actors to imply in the process has been drawn up; 42 interviews were realised in Niger, implying about 70 people.

#### 3.1.2 Definition and organization of sustainable development issues

Stakeholder interviews in Niger were based on a semi-directive approach with two main questions: According to you, what are the impacts of, and your concerns related to, the mining activity? How would you measure these impacts?

Table 1: Number of indicators by issue category.

Issue Category	Number of indicators
Economic and financial performances	9
Redistribution of benefits	6
Local community	13
Employee health and safety	18
Employment and equity	13
Wages and working conditions	12
Environmental management	14
Resources and products management	19
Environmental impacts	16

Not surprisingly, a large spectrum of sustainability issues was mentioned by the participants, from the preservation of traditional ways of living, to health, through economic development, contributions to state revenue or water access and impacts on biodiversity. We organized these impacts in nine broad categories based on an analysis of all contributions and on international frameworks (Table 1).

#### 3.2 Step 2: Identifying "candidate" indicators

The objective of this step was to define a first set of indicators that fit with issues defined in Step 1 but also on broader requirements for mining sites sustainability assessment (for example, energy consumption, though a major issue for mining, was not mentioned by stakeholders). Relevancy of these indicators would then be submitted to stakeholders' judgement, that is the reason why we're speaking here of "candidate" indicators, which means they are potentially relevant for the moment.

Three main sources of indicators were available:

- *Stakeholder' proposals* made during our first mission;
- *Indicators used by the Nigerian companies for their CSR reporting*;
- Indicators that are specific to the mining sector, coming from international initiatives (Chamaret et al., 2005).

A total of 127 indicators was obtained after reconciling all three sources, more or less equally distributed between all nine issue categories (Table 1).

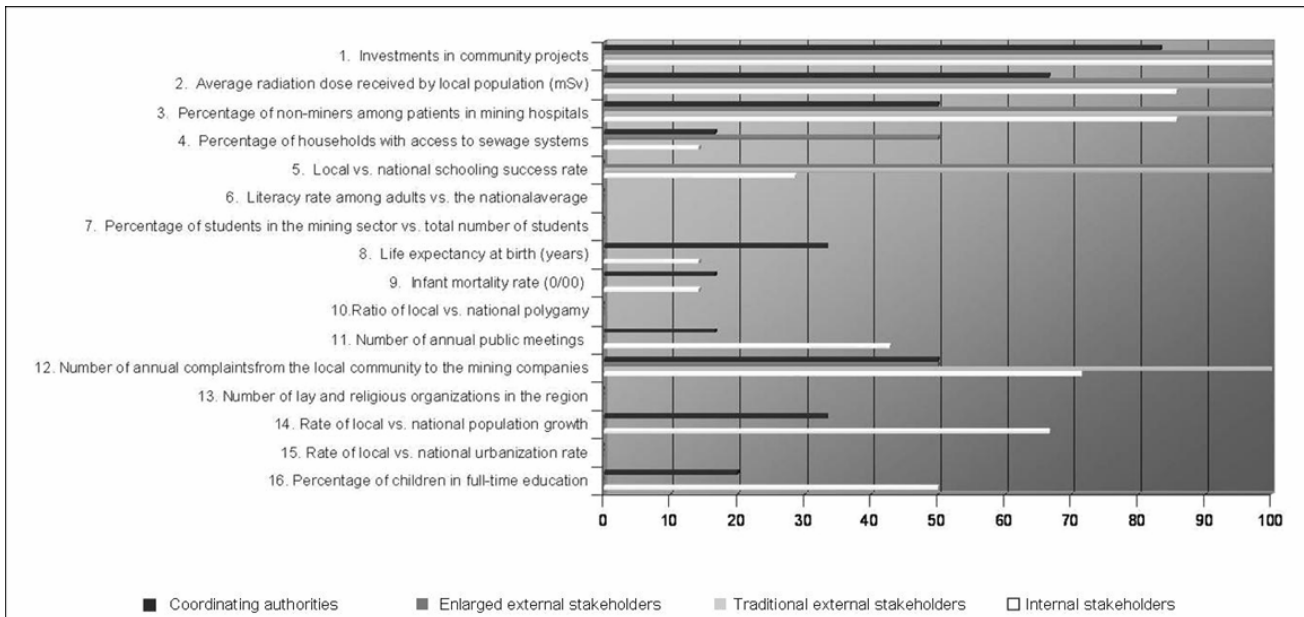


Figure 2: Voting results by participants for each type of stakeholders' category for the "Local community" issue category.

### 3.3 Step 3: Assessing the relevancy of candidate indicators with stakeholders

Assessing the relevancy of candidate indicators was again based on a participatory process in Niger, involving the same stakeholder groups as during the first phase of issue definition. Fifteen meetings took place with 80 persons, 97% of whom were Nigerian. Two categories were particularly well represented: internal stakeholders (6 groups and 34 people) and coordinating authorities (6 groups and 30 people).

Each group was asked to agree on a maximum of five indicators, deemed to be the most pertinent for each of the nine categories. They were free, however, to formulate new proposals if necessary. This ceiling of five indicators, which some participants found frustrating, had the double objective of (1) reducing the number of indicators to obtain a workable data set, homogeneously distributed amongst the nine categories, and (2) favouring the dialogue between participants.

### 3.4 Step 4: Selection of the final set of indicators

Selection of the final set of indicators was based on the principle of "representative diversity" which aims at highlighting, as much as possible, the diversity of (1) issues and (2) viewpoints of the stakeholders, without drowning them in the majority opinion. As much as possible such de-

liberative procedures should attenuate contradictory opinions without eliminating them, providing the opportunity to all parties, even minorities, to be represented and thus to make them feel involved in the final result (O'Connor, 2000). In fact, this selection process of the final data set reproduced a process of artificial negotiation between the four groups of stakeholders, with the objective of reaching equilibrium between consensus and strong expressions of interest, but attempting to preserve the entire diversity of stakes.

Four selection rules were applied in a non-linear and non-exhaustive manner:

- Search for and selection of indicators with a strong measure of consensus;
- Search for and selection of indicators stressing strong expressions of interest of stakeholder groups;
- Search for and selection of "compensation" indicators for the other stakeholders;
- Search for and selection of indicators to favour a diversity of issues in case the other selection criteria arrive at a stalemate.

Taking the example of the "Local community" category (Fig. 2), two indicators obtained a certain measure of consensus in the eyes of the four stakeholder groups. They were "Investment in community projects/turnover" and "Average radiation dose received by local population". A strong interest was expressed by external stake-

holders for the indicator "*Local vs. national schooling success rate*". In compensation, the indicator that best answers the expectations of internal stakeholders and the coordinating authorities is "*Percentage of non-miners among patients in mining hospitals*". Finally, among the remaining indicators, the "*Number of complaints from the local community to the mining companies*" corresponds most to the expectations of all four groups, as well as highlighting another facet of the Local Community aspect.

At the end of this selection work, 45 indicators were retained, homogeneously distributed within the nine issue categories. A quick comparison between this approach and a selection based on majority opinion (viz. selecting the most popular indicators among all stakeholders groups) shows a 10% difference gap in the results. In fact, most of the indicators retained by the majority opinion approach could have been chosen in our selection. But the diversity criteria enriched the selection with more issues. For example, through the majority approach two indicators would have been retained for measuring water consumption in the issue category "Resources management". We chose only one and replaced the second by an indicator measuring the space used by mining, revealing a concern of the enlarged external stakeholders group.

Among the 45 indicators selected in the final set, 35 were chosen by enlarged external stakeholders, 34 by the traditional external stakeholders, 34 by the internal stakeholders and the coordinating authorities. These figures show that viewpoints' diversity has been assured.

#### 4. CONCLUSIONS

This article has exposed an original approach for building sustainable development indicators, using the Arlit mines as case study. This approach is based on the principle that a sustainability assessment should reveal the diversity of issues associated with mining and the diversity of stakeholders concerns in a structured way. For this, we used an hybrid approach, combining top-down and bottom-up tools.

The satisfaction survey carried out at the end of the process enabled a better understanding of the participants' expectations concerning the proposed work. For 75%, the main interest of the exercise was to obtain a better understanding

of the stakeholders' preoccupations. This result shows that, despite the traditional pitfalls inherent to the participative process (legitimacy of the participants; representativeness of the weak stakeholders such as future generations; anchoring in a given temporal reality; and the difficult and lengthy implementation period), our method represents a real tool for dialogue and mutual reconnaissance that favours the construction of a common reality for the various actors.

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