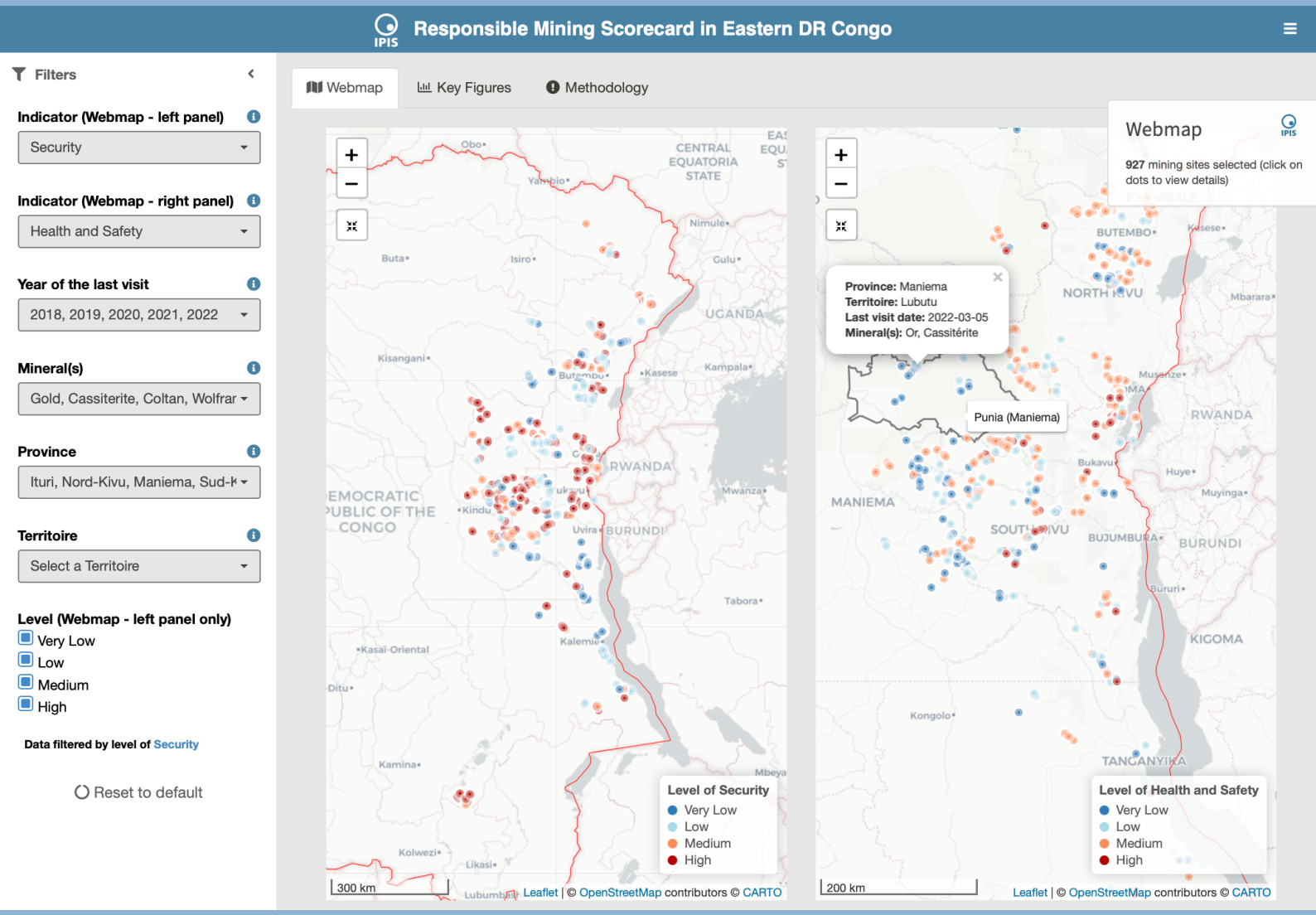
IPIS Due Diligence series

Responsible mining scorecard in eastern DRC



IPIS

International Peace Information Service vzw

EDITORIAL

IPIS Due Diligence series

Responsible mining scorecard in eastern DRC

Antwerp, August 2022

Cover image: Screenshot of IPIS' *responsible mining scorecard dashboard*

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Suggested citation: Hoex L., Matthysen, K. & Muller, T. (2022) *Responsible mining scorecard in eastern DRC* (IPIS, Antwerp, 2022), 28p.

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D/2022/4320/06

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TABLE OF CONTENTS

1. INTRODUCTION

Over the years, IPIS has systematically collected mine site and trade hub level data on artisanal and small-scale mining (ASM) in eastern DRC. The indicators for data collection are based on the parameters and norms captured by the Annex II of the OECD Due Diligence Guidance for responsible Supply Chain, the LBMA (London Bullion Market Associate), the ICGLR's Certification Mechanism, and finally the SALT criteria (Security, Accessibility, Legality and Traceability) used by the Joint Validation Teams in Eastern DRC[1].

This data collection has enabled IPIS to generate a sizable database of more than 3,000 ASM sites that draws both on sites visited by IPIS and data from third party sources including the Congolese mining cadastre and the Ministerial qualification teams. This database is the point of departure of the **Responsible mining scorecard, which aims to assess mining sites against different indicators of responsible mining, namely security, health and safety, presence of state services, and level of formalisation**. Other indicators such as the environmental impact, are not assessed in detail and hence not part of the scorecard.

The Responsible mining scorecard is a derivative project rooted in previous projects commissioned by USAID[2] and IOM[3] that asked IPIS to evaluate the potential for responsible mineral sourcing efforts. The scorecard will help users, e.g. companies sourcing, or planning to source from the DRC, to assess to what extent a region or mining site is compliant with international guidelines such as the OECD Guidance. Moreover, the scorecard gives an idea of the relationship between different indicators, e.g. what effect has formalization of mining sites on the safety at these mining sites? What are the possible effects of investing in state presence?

An interactive web app enables users to compare the spatial distribution of the scores for the different indicators, to subset mines, and to zoom in on an area of interest using various combinations of filters. This dashboard does not reveal scoring details about the different indicators for individual mining sites because pinpointing individual mining sites could be misleading due to the volatile aspect of the ASM sector. Assessing the potential for responsible sourcing seems therefore more realistic per area.

This Responsible mining scorecard is a work in progress and will be updated by IPIS after each new mining site visit. The calculation system will be implemented to a growing number of additional mining sites to achieving the main objectives of the scorecard: assessing compliant zones for responsible sourcing and exploring linkages between the different indicators.

It is noteworthy that this Responsible mining scorecard does not aim to serve for validation of the legality or formality of ASM operations but should be an indicative tool for the Congolese civil society organisations, local authorities, international organisations and observers, and private actors to assess and track the improvement of efforts towards responsible mining.

1 *Ministerial Decree* « 0919/CAB.MIN/Mines/01/2015 du 29 octobre 2015 fixant les *procedures d'inspection, de qualification et de validation des sites miniers des filières aurifère et stannifère en République Démocratique du Congo* »

2 IPIS, *Evaluation of Potential Responsible Artisanal Mine Site Hubs: South Kivu*, commissioned by USAID and TetraTech, November 2018, https://ipisresearch.be/wp-content/uploads/2018/12/CBRMT-Evaluation-of-Potential-Responsible-Artisanal-Mine-Sites-S-Kivu-DRC.pdf

3 ASADHO, ASSODIP and IPIS, *L'exploitation minière artisanale à Beni-Mbau: Etat des lieux et cartographie des sites miniers*, commissioned by 'Ensemble pour Beni'/OIM, 30 October 2020, https://ipisresearch.be/publication/lexploitation-miniere-artisanale-a-beni-mbau-etat-des-lieux-et-cartographie-des-sites-miniers/

2. METHODOLOGY

2.1. Data acquisition and processing

Since 2009, IPIS has collected quantitative and qualitative data on more than 2,720[4] geolocated mining sites producing mostly tin, tantalum, tungsten, and gold (3TG). Using Open-source Mobile data collection tools, including Open Data Kit questionnaires and Kobo Toolbox, the IPIS questionnaires cover a wide range of information such as the number of workers, techniques and procedures of extraction, tools and protective equipment, production figures, child labour, presence and interference by state and non-state armed actors, roadblocks near and at the mining sites, conflicts and violence, presence and activity of state services, cooperatives and the legal status of the mine.

IPIS surveyors collect quantitative and qualitative data through a combination of observations and interviews with a selection of stakeholders at and around ASM sites, support villages, and trading hubs. Data collection methods and verification rely extensively on triangulation of sources, and interviewees include artisanal miners, shop keepers, representatives of cooperatives and heads of miner camps.[5] Most sites have been visited multiple times since 2009 and as of June 2022, IPIS teams have proceeded to a total of 5,971 visits.

Over the years, IPIS has refined its questionnaire and field methodology to collect key information to enable the calculation of scores indicative of responsible mining and working conditions at the level of the mining sites. In addition to official criteria such as the ministerial **qualification status**[6] and **mining concessions**[7], the first-hand data collected in the field constitutes the principal criteria used for calculation of aggregated scores indicative of responsible mining at the mining site level, namely *security*, *health and safety*, *presence of state services*, and *level of formalisation*. To provide further contextualisation and perspective on working conditions, as well as to help prioritising areas to set-up a responsible sourcing initiative, we further consider *production* and *accessibility* to the mining site as two additional indicators.

IPIS has started calculating scores for all the mining sites that have been last visited by its teams after May 2018 and which were reported at the time as being active. We considered that data from pre-2018 field visits would not allow us to calculate the aggregated scores as accurately as with the most recent visits. As of March 2022, IPIS can therefore provide a scorecard for 927 mining sites, which have at least 5 workers[8] (Figure 1).

After field data collection, the data are carefully cleaned, harmonised, and uploaded into a PostgreSQL database where they are managed and curated to be processed for scores calculation. In addition to con-

4 It is noteworthy that third-party partners shared data with IPIS on an additional 558 mining sites which have not yet been visited by IPIS teams. IPIS database therefore covers a total of 3,060 sites (data as of March 2022). Users can download open data and access our Open data dashboard at: https://ipisresearch.be/publication/ipis-open-data-dashboard-on-the-artisanal-and-small-scale-mining-sector-in-eastern-drc/

5 Some more explanations on the methodology of data collection: IPIS, ASADHO and ASSODIP, *L'exploitation minière artisanale à Beni-Mbau : Etat des lieux et cartographie des sites miniers*, commissioned by International Organization for Migration (IOM) through the consortium 'Ensemble pour Beni', February 2020, pp. 8-9; IPIS, *Mapping artisanal mining areas and mineral supply chains in eastern DR Congo, Impact of armed interference & responsible sourcing*, April 2019, p. 13; IPIS, *Analysis of the interactive map of artisanal mining areas in eastern DR Congo – 2015 update*, October 2016, p. 8

6 Mines have been visited (periodically) by 'joint validation teams', which include representatives from the government, state agencies, and international partners working in the natural resources sector. These teams assess the situation at the site and its surroundings against the standards set by the DRC government (*Ministerial Decree « 0919/CAB.MIN/Mines/01/2015 du 29 octobre 2015 fixant les procedures d'inspection, de qualification et de validation des sites miniers des filières aurifère et stannifère en République Démocratique du Congo*) and the ICGLR's Regional Certification Mecanism. These teams classify sites as red, yellow or green depending on their observations. Next, the Minister of Mines validates this qualification.

7 The DRC Mining Registry (*Cadastre Minier*, CAMI) grants these concessions and manages the database. Existing concessions can be consulted at its publicly accessible portal: http://drclicences.cami.cd/EN/

8 This data has been collected throughout a wide range of projects supported by various donors, including 'Madini kwa Amani na Maendeleo' (https://ipisresearch.be/project/madini-strengthening-regional-stability-in-the-great-lakes/); 'Ensemble Pour Beni' (Consortium for Integration, Peace and Stabilisation in Eastern DRC, https://ipisresearch.be/nl/project/responsible-gold-beni/) through IOM, and USAID (through it's program *Integrated Land and Resource Governance*, https://ipisresearch.be/project/understanding-artisanal-mining-supply-chains-and-conflict-financing-in-drc/)

verting both qualitative and quantitative variables into an aggregated scoring system, IPIS set specific **weight** values to each criterion according to their relative importance. The next section explains how the scores are calculated for each indicator; more details are available in the Appendix.

Box 1 – Terminology

For each **indicator** (i.e., security, health and safety, state presence, formalisation, access and production), **data** (i.e. information) collected in the field are compared against several **criteria** to assign **values**. According to the relative importance of each criterion, these values are **weighted** and aggregated by indicator to calculate the final **scores**. In the RSM dashboard, the scores of each indicator are reclassified into **4 levels** (i.e., very low, low, medium, high).

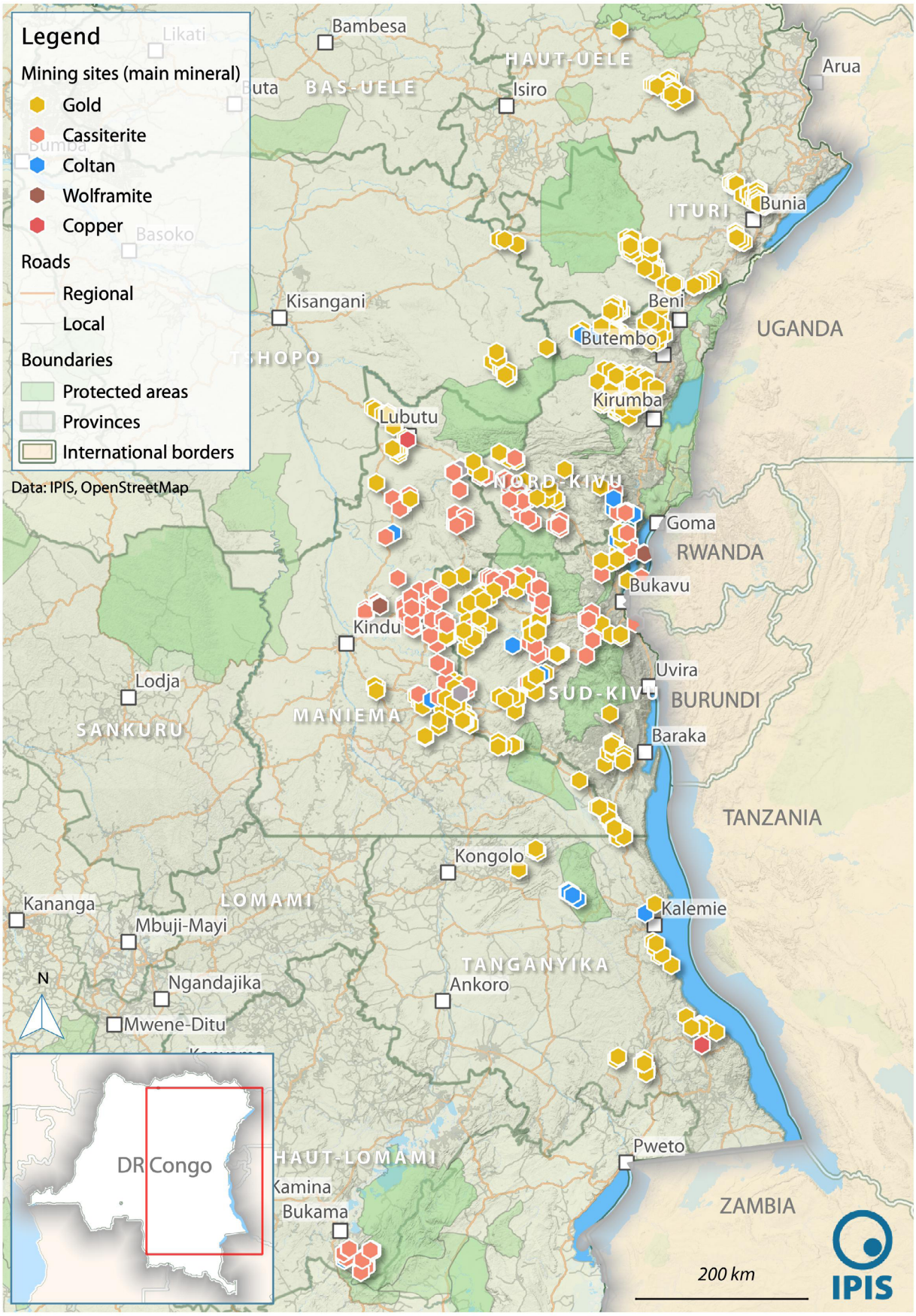

Figure 1. Map of the mining sites integrated in the responsible mining scorecard as of June 2022

2.2. Calculation of the scores for each indicator

2.2.1. Indicators

Security

The security indicator aims to translate the context of security at each mining site (Table 1). This indicator gives highest importance (i.e., weight) to the reported presence of non-state armed actors at the mining site or its vicinity over the last 6 months, and that conduct illegal activities such as taxation or controlling access to the sites. This indicator additionally considers the interference of FARDC at the mining sites, including pillaging, illegal taxation, pit ownership, monopoly on selling goods, forced labour of mining workers, buying minerals, digging for minerals, and operating roadblocks. Finally, this indicator accounts for reported sexual violence during the 6 months before the visit date, but also reported conflicts and all other forms of violence.

Table 1. List of the criteria and weights of relative importance to calculate the scores for security

Security		
Criteria	**Values**	**Weight**
Visits by non-state armed groups in last 6 months	-1.5, 0	4
Roadblocks on roads accessing the mining site by non-state armed groups	-1, 0	3
FARDC presence and interference in last 6 months	-1.5, -1, 0 or 1	3
Roadblocks on roads accessing the mining site by FARDC	-1, 0	2
All forms of sexual violence in last 6 months	-1, 0	3
Conflicts and tensions in last 6 months	-1, 0	2
Violence in last 6 months	-1, 0	2

Health and safety

The indicator Health and safety at the mining site covers the use of personal protective equipment and the reported number of wounded and fatalities due to accidents in the last 6 months. It additionally considers presence of separate sanitary facilities for women (rated positively) and the use and burning of mercury (rated negatively). It also assesses child labour in mining and non-mining activities, distinguishing between worst and other forms of child labour. Finally, the mining sites with pits and galleries depth exceeding 30 meters are rated negatively as prohibited by the mining regulation[9] for safety reasons (Table 2).

9 *Décret N° 038/2003 Du 26 Mars 2003 portant Règlement Minier tel que modifié et complété par le décret n° 18/024 du 08 juin 2018, Annexe IV : Code de conduite de la coopérative minière ou des produits de carrières agréée et de l'exploitant artisanal, article 9*

Table 2. List of the criteria and weights of relative importance to calculate the scores for health and safety

Health and safety		
Criteria	**Values**	**Weight**
Use of protective equipment	0, 1	2
Accidents with injuries in last 6 months	-1, 0	2
Fatal accidents in last 6 months	-1, 0	3
Maximum depth of wells	-1, 0	2
Child labour related to mining production (e.g., digging, washing minerals, transport of minerals)	-1.5, -1 or 0	3
Child labour not related to mining production (e.g., transport of goods, shops, and food service)	-1, 0	2
Health facilities for women*	0, 1	2
Mercury use	-1, 0	2

* From 2019 onwards

Presence of state services

The indicator Presence of state services focuses on state oversight and interference. It rates whether SAEMAPE and *Division des Mines* – the state services that are mandated to monitor ASM – frequent sites, how regularly, and whether they keep records and provide training and assistance to miners. The presence of the Mining Police for reasons other than law enforcement is illegal and is rated negatively. The same goes for ownership of pits or worksites by state services, the lack of receipts provided by these services after taxation, and any other illegal taxation and harassment by state services other than SAEMAPE and *Division des Mines* (Table 3).

Table 3. List of the criteria and weights of relative importance to calculate the scores for presence of state services

State presence		
Criteria	**Values**	**Weight**
Frequency of visits of SAEMAPE and/or *Division des Mines*	-1, 0 or 1	3
SAEMAPE and/ or *Division des Mines* provide trainings and regular assistance to the miners	0, 1	2
Data collection by SAEMAPE and/ or *Division des Mines*	0, 1	1
Presence of Mining Police (*Police des Mines*)	-1, 0	2
Illegal taxation or harassment by state services other than SAEMAPE and *Division des mines*	-1 (by service), 0	2
Ownership of wells or worksites by state services	-1, 0	2
Receipt given by state services after taxation*	-1, 0	1

* From 2019 onwards

Level of Formalisation

This indicator includes in the first place the official mine qualification status by the joint validation missions. '*Red*' and '*yellow*' sites receive a negative rating, while '*green*' sites receive a positive rating. The sites without qualification receive a null score. Another criterium relates to the legal status of the mine. Negative scores are assigned to mines where there is a title or land dispute, where the legal status is unknown

or when located on an industrial concession. Positive scores are assigned when the site is located on an Artisanal Mining Zone (ZEA, *Zone d'Exploitation Artisanale*). Finally, we score the presence of mining cooperatives, whether the cooperative has been registered or received a favorable opinion from the provincial government, and presence of women in a managerial position in the cooperative (Table 4).

Table 4. List of the criteria and weights of relative importance to calculate the scores related to the level of formalisation

Formalisation		
Criteria	**Values**	**Weight**
ICGLR qualification	-1.5, -1, 0 or 1	2
Legal status of the mining site	-1, 0 or 1	3
Legality of the miners	-1, 0 or 1	1
Presence of a cooperative	0, 1	2
Cooperative has been approved or has received a favourable opinion from the provincial government	0, 1	1
Women have a managerial position in the cooperative*	0, 1	0.5

* From 2019 onwards

Production

The scope of mine production evaluates indirectly the production volume by assessing the activity at the mining site via criteria including the number of workers, the level of mechanisation, and number of working days per week during the dry and the wet season. The mining sites with higher production obtain higher scores. The number of pits was not retained as an indirect indicator to avoid favouring hard-rock open pit and underground mining sites over alluvial mines (Table 5).

Table 5. List of the criteria and weights of relative importance to calculate the scores related to production

Production		
Criteria	**Values**	**Weight**
Number of workers	-1, 0 or 1	3
Level of mechanisation	-1, 0 or 1	1
Number of working days per week during the wet season*	-1, 0 or 1	1
Number of working days per week during the dry season*	-1, 0 or 1	1

* From 2019 onwards

Accessibility

This indicator assesses the travel time and means of transport to access the mining site from the main road. The methodology favours the sites reachable by car or motorbike and it differentiates the access between dry and wet seasons as the latter can heavily affect mobility. We also assess phone coverage at and around the site, which enables closer monitoring and is relevant information for actors interested to work in the area, including responsible sourcing initiative (Table 6).

Table 6. List of the criteria and weights of relative importance to calculate the scores related to accessibility

Accessibility		
Criteria	**Values**	**Weight**
Access to the mining site during dry season (by foot, car or motorbike, and travel time)	-1, 0 or 1	1
Access to the mining site during wet season (by foot, car or motorbike, and travel time)	-1, 0 or 1	1
Phone network	-1, 0 or 1	1

2.2.2. *Classification of scores*

The scores are subsequently classified into four classes (i.e., levels), namely *very low* and *low* for sites scoring below 0, and *medium* and *high*, for sites scoring 0 or above. We used equal intervals to draw a threshold between *very low* and *low* on the one hand, and *medium* and *high* on the other hand (Figure 2). The calculation and re-classification of the scores are performed with R (version 4.0.2) and dplyr package (version 1.0.3).

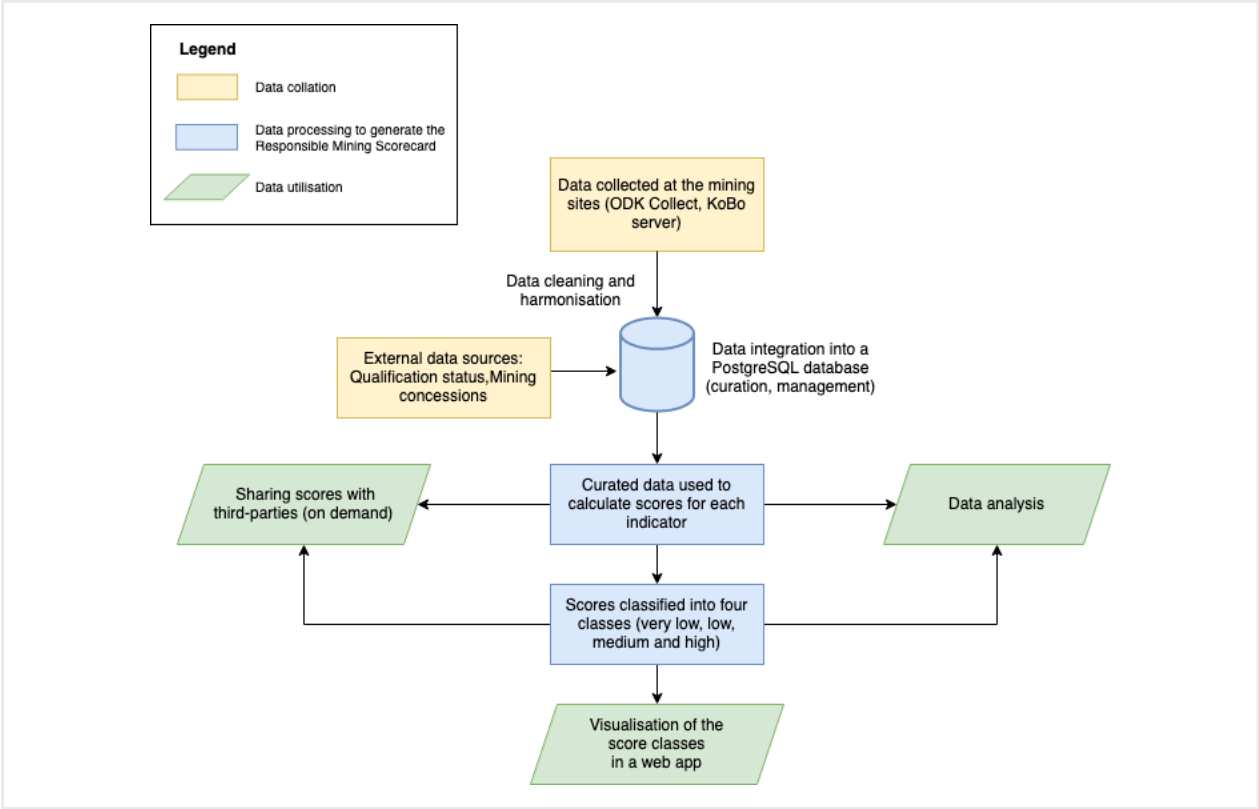

Figure 2. Workflow to generate the Responsible Mining Scorecard

2.3. An online dashboard to explore the Responsible Mining Scorecard in eastern DRC

IPIS developed a web app to explore the spatial distribution of the different indicators under the form of a dashboard. This app is available at:

https://ipisresearch-dashboard.shinyapps.io/mining_scorecard_easterndrc_app/

The Responsible Mining Scorecard dashboard in eastern DRC enables users to compare the spatial distribution of the scorecard levels of two indicators, to subset mines and to zoom in on an area of interest using various combinations of filters, namely the mineral(s) extracted in the mining sites[10], province and territory, year of last visit, and the level of the indicator of their choice (i.e., *very low*, *low*, *medium*, and *high*). The different filters are available on the left sidebar. The names of the territories are displayed on hover and more information on the mining sites appear by clicking on the dots (Figure 3).

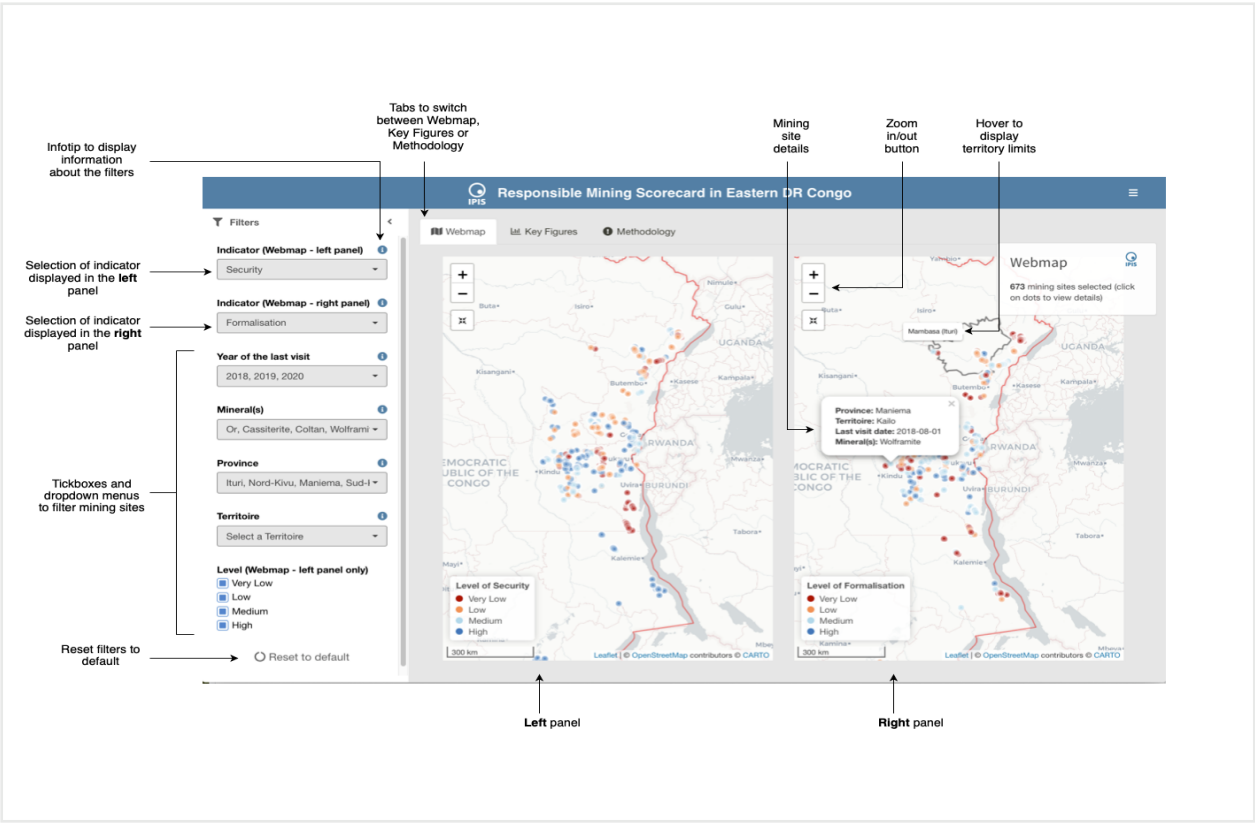

Figure 3. Key elements of the Responsible Mining Scorecard dashboard. It is noteworthy that the filter on the different levels (bottom of the left sidebar) applies to the map displayed in the left panel only.

A second tab named *Key figures* allows access to further information regarding the number of mining sites falling in the different levels for each indicator (Figure 4). These figures are synchronised with data displayed on the maps and are therefore also reactive to the filters in the left sidebar.

10 IPIS teams collect data on up to three minerals extracted per mining site.

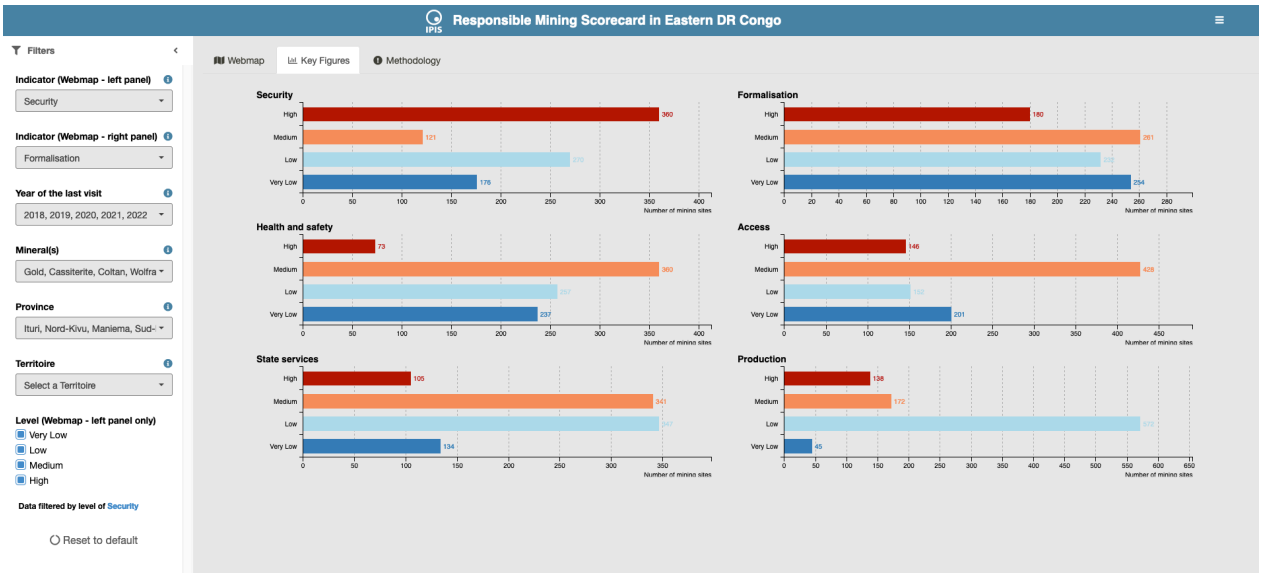

Figure 4. Key figures of the Responsible Mining Scorecard Dashboard.

The dashboard does not reveal indicators scoring for individual mining sites because the ASM sector is volatile. Artisanal miners are flexible, moving from one site to another based on a wide range of parameters, including production variations, seasonality, new discoveries, and reports (and rumours) about new opportunities. Pinpointing individual mining sites with positive or negative scores could therefore be misleading. Assessing the potential for responsible sourcing per area is therefore more appropriate. International organisation or private actors who wish to know more about specific areas or mines are welcome to contact IPIS to discuss data sharing on a case-by-case basis.

2.4. Geospatial analysis using local spatial autocorrelation

To explore the spatial distribution of the scores for each indicator, we use a local spatial autocorrelation mapping technique relying on Local Moran's I statistic as introduced by Anselin[11]. Local Moran's I allows identifying on a map whether individual sites are part of spatially similar or dissimilar clusters relative to nearby sites and using significance tests (with a P <.05 as significant). The values in the **LISA maps** (Local Indicator of Spatial Autocorrelation) presented in Chapter 3 can be read as follows:

- **High-high**: mining sites with high scores, which are grouped together in space to form *hot-spots*.
- **Low-low**: mining sites with low scores, which are grouped together in space to form *cold-spots*.
- **Low-high**: mining sites with low scores that are surrounded by mining sites with higher scores.
- **High-low**: mining sites with high scores that are surrounded by mining sites with lower scores.

The sites identified as 'high-high' or 'low-low' form the core clusters of sites with relatively higher or lower scores. The sites identified as 'high-low' or 'low-high' can be considered as significant spatial outliers. They may reflect some local characteristics distinct from the other mines in the vicinity. E.g., a mining site with a relatively low access surrounded by mining sites with significantly higher access (i.e. 'low-high'); a mining site with high security surrounded by mining sites with significantly lower security (i.e. 'high-low').

The LISA maps are created for each indicator to identify patterns of geographic clustering. In the top right-hand corner of the LISA maps, we also include a reading for **Global Moran's I**. This value ranges between 1 and -1 and indicates how much spatial autocorrelation is occurring across the whole dataset. Closer to 1 means observations with a certain value tend to geographically be grouped together (pos-

11 Anselin, L (1995). Local indicators of spatial association—LISA. Geographical Analysis. 27, 93–115.

itive spatial autocorrelation). Closer to -1 means observations with a certain value are close to observations with contrasting values (negative spatial autocorrelation). A reading near 0 refers to no spatial autocorrelation, i.e. observation values seem distributed randomly in space.

The LISA maps were created using R version 4.0.2 with leaflet (2.0.3) and spdep (1.1-5) packages.

3. RESULTS AND DISCUSSION

After a general overview of the data, this chapter will illustrate through a few case studies and examples how the responsible mining scorecards (RMS) can be used and interpreted. The case studies give some insight into the realities behind the data, and how different situations on the ground may lead to different - or sometimes similar - scores.

3.1. Presentation of the RMS data

Tables 7 and 8 introduce characteristics of the 927 ASM sites included in the RMS and analysed in the following sections. Table 7 shows that most of the mines included in the responsible mining scorecard produce gold (654 of 927 mines). These mines represent 80% of the total number of workers. More than half of the mining sites included in the scorecard are in the two Kivu provinces (532 sites, representing 57% of the total number of mining sites), followed by Maniema (146 sites, 16%) and Ituri (134 sites, 14%). (Table 8)

Table 7. Mining sites per mineral included in the responsible mining scorecard as of June 2022

Type of mineral	Number of mines per mineral	Percentage of mines per mineral	Number of workers per mineral	Percentage of workers per mineral
Gold	630	68%	107,538	78.5%
3T	264	28%	27,025	19.7%
3TG*	24	3%	1,983	1.5%
Other minerals**	9	1%	423	0.3%
Total	**927**		**136,969**	

* Tin, Tantalum, Tungsten and Gold / ** Diamond, Tourmaline and Copper

Table 8. Mining sites per province included in the responsible mining scorecard as of June 2022

Province	Number of mines per province	Percentage of mines per province	Number of workers per province	Percentage of miners per province
South Kivu	301	32%	45,358	33.1%
North Kivu	231	25%	34,516	25.2%
Maniema	146	16%	20,336	14.8%
Ituri	134	14%	25,354	18.5%
Tanganyika	50	5%	5,247	3.8%
Haut-Lomami	25	3%	1,333	1.0%
Haut-Uele	25	3%	3,745	2.7%
Tshopo	15	2%	1,080	0.8%
Total	927		136,969	

Figure 5 shows how the scores for each indicator are distributed. For most indicators the median is balanced around 0, except for 'production' and 'safety' indicators, which have a median of -2. The distribution of the scores for 'safety' and 'security' is relatively more asymmetrical due to a higher number of mining sites with extremely low values (outliers).

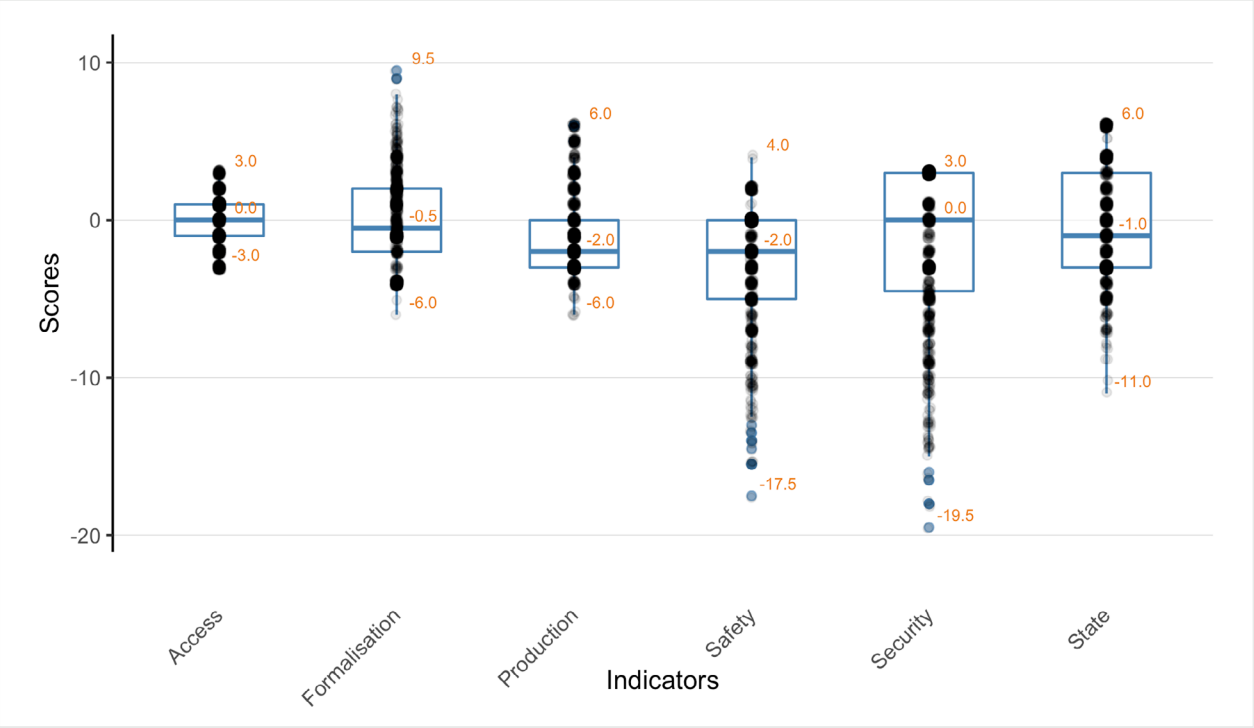

Figure 5. Distribution of the scores per indicator (minimum, median and maximum values are indicated)

3.2. Access

The scores for the indicator "access" vary between -3 and +3, depending on accessibility during the dry season and the wet season, and whether there is telephone coverage.

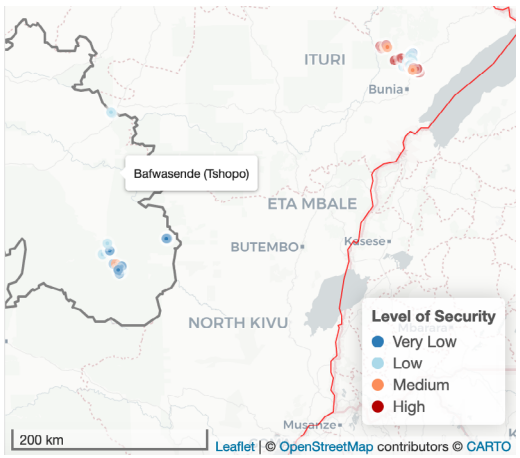

Figure 6. Screenshot of the RSM dashboard showing the level of access for mines in the territories of Bafwasende (Tshopo) and Djugu (Ituri).

The 'Responsible Mining Scorecard-dashboard'[12] helps to identify areas which are more or less accessible by phone and/or in person. In Bafwasende territory (Tshopo province), all sites visited by IPIS in 2021 were very difficult to access (Figure 6, bottom left of the map). This zone is a forested area near the Maiko National Park and distant from Bafwasende town. On the top right corner, the map shows a cluster of comparatively easily accessible sites (medium and high levels). Located in Djugu territory, these sites have the benefit of being located near Bunia town, the capital city of Ituri province.

The LISA map on the indicator accessibility (Figure 7) shows that a lot of highly accessible sites are geographically clustered (Moran's I = 0.36, $P <$

12 https://ipisresearch-dashboard.shinyapps.io/mining_scorecard_easterndrc_app/

.001). These clusters of high scores ('high-high' on the LISA map) often occur in the vicinity of important towns such as Bunia, Beni, Butembo, Goma and Bukavu, or along National Roads (NR) such as NR 4 in Mambasa territory (Ituri) and NR 5 in Fizi territory (South Kivu). The clusters of low scores indicate areas that are more difficult to access. They can be found further away from the provincial capitals where the condition of road infrastructure deteriorates, but also in and around more forested areas such as national parks (e.g. Maiko National Park).

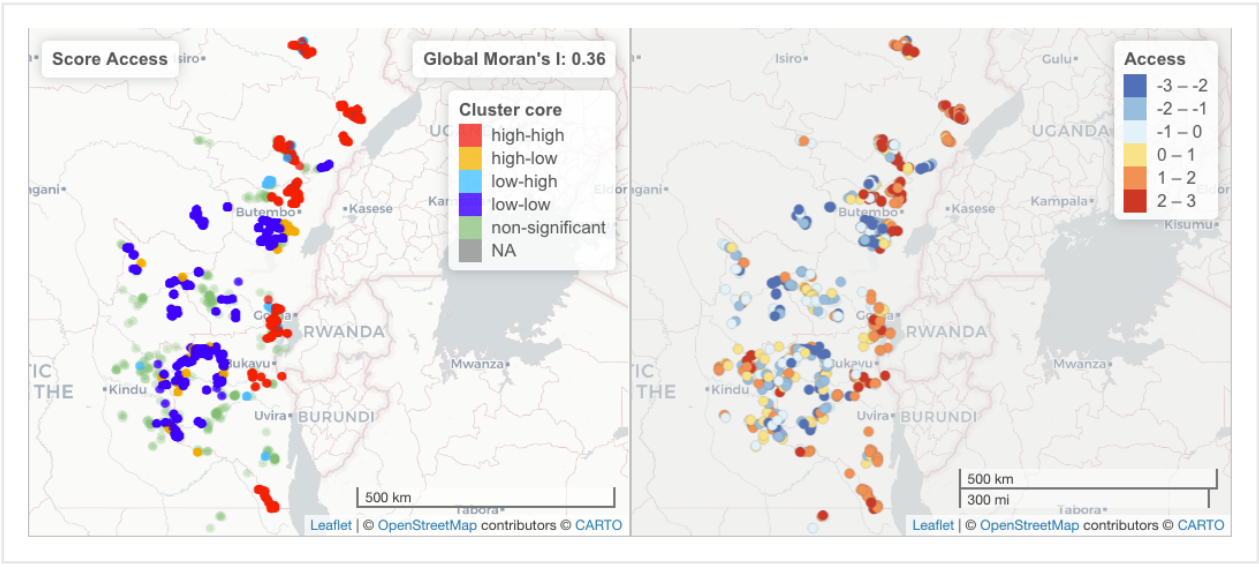

Figure 7. LISA map of the indicator 'access' (left). Map of scores (right).

3.3. Health and safety

The score calculation for 'health and safety' includes the following characteristics: child labour, number of accidents, use of protective equipment, and use of mercury (for the full list of criteria and scores, see "Appendix: score calculation"). The province of Ituri has one of the lowest safety scores (average score is -4.7 for 134 sites), along with Maniema and South Kivu (average score is -3.8 and -1.4 for 146 and 301 sites, respectively). When comparing safety scores by minerals mined, it is clear that gold mines (630 sites) score much lower than the other mining sites (e.g. average score for gold is -3, against -1.6 and -0.3 for Cassiterite and Coltan, respectively).

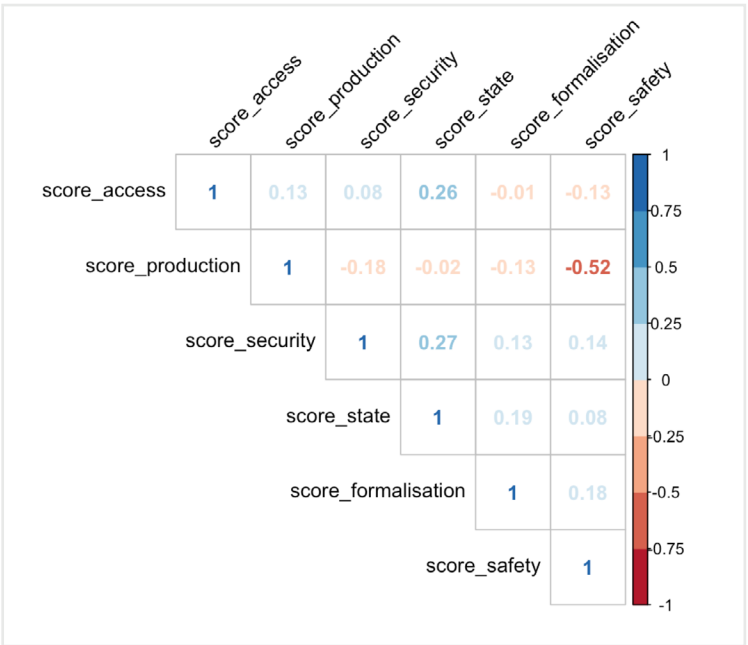

Figure 8. Correlogram showing the correlation between the different indicators (using Pearson correlation coefficient) for gold mining sites.

A correlogram is a correlation matrix that compares the scores of indicators by all possible pairs and provide with a Pearson correlation coefficient ranging from -1 (negative correlation) to 1 (positive correlation)[13]. Figure 8 indicates a strong negative correlation between the indicators 'safety' and 'production', meaning that more productive mining sites seem to struggle more often with issues related to 'health and safety', and especially within the gold mining sector (i.e. corr = -0.52, $P < .001$). (Figure 8)

A few factors may explain this correlation. Mercury is used for treatment of gold ores. A closer look at the data reveals that mercury is mainly used at the most productive gold mining sites. The median number of mine workers at gold mines using mercury is 103, compared with 60 workers for gold mines where no mercury is used. Mercury is used at 35% of the gold mines (228 of 654 mines). This 35% however employs almost 60% of the gold miners (109,521 gold miners). The same goes with 'child labour', another criteria for the scoring that has been observed at 36% of the mines (234 of 654 sites), while these sites employ 60% of the mine workers.

Finally, more productive mines having higher number of workers, the number of accidents naturally increases with production. On average, gold mines attract more miners than 3T mines. The median number of workers for gold and 3T mines is 70 and 61 workers, respectively. Gold sites are also much more prone to mining rushes, i.e. the sudden influx of hundreds or even thousands of miners after the discovery of a promising exploitation. These rush exploitations are hard to manage and therefore decrease safety.

The same observations applied a few years ago, when IPIS assessed gold mining in Beni territory (North Kivu). The area around Cantine (West of Beni town) was relatively productive. As 'security' was rather stable around Cantine, compared with the rest of the territory, IPIS observed more child labour in these mines, which resulted to a lower score for 'health and safety' than other mines in the territory. The fact that higher security level may also lead to a lower score for 'health and safety' highlights the complex interplay sometimes at stake between different indicators. Mercury was also used for gold processing at several of the mines supplying gold to Cantine.[14]

3.4. Security

Maniema is reported as one of the most secure provinces (average is -0.2) while North Kivu and Ituri have some of the lowest average security scores (average is -2.0 and -2.1, respectively). Gold mining sites are scoring the worst on all the security characteristics. While cassiterite and coltan have an average score of 0.6 and 1.1 for 'security' (median score is 3 for both), gold has an average score of -2.5 (median score being -3). Gold has traditionally been much more prone to illicit trade and interference of armed actors. In previous analyses, IPIS also highlighted the difference between the gold and 3T minerals. In 2015, IPIS reported that 64 % of gold miners work in the presence of an armed actor, compared with 21 % of 3T miners.[15]

Figure 9 shows that the sites with high security values (high-high) and low security values (low-low) tend to group together separately, reflecting contrasted security situation in eastern DRC. The border between Ituri and North Kivu, and South Kivu's Fizi territory tend to cluster particularly more as 'low-low'. Fizi territory is the area of operation of the Mai Mai Yakutumba. Previous reports[16] have already discussed in detail their involvement in natural resources exploitation. More to the west, on the border between Shabunda and Kabambare territories, Mai Mai Malaika tend to interfere in the area's gold mines. The low scores on the border area between Ituri and North Kivu are a consequence of the volatile security situation following the presence of CODECO and ADF. In Ituri, CODECO is present in several mines, as well as

13 Although the correlogram provides relevant insights into score correlations between indicators, it should be interpreted with caution as it does not recognise spatial effects such as spatial autocorrelation, which can inflate the correlation coefficient in areas where scores cluster the most.

14 IPIS, ASADHO and ASSODIP, *L'exploitation minière artisanale à Beni-Mbau : Etat des lieux et cartographie des sites miniers*, commissioned by International Organization for Migration (IOM) through the consortium 'Ensemble pour Beni', February 2020.

15 IPIS, *Analysis of the interactive map of artisanal mining areas in eastern DR Congo: 2015 update*, October 2016: https://ipisresearch.be/wp-content/uploads/2016/10/Analysis-and-map-artisanal-mining-DR-Congo_v005-1.pdf

16 IPIS, Conflict analysis and stakeholder mapping in South Kivu and Ituri, commissioned by Madini project, April 2021; UN Group of Experts reports on DRC: https://www.un.org/securitycouncil/sanctions/1533/panel-of-experts/expert-reports

the army units deployed there. In Beni territory, ADF atrocities have incited a heightened Mai Mai activity (in particular UPLC). Both ADF and UPLC sides have interfered in Beni's gold mines.

The clusters of sites with high scores indicate more secure areas. The cassiterite producing area of Kalima (centre of Maniema province) and the border between North and South Kivu appear as relatively secure areas. IPIS has observed limited direct interference in the mining business by armed actors. The border area between North and South Kivu is however notorious for the presence of Nyatura armed groups. During the last visits, their presence had mainly been observed in some villages, but not at the level of the mines. Nevertheless, a lot of the miners in the area are known to be Nyatura.[17] A closer look at the area also reveals some 'low-high' mining sites near Rubaya showing insecure mines in the middle of a cluster of more secure mines. This observation reflects some of the tensions and violence that occurred over the past years between the concession holder SMB and police forces on the one hand, and artisanal miners on the other hand.[18]

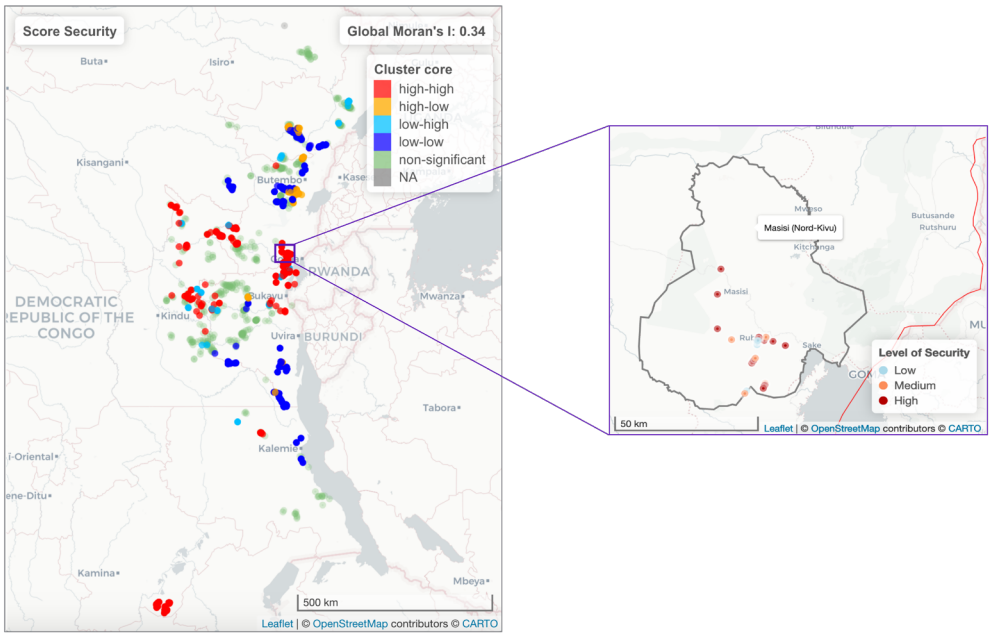

Figure 9. LISA maps of the scores for security indicator and score levels around Rubaya.

3.5. State presence

For the indicator 'state presence', we can also observe some geographically contrasted scores. In the first place, 3T mines tend to hold higher 'state presence' scores than gold, with an average score of 1.6 (median is 3) compared to an average of -1.0 for gold (median is -2). The area to the north-east of Kindu (at the lefthand side of the map, Figure 10) is Kalima, a well-known cassiterite mining area, where tin exploitation goes back to colonial times. The presence of the state mining company SAKIMA, the calm security situation, and the relatively good connection with the provincial capital Kindu, facilitate a high level of state presence. The border areas between Kalehe (South Kivu) and Masisi (North Kivu) territories have also higher levels of state presence (located in between Goma and Bukavu). Several reasons may explain this 'high-high' cluster: it is another 3T mining area, a lot of sites are covered by the iTSCi traceability system, and sites are more accessible for the state services.

17 IPIS, Mapping artisanal mining areas and mineral supply chains in eastern DR Congo Impact of armed interference & responsible sourcing, April 2019: p.30: https://ipisresearch.be/wp-content/uploads/2020/10/1904-IOM-mapping-eastern-DRC.pdf

18 The June 2021 report of the UN Group of Experts discusses these tensions in detail: *Final report of the Group of Experts on the Democratic Republic of the Congo*, 10 June 2021, S/2021/560

Several of the low-low clusters (i.e. low state presence), can be explained by high levels of insecurity. In southern Lubero, for example, the armed groups FFP/AP (of rebel leader Kabidon)[19] and NDC-R (Guidon) prohibit state agents from visiting the gold mines.

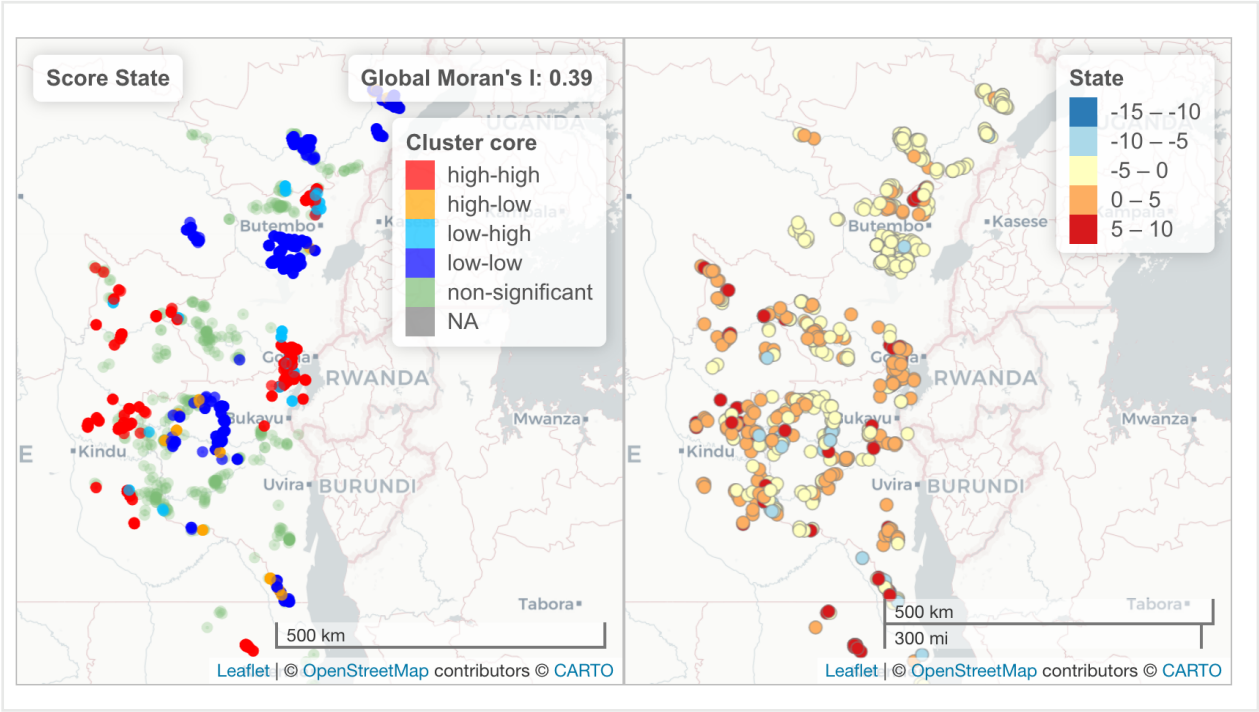

Figure 10. Lisa map (left) of the indicator state presence. Map (right) with the scores of the indicator state presence.

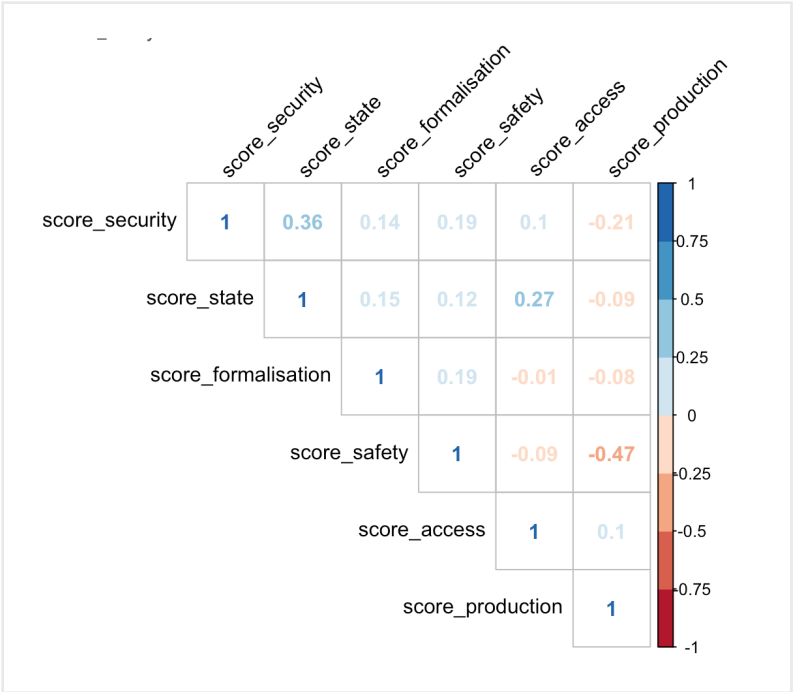

Figure 11. Correlogram showing the correlation between the different indicators (using Pearson correlation coefficient) for all mining sites

Figure 11 indicates a positive correlation between 'security' and 'state presence' on mining sites (corr = 0.36, $P < .001$). This suggests that higher levels of security (less armed groups, less interference in mining by armed groups, and less violence) have been reported in mining sites with regular presence of state actors that behave properly (see "Appendix: score calculation"). This correlation is true for both Gold and 3T, but even more outspoken for the latter (corr = 0.43, $P < .001$).

19 Final report of the UN Group of Experts on the DRC, 10 June 2021, S/2021/560, Annex 30

It is noteworthy that 'state presence' is often rather the consequence of higher security levels, than the contrary. In several territories, state agents testify how they could not visit mines under control of armed groups (e.g. Mai Mai Luc in Bafwasende, or Mai Mai Mailaika in Kabambare). (Figure 12)

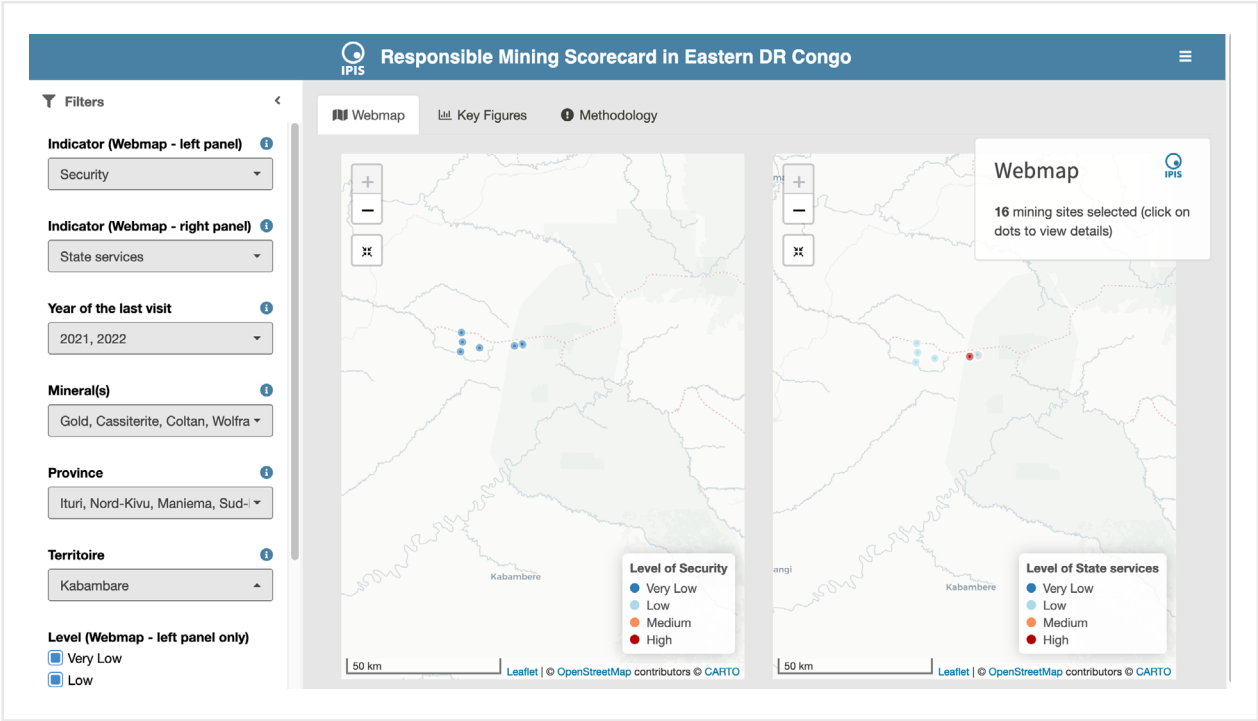

Figure 12. Screenshot of the Responsible mining scorecard, zooming in on Kabambare territory, where Mai Mai Malaika controls several gold mines.

Figure 11 shows another significant positive correlation between 'state presence' and 'access' to the mining sites (i.e. corr = 0.27, $P < .001$). This is understandable as the more accessible a site is, the easier it is for state services to be present. It does also flag one of the main challenges for ASM: many mining sites are remote and hard to access, consequently state control is very limited in these areas.

4. FUTURE WORK AND WORD OF CAUTION

In the coming years, IPIS aims to 1) update the calculation of the responsible mining scorecard after each new visit by its teams, 2) implement the calculation system to a growing number of mining sites; and 3) keep refining its methodology on data collection.

It is noteworthy that certain caveats will remain:

- The data collected at the mining sites should be considered as a snapshot of the situation at the mining site at the time of the visit. As the mining sector in eastern DRC is extremely dynamic, the responsible scorecard is not always reflecting the latest evolutions. To help the user assess the tenability of the data, the 'last visit date' can be consulted in the dashboard by clicking on individual mining sites. Furthermore, the user can filter results based on the 'year of the last visit'.

- The geographic extent of the mining sites covered by the responsible mining scorecard is not representative of the entire mining sector in eastern DRC. Some active mining areas have not been visited for instance because of insecurity in the region, which could represent a selection bias. Similarly, mining scorecards cannot be calculated for mining sites that are inactive (no worker) due to insecurity or climatic circumstances at the time of the visit.

- After filtering by territory, some mining sites may appear outside the limits of their territory as displayed on the map. This discrepancy is due to a lack of digital geographic data from official sources to define the exact limits of each territory.

- The data used for the calculation of the formalization indicator, namely the mine qualification status by the joint validation missions and the legal status of the mine, are not always up to date. IPIS strives to always use the most up-to-date information.

The scorecard provides a comprehensible overview of mining sites, and areas, on criteria that are important to assess challenges and opportunities for responsible mining and mineral sourcing. While the scorecard is accessible and concise, the indicators' scores summarise a wide range of data. As a result, the scores may not reflect certain nuances and complexities observed on the ground. When zooming into specific areas, we invite the users to look for more detailed and nuanced information in the IPIS' Open Data Dashboard[20] and Open Data download page[21].

20 https://ipisresearch.be/nl/publication/ipis-open-data-dashboard-on-the-artisanal-and-small-scale-mining-sector-in-eastern-drc/

21 https://ipisresearch.be/nl/home/maps-data/open-data/ and http://geo.ipisresearch.be/geoserver/web/wicket/bookmarkable/org.geoserver.web.demo.MapPreviewPage;jsessionid=D3FC604F4A8E78E995517A74D4F1C97C?0

5. APPENDIX: SCORE CALCULATION

5.1. Sécurité

Indicateur	Valeur	Score	Importance
Visites de groupes armées non-étatiques à la mine	• Un groupe armé non-étatique fréquente le site • Aucun groupe armé non-étatique n'a fréquenté le site dans les 6 derniers mois	-1,5 0	4
Barrières de groupes armés autres que FARDC sur les routes d'accès aux mines (routes entre mine et point de vente)	• Oui (un ou plusieurs) • Non	-1 0	3
FARDC présence et ingérence	• Travail forcé, pillage et/ou possession des puits • Taxes illégales imposées, monopole de la vente, achat d'or ou d'autres produits et/ou extraction minière par les FARDC • Pas d'ingérence dans les 6 derniers mois ou pas d'information • Pas de présence des FARDC sur le site dans les 6 derniers mois	-1,5 -1 0 1	3
Barrières des FARDC sur les routes d'accès aux mines	• Une ou plusieurs barrières où les FARDC prélèvent des taxes illégales • Aucune barrière ou seulement des barrières stratégiques/de sécurité des FARDC	-1 0	2
Toutes les formes de violences sexuelles	• Plusieurs cas de violences sexuelles dans les 6 derniers mois • Aucun cas de violences sexuelles dans les 6 derniers mois • Ne sais pas	-1 0 0	3
Autres conflits et tensions	• Ces 6 derniers mois, le site minier a été touché par des conflits entre creuseurs, coopératives, populations locales, compagnies, etc. • Aucun conflit ou tension dans les 6 derniers mois	-1 0	2
Violence	• Ces 6 derniers mois, ces conflits ou tensions se sont transformés en violence (contre les civils) • Ces 6 derniers mois, ces conflits ou tensions ne se sont pas transformés en violence • Ne sais pas	-1 0 0	2

5.2. Accessibilité

Indicateur	Valeur	Score	Importance
Moyen de transport pour accéder au site depuis le point de vente (saison sèche)	• Pour accéder au site, il faut plus de 2 heures à pied • Pour accéder au site, il faut moins de 2 heures à pied • Le site est entièrement accessible en voiture (4x4) ou à moto	-1 0 1	1
Moyen de transport pour accéder au site depuis le point de vente (saison des pluies)	• Pour accéder au site, il faut plus de 2 heures à pied • Pour accéder au site, il faut moins de 2 heures à pied • Le site est entièrement accessible en voiture (4x4) ou à moto	-1 0 1	1
Réseau téléphonique	• Non • A distance de marche • Sur le site	-1 0 1	1

5.3. Statut niveau de formalisation du site minier

Indicateur	Valeur	Score	Importance
Qualification du site	• Le site a la qualification 'rouge' • Le site a la qualification 'jaune' • Le site n'a pas de qualification • Le site a la qualification 'verte'	-1,5 -1 0 1	2
Statut légal du site	• Il y a un litige sur le titre et/ou la propriété foncière • Le statut légal du site minier est inconnu ou n'est pas clair • Le site minier est situé sur la concession d'une entreprise industrielle • Il n'y a pas de titre minier • Le site est situé sur une ZEA	-1 -1 -1 0 1	3
Légalité des creuseurs	• Entre 0 et 25% des travailleurs ont la carte de creuseur • Entre 26 et 50% ont la carte de creuseur • Plus de 50% ont la carte de creuseur	-1 0 1	1
Présence de coopératives et/ou regroupements de creuseurs	• Oui • Non	1 0	2
Les coopératives/ regroupements ont été agréés ou ont reçu un avis favorable du gouvernement provincial	• Oui • Non	1 0	1
Des femmes occupent une position managériale dans la coopérative	• Au moins une femme (présidente, vice-présidente, trésorière) • Aucune	1 0	0,5

5.4. Production de la mine

Indicateur	Valeur	Score	Importance
Nombre de travailleurs	• Moins de 100 travailleurs • Entre 101 et 200 travailleurs • Plus de 200 travailleurs	-1 0 1	3
Niveau de mécanisation	• Bas (pioche, pelle, machette, barre de fer, brouettes, batées) • Moyen (marteau piqueur, poulie, treuil, motopompe, canne à sonder, détecteur de métaux, laverie, tronçonneuses) • Haut (concasseur, broyeur, ventilateur, barges)	-1 0 1	1
Nombre de jours travaillés par semaine en saison sèche	• 1- 3 jours • 4-5 jours • 6-7 jours	-1 0 1	1
Nombre de jours travaillés par semaine en saison humide	• 1- 3 jours • 4-5 jours • 6-7 jours	-1 0 1	1

5.5. Surveillance et ingérence de l'État

Indicateur	Valeur	Score	Importance
Fréquence des visites du SAEMAPE et/ou de la Division des Mines	• Moins d'une fois par mois • Une ou plusieurs fois par mois mais moins d'une fois par semaine (pour au moins un des services) • Chaque semaine	-1 0 1	3
Le SAEMAPE et/ou la Division des Mines offre(nt) des formations et une assistance régulière aux creuseurs	• Oui • Non • Ne sais pas	1 0 0	2
Collecte des données par le SAEMAPE et/ou la Division des Mines	• Documents écrits sur la production, cartes de creuseurs/négociants • Pas de documents écrits • Ne sais pas	1 0 0	1
Présence de la Police des Mines	• Oui, pour faire appliquer la loi • Oui, pour d'autres raisons • Ne sais pas	0 -1 0	2
Imposition illégale ou harcèlement par des services de l'État autres que SAEMAPE et Division des mines	• Imposition illégale ou harcèlement • Pas d'imposition illégale ou de harcèlement	-1 (par service*) 0	2
Propriété des puits ou des chantiers par les services de l'État	• Des membres du service possèdent des puits sur le site • Aucun membre du service ne possède de puits sur le site	-1 0	2
Reçu après taxation	• Non • Ne sais pas • Oui	-1 0 1	1

5.6. Santé et sécurité

Indicateur	Valeur	Score	Importance
Utilisation d'équipements de protection individuelle	• La majorité des travailleurs porte des protections (casque, casque anti-bruit, lunettes de protection, masque anti-poussière) • La majorité des travailleurs ne porte pas de protections	1 0	2
Accidents avec blessés	• Au moins un creuseur a été blessé en raison d'un accident sur le site dans les 6 derniers mois. • Il n'y a pas eu d'accidents avec blessés dans les 6 derniers mois	-1 0	2
Accidents mortels	• Au moins un creuseur est décédé en raison d'un accident sur le site dans les 6 derniers mois. • Il n'y a pas eu d'accident mortel dans les 6 derniers mois	-1 0	3
Profondeur maximale des puits	• Plus de 30 mètres • Moins de 30 mètres	-1 0	2
Travail des enfants (exploitation minière)	• Des enfants (entre 0-15 ans) effectuent des travaux miniers dangereux (descente dans les puits, traitement au mercure, plongée) • Des enfants (entre 0-15 ans) effectuent d'autres travaux miniers (transport des minerais, lavage) • Aucun enfant (entre 0-15 ans) n'effectue de travaux miniers sur le site	-1,5 -1 0	3
Travail des enfants (autre)	• Des enfants (entre 0-15 ans) effectuent d'autres travaux (transport de biens, restauration, commerce) • Aucun enfant (entre 0-15 ans) ne travaille sur le site	-1 0	2
Structures sanitaires pour les femmes	• Il existe des structures sanitaires séparées pour les femmes sur le site • Il n'existe pas des structures sanitaires séparées pour les femmes	1 0	2
Utilisation du mercure et d'autres produits chimiques dont cyanure	• Utilisation • Pas d'utilisation	-1 0	2
Combustion de mercure à l'air libre	• Le mercure est brûlé à l›air libre sur le site/ près du site • Le mercure n'est pas brûlé à l›air libre	-1 0	2

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