Environmental Research of the
Federal Ministry for the
Environment, Nature Conservation and Nuclear Safety

Project number: 3715 32 3100

Report number: FB000275/ANH,5,4,ENG

# OekoRess II: Country Case Study II

## India: Iron Ore Mining (Bailadila)

by

Dolega, Peter; Rechlin, Aissa; Projekt-Consult

Rüttinger, Lukas; Scholl, Christine; van Ackern, Pia; adelphi

On behalf of the German Environment Agency

Completion date March 2017

**Abstract**

The project "Further development of policy options for an ecological raw materials policy" (OekoRess II) builds on the results of two preceding research projects, UmSoRess and OekoRess I. It links experiences gained in the analysis of environmental and social standards with the assessment of environmental risks in the mineral resources sector. The project team conducts 10 case studies to evaluate and refine the method to assess site-related environmental hazard potentials posed by mining operations, which was developed in the OekoRess I project. The focus is on improving the indicator for environmental sector governance, by comparing the assessed environmental hazard potentials, the observed environmental impacts and the governance analysis with existing governance indicators. The aim is to answer the questions whether existing governance indices and indicators are able to adequately reflect the capacity of governments, companies and civil society to manage potential environmental hazards and avoid or reduce environmental impacts of mining.

This case study analyses the environmental hazard potentials and the actually reported environmental impacts of the Bailadila iron ore mining complex in India, which is one of the country's largest iron ore mines. The main environmental impacts observed at the site are large-scale deforestation, water contamination as well as increased noise and dust levels. The assessment of environmental hazard potentials pointed accurately to the water contamination with heavy metals. The deforestation and increased dust emissions were indirectly described by the environmental hazard potentials for the indictor "mine type", since open pit mines are often associated with wide-ranging impacts on the landscape. However, the environmental hazard potentials for remediation measures and protected areas were lower than the actual impacts identified at the site.

India's overall weak sector governance is reflected well by most governance indicators assessed. The country's struggle with corruption, political instability in parts of the country and insufficient regulation is well reflected in the Worldwide Governance Indicators. The Fraser Investment Attractiveness Index captures best the uncertainties in the interpretation and enforcement of regulations, regulatory duplication and inconsistencies as well as the weak legal system. In terms of environmental governance, the Environmental Performance Index reflects India's weak governance well, while the Environmental Democracy Index seems to strongly overestimate India's governance capacities in the mining sector.

**Kurzbeschreibung**

Das Vorhaben „Weiterentwicklung von Handlungsoptionen einer ökologischen Rohstoffpolitik" (ÖkoRess II), welches auf den Ergebnissen zweier vorangegangener Forschungsprojekte (UmSoRess und ÖkoRess I) aufbaut, verbindet Erfahrungen aus der Analyse von Umwelt- und Sozialstandards mit der Bewertung von Umweltrisiken im Rohstoffsektor. Das Projektteam führte 10 Fallstudien durch, um die im Rahmen des ÖkoRess-I-Projekts entwickelte Methode zur Bewertung standortspezifischer Umweltgefährdungspotenziale im Bergbau zu evaluieren und weiterzuentwickeln. Der Fokus liegt auf der Verbesserung des Indikators für Umwelt-Governance, indem die bewerteten Umweltgefährdungspotenziale, die tatsächlichen Umweltauswirkungen und die Governance-Analyse mit vorhandenen Governance-Indikatoren verglichen werden. Ziel ist es, die Frage zu beantworten, ob die Governance-Indikatoren in der Lage sind widerzuspiegeln, inwiefern relevante Akteure (Regierungen, Unternehmen und Zivilgesellschaft) potentielle Umweltgefährdungen bewältigen und Umweltauswirkungen des Bergbaus vermeiden oder reduzieren können.

In dieser Fallstudie werden die Umweltgefährdungspotenziale und die tatsächlichen Umweltauswirkungen des Eisenerzkomplexes Bailadila, das eine der größten Eisenerzminen in Indien ist, analysiert. Die dort beobachteten Hauptumweltauswirkungen sind großflächige Entwaldung, Wasserverschmutzung sowie erhöhter Lärmpegel und Staubemissionen. Die analysierten Umweltgefährdungspotentiale

haben akkurat auf die Wasserverschmutzung mit Schwermetallen hingewiesen. Die Entwaldung und die erhöhten Staubemissionen wurden indirekt durch die Umweltgefährdungspotentiale für den Indikator „Bergbautyp“ beschrieben, da Großtagebaue häufig mit weitreichenden Auswirkungen auf die Landschaft verbunden sind. Die Umweltgefahrenpotenziale für Rekultivierungsmaßnahmen und Schutzgebiete waren jedoch geringer eingeschätzt, als die am Standort tatsächlich festgestellten Auswirkungen.

Die meisten der analysierten Governance-Indikatoren spiegeln Indiens insgesamt schwache Bergbau-Governance adäquat wider. Die Worldwide Governance Indicators deuten hinreichend auf Probleme mit Korruption, politischer Instabilität in Teilen des Landes und unzureichende Regulierung hin. Der Fraser Investment Attractiveness Index wiederum erfasst die Unsicherheiten bei der Interpretation und Durchsetzung von Vorschriften, aufsichtsrechtliche Überschneidungen und Inkonsistenzen sowie das schwache Rechtssystem des Landes. In Bezug auf Umwelt-Governance spiegelt der Environmental Performance Index die schwache Regierungsführung gut wider, während der Environmental Democracy Index die Governance-Kapazitäten Indiens im Bergbausektor stark zu überschätzen scheint.

# Table of Contents

## List of Figures

## List of Tables

## List of Abbreviations

| | |
|---|---|
| **AMD** | Acid Mine Drainage |
| **CPCB** | Central Pollution Control Board |
| **CPI(ML)** | Communist Party of India (Marxist -Leninist) |
| **DPSIR** | Driving forces, Pressures, States, Impacts and Responses |
| **EDI** | Environmental Democracy Index |
| **EIA** | Environmental Impact Assessment |
| **EPA** | Environment Protection Act |
| **EPI** | Environment Performance Index |
| **FIMI** | Federation of Indian Mineral Industry |
| **FRA** | Forest Rights Act |
| **GDP** | Gross Domestic Product |
| **GPI** | Global Peace Index |
| **GSI** | Geological Survey of India |
| **ha** | Hectare |
| **HDI** | Human Development Index |
| **ISO** | International Organization for Standardization |
| **kWh** | Kilowatt hour |
| **Mil. t/a** | Million tons per annum |
| **MMRD** | Mines and Mineral (Regulation and Development) Act |
| **MoEF&CC** | Ministry of Environment, Forest and Climate Change |
| **NMDC** | National Mineral Development Corporation |
| **OekoRess** | UBA Project "Discussion of ecological limits of raw materials production and development of a method to evaluate the ecological availability of raw materials with the aim of further developing the criticality concept" |
| **PESA** | Panchayats (Extension to Scheduled Areas) Act |
| **PH** | Hydrogen Ion Concentration |
| **SDF** | Sustainable Development Framework |
| **ST** | Scheduled Tribes |
| **UBA** | Umweltbundesamt (German Environment Agency ) |
| **UmSoRess** | UBA Project "Approaches to reducing negative environmental and social impacts in the production of metal raw materials" |
| **UN** | United nations |
| **UNDP** | United Nations Development Programme |
| **US$** | United States Dollars |
| **WGI** | Worldwide Governance Indicators |

| | |
|---|---|
| **WHO** | World Health Organization |

# 1 Focus of the study and relevance

The following case study is the second of ten case studies that are being prepared as part of the project Further development of policy options for an ecological raw materials policy" (OekoRess II) commissioned by the German Federal Environment Agency. The case studies build on the results of two research projects, the UmSoRess[1] project and the OekoRess I[2] project. In UmSoRess, the impacts of raw material production on the environment, society and the economy were analyzed in 13 case studies.[3] The goal of the case studies was to gain a better understanding of the connections between the environmental and social impacts of mining in the context of various countries with different problems and governance contexts. In OekoRess I, a method to evaluate the ecological availability of raw materials and the site-related environmental hazard potentials posed by mining operations was developed with the aim to further developing the criticality concept.

As part of the follow-up project OekoRess II, 10 additional case studies will be conducted combining the analytical approaches of UmSoRess and OekoRess I in order to evaluate and further develop the method to assess the site-related environmental hazard potentials posed by mining operations, which was developed in the OekoRess I project. This effort will particularly focus on improving the indicator for environmental sector governance used in the methodology, by comparing the assessed environmental hazard potentials, the observed environmental impacts and the governance analysis with existing governance indicators. The aim is to answer the questions if existing governance indices and indicators are able to adequately reflect the capability of governments, companies and civil society to manage potential environmental hazards and avoid or reduce environmental impacts of mining. The results of the 10 case studies will be compared and a set of governance indicators will be identified that can be used to improve the raw-material-specific assessment approach developed as part of the OekoRess I project.

This case study analyses the environmental hazard potentials and the environmental impacts of the Bailadila iron ore mining complex in India and the country's mining governance. The Bailadila iron ore complex is one of the largest iron ore mines in India and operates in a highly mechanized way. The mining operation has led to pollution of groundwater and rivers, deforestation, high noise levels and impacts on people's health. Mining is also happening against the backdrop of an on-going conflict with a non-state armed group and has led to protests of the local communities.

The case study is structured in four parts: First, the structure of the mining sector of India and its contribution to the national economy is analysed (chapter 2). Second, a brief overview of the Bailadila mining complex is given. The geographic and geologic context is analysed followed by an overview of the applied mining and processing methods (chapter 3). Third, the environmental hazard potentials posed by the mining operation are discussed using the OekoRess I methodology and selected environmental impacts and reactions to these are described using the DPSIR framework that was also used in the UmSoRess case studies (chapter 4).[4] Fourth, the governance of India's mining sector is analysed (chapter 5) and last, the findings of the assessment of the potentials for environmental hazards and environmental impacts and the governance analysis are compared to existing governance indicators and indices and first conclusions for the methodology development are drawn (chapter 6).

[1] Approaches to reducing negative environmental and social impacts in the production of metal raw materials. For more information see https://www.umweltbundesamt.de/umweltfragen-umsoress

[2] Discussion of ecological limits of raw materials production and development of a method to evaluate the ecological availability of raw materials with the aim of further developing the criticality concept. For more information see https://www.umweltbundesamt.de/umweltfragen-oekoress

[3] The case studies and fact sheets on the standards and approaches analysed can be accessed here: https://www.umweltbundesamt.de/umweltfragen-umsoress

[4] The DPSIR framework comprehensively accounts and visualizes the causal connection between environmental issues, their origin, their impacts and the responses taken. The model consists of driving forces, pressures, state, impacts and responses. For further information, see e.g. Kristensen (2004).

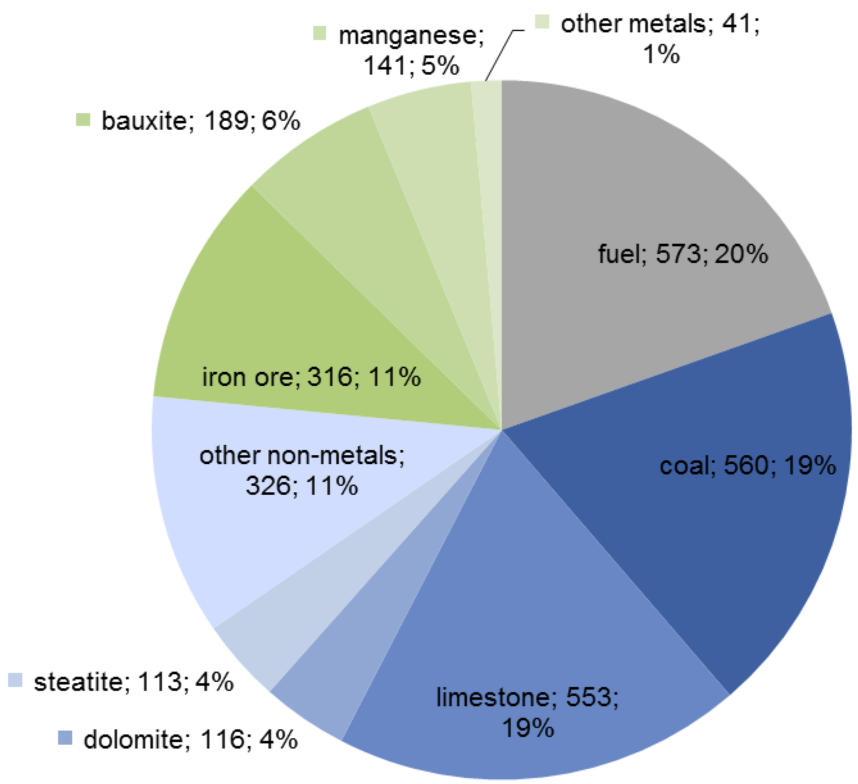
## 2 Structure and macroeconomic relevance of India's mining sector

In 2012, India's mining sector provided 3 million jobs directly and 8 million indirectly. The same year the direct and indirect contribution of the mining sector to GDP amounted to US$ 50 billion. The total government revenue from mining and its downstream sectors added up to US$ 18 billion (McKinsey 2014). Compared to other mining countries, the GDP contribution of the extractive industry is low and declining. While the contribution to the GDP in 1992 was 3.4 %, it only amounted to approximately 2 % in 2012 (FICCI 2013). The export of ores, metals and coal amounted to 11.4 % of total merchandise exports in 2012 (Haglund et al. 2014).

The mining sector in India grows at a much smaller rate in comparison to other major mining countries. Between 2010 and 2012, the Indian mining sector grew by 0.8 %. In comparison: The Chinese mining sector grew in the same timeframe by 15 %, the mining sector of the USA by 2.5 % and the mining sector of Canada and Brazil by 2 % (McKinsey 2014).

In India, metal ores are extracted in 687 mines and non-metallic minerals in further 1,668 mines. The major three mined materials are coal, limestone and iron ores. These are mined in 560, 553 and 316 mines, respectively. Other important ores for the Indian economy are bauxite and manganese ores (compare Figure 2-1) (FICCI 2013).

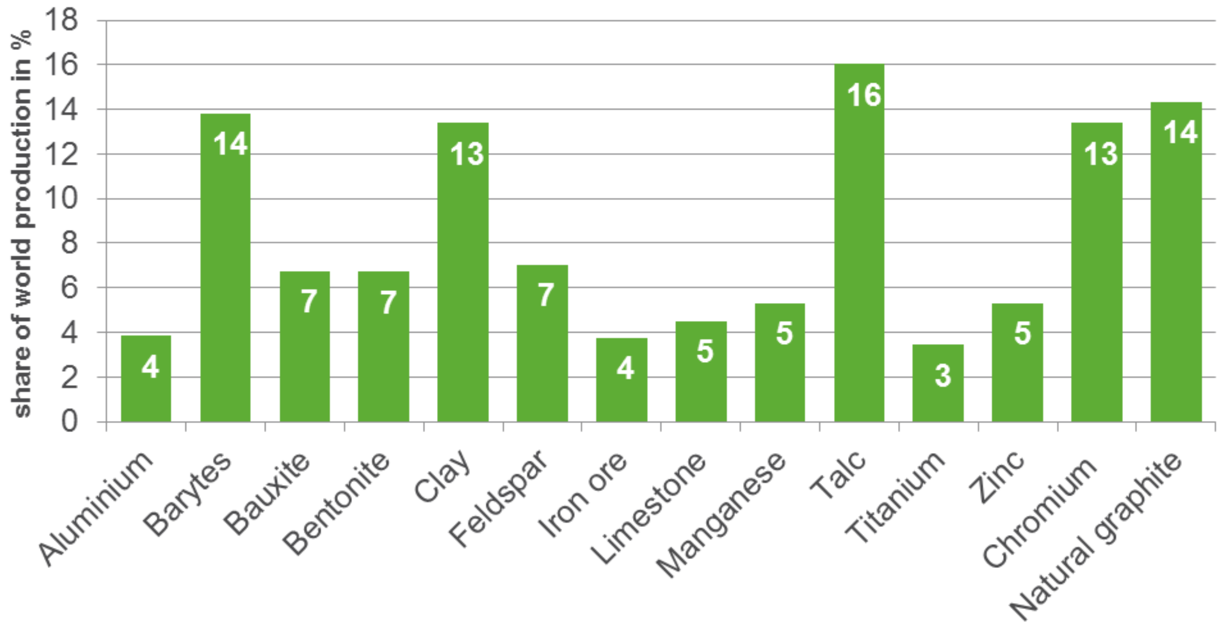
Figure 2-1: Share of number of mines in India in 2010 (material; number of mines; share)




Source: Own graphic based on information in FICCI (2013).

In total 87 minerals are produced in India, including 4 fuel minerals, 10 metallic minerals, 47 non-metallic minerals, 3 atomic minerals and 23 other minerals, such as building materials (FICCI 2013). Approximately one fifth of global barite, clay, talc, chromium and graphite were produced in India in 2014 (compare Figure 2-2).

Figure 2-2: India's share of world production for selected raw materials in 2014

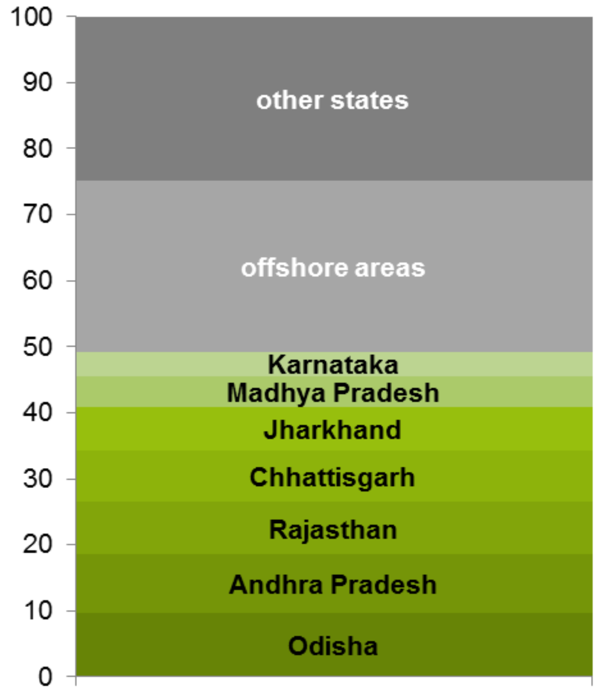



The figure was compiled based on information in USGS (2016).

The mining industry in India is dominated by the public sector, which accounted for 68 % of mineral production in 2012. Although the National Mineral Policy was reformed in 2008 to attract more private sector participation, the incentives have not been sufficient to foster more private investment in the industry. Domestic and Foreign Direct Investments are relatively low. Less than 0.5 % of global exploration expenditures in 2010 were spent in India. According to the Federation of Indian Chambers of Commerce & Industry, there are three main reasons for the lack of investment. First, the regulatory and administrative procedures are not adequate; second, infrastructure facilities are underdeveloped and third, sustainability issues (FICCI 2013).

Nearly half of all mined materials production value (including oil and gas) in India was produced by only seven of 29 states (Figure 2-3) in 2010 (FICCI 2013). Additionally almost a quarter was produced by offshore areas, where almost exclusively oil and gas are extracted. Therefore, the significance of the mining industry in these seven key states is even higher (FICCI 2013).

Figure 2-3: Share of mineral production by federal state




Source: Own graphic based on information in FICCI (2013).

The country had estimated iron ore resources of 28 billion tons in 2010; the most important ores being hematite and magnetite (FICCI 2013). India is the fourth largest producer of iron ore (rank in 2014), accounting for approximately 5 % of the world's iron production (USGS 2016).

# 3 Overview of the Bailadila mining operation and geology

The Bailadila Iron Ore Mine complex is operated by the National Mineral Development Corporation Limited (NMDC), which is the largest producer of iron ore in India. NDMC is a mineral producer owned by the Government of India and is under administrative control by the Ministry of Steel (NMDC Limited 2016b). The state owned company NDMC was founded in 1958 (NMDC Limited 2016a). In 1968, the first iron ore mine opened in Bailadila in cooperation with a Japanese steel manufacturer (NMDC Limited 2016b). Since the opening of the first mine the company expanded its operations in the region, exploiting several deposits covering an area of 29.6 km² (NMDC Limited 2010).

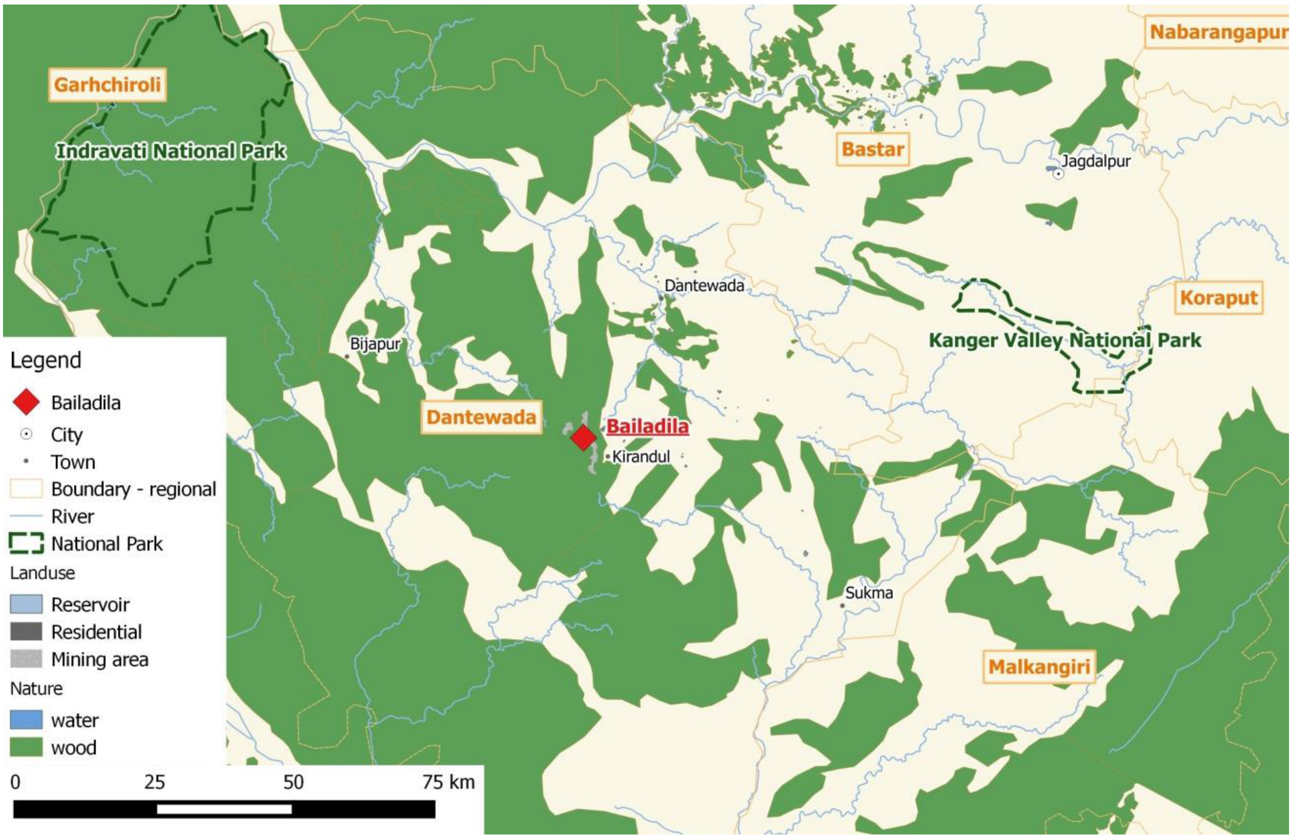
## 3.1 Geography

The Bailadila mine complex is located in the southern part of the state Chhattisgarh in the district Dantewada in the eastern part of central India (compare **Fehler! Verweisquelle konnte nicht gefunden werden.** and Figure 3-2). The ore deposits are situated within the Bailadila range, a 36 km long and 10 km wide hill range with its highest peak at 1,276 meters above sea level. The area is characterised by a rugged terrain, planes are ranging between 300 and 400 m with smaller hills of up to 600 m. The geomorphology of the area is characterised by relict hill ridges with cliffs that formed because of harder iron ore bodies withstanding erosion. In total, there are 14 iron ore deposits, which are separated into two complexes - Kirandul in the south and Bacheli in the north (Tata Energy Research Institute 2002; Central Pollution Control Board 2007).

Figure 3-1: Location of the Bailadila mining complexes


Source: Own graphic.

Figure 3-2: Location of the Bailadila mine complex




Source: Base Data © OpenStreetMap contributors (www.openstreetmap.org), artography: ifeu Institute 2016.

The surroundings of the mine are covered by a wide spread of tropical dry deciduous forest. Hilltops are not covered by vegetation (Tata Energy Research Institute 2002). The surroundings of the mine are not protected as conservation areas and no endangered animal or plant species are found in the surroundings of the mines (Vimta Labs 2015). Still, the flora and fauna are described as rich (Tata Energy Research Institute 2002) and the area is referred to as an ecological hotspot which is threatened by the mining activities by the Centre for Science and Environment (CSE India n.d.).

The climate is tropical with intense monsoon rainfall (Nova Mining 2014), with precipitation being much higher during summer than winter. The mean annual rainfall is 1,391 mm. Cyclic heavy rain occurs every 4 to 5 years. The mean annual temperature is 26.2°C (Tata Energy Research Institute 2002).

The main rivers in the area are Shankhini and Dankini, which are used for irrigation for agriculture. According to the Centre for Science and Environment (CSE India n.d.), the rivers are among the most polluted in India.

Prior to the mining project, access to the region from the rest of the country was limited. Infrastructure was built during the development of the mine. NMDC financed the building of all-weather roads connecting villages and a connection to the state highway. In addition, peripheral villages were electrified and provided with streetlights (Tata Energy Research Institute 2002).

## 3.2 Geological context and ore deposit formation

The deposits of the Bailadila mountain range formed along two N-S trending synclinal ridges (Mukherjee et al. 2010). The latter are reflected in the geomorphology in two nearly parallel ridges (Figure 3-3). The formation of the deposit consists of sedimentary and metamorphic rocks from the Paleoproterozoic era (Geological Survey of India 2005). The iron ore occurs as banded hematite quartzite. Those ores vary in their appearance from solid ores to flaky friable, soft ore, laterite and blue dust (NMDC Limited 2010). The banded iron ore is only slightly dipping. Hence, exploration by vertical drill holes filled with explosives is common.

## 3.3 Mining and Processing

The deposits at the Bailadila range are exploited in a highly mechanized open pit mining procedure. The mine produces lump ore (10 mm to 150 mm) and fine ore (-10 mm) (Vimta Labs 2015). The operation systematically forms benches by open cast mining and deep hole drilling (Central Pollution Control Board 2007). NMDC uses bench blasting, which is a commonly used blasting method in open pit mining. After blasting, heavy-duty earth moving machines transport the material. Bulldozers dump the overburden and side burden dumped along hill slopes. Currently, no material is used for backfilling the pits (Central Pollution Control Board 2007). The high-grade ore is mechanically crushed in a multi-step procedure to a fraction size between >10 and 40 mm, which is then sold as calibrated lump ore. Part of the process is wet screening, where fine ore fractions are separated and stockpiled while slimes are dewatered and pumped to tailings storage facilities (Kumar and Rustan 1996).

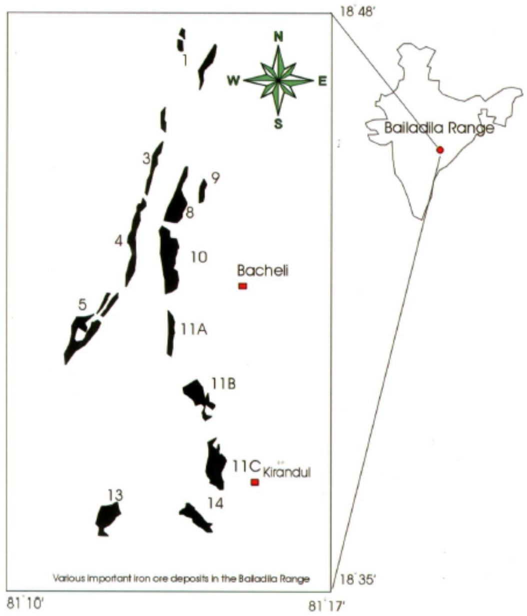
The tailings storage facilities are not located within the lease areas of the mines. Approximately 3 to 5 % of the run-off mine[5] is dumped in the tailings storage facilities as slurry (Central Pollution Control Board 2007).

Most of the land used by the operation is under quarrying (25 to 35 % of land use), 2 to 10 % is under waste dumps and 4 to 15 % is used for plant and infrastructure facilities. Mineral processing facilities are attached to the large mines, whereas tailing impoundment/dams are located mostly outside the mining lease area. The generation of waste rock (overburden and intra-burden) ranges from 0.15 to 0.35 tons of waste per ton of run-of-mine ore. Waste rock is taken by dumpers to the nearest waste rock dump. Afterwards, further slimes/ tailings are generated of the order of 3 to 5 % of the run-of-mine ore during processing (Central Pollution Control Board 2007). This summarizes to 18 – 40 % of overall waste (overburden, intra-burden, and slimes/tailings) per ton of run-of-mine ore.

[5] Run-off mine is the mined ore, which is of a size that can be processed without further crushing. The less crushing is needed, the less energy input is required.

The lump ore is transported via railway (Kumar and Rustan 1996) to the harbour of Visakhapatnam, which is approximately 400 kilometres southeast of the mine (NMDC Limited 2016b) and shipped overseas. Additionally to the transport over road, a 267 km long pipeline facilitates the transport of 800,000 tons of fragmented iron ore annually from the mine to the harbour. The pipeline came into use in 2006 and at the time was the second longest pipeline worldwide. The pipeline cuts down transport costs drastically to seven times less than road transport (Putul 2007).

Figure 3-3: Distribution of Bailadila iron ore deposits




Source: Mukherjee et al. (2010).

Figure 3-3 shows the Location of the 14 identified ore deposits. Currently, the deposits 14 and 11B in the Kirandul complex as well as 5, 10 and 11A in the Bacheli complex are exploited. Deposits 4 and 13 are in the scope of future expansion (NMDC Limited 2016a). Deposit 14 has been mined since 1968, followed by 5 in 1977 and 11C in 1987. The deposits 10 and 11B started production in 2003 and 11 B operates since 2015. The annual production capacity amounts to 36 million tons of iron ore (compare Table 3-1). In 2011, the actual production of the Bailadila mine complex amounted to approximately 20 million tons (NMDC Limited 2016a).

Table 3-1: Production capacities and start of operation of Bailadila deposits

| Deposit no. | Operating since | Production capacity (mil. t/a) |
|---|---|---|
| 14 | 1968 | 5.0 |
| 5 | 1977 | 10.0 |
| 11C | 1987 | 7.0 |
| 10 / 11A | 2003 | 7.0 |
| 11B | 2015 | 7.0 |
| Total production capacity | | 36.0 |

Source: Vimta Labs (2015).

The currently mined deposits of Kirandul and Bacheli complex contain more than 1,200 million tons of high grade iron ore reserves of average ore grades between 64°%and 67 % Fe. The energy use of the operation amounts to 1.66 kWh per ton of ore. In 2009, a wind energy park was built (NMDC Limited 2015). However, there is no information provided on how much of the mine’s energy consumption is covered by this park.

NDMC employs 5,773 permanent employees, of which 4,049 are workmen, 1,518 management staff and 206 junior officers. All of the mentioned workgroups have their own association. Only 5 % of the permanent employees are woman and 1 % is disabled (numbers from 2016). Almost two thirds of the workforce -9,385 workers- is employed temporarily or on a contractual basis (NMDC Limited 2016d).

# 4 Overview of environmental hazard potentials and environmental impacts

## 4.1 Environmental hazard potentials

As part of the OekoRess I research project an evaluation scheme for assessing the environmental hazard potentials (EHPs) of the extraction of primary abiotic raw materials was developed. This evaluation scheme is based on indicators, which are assigned to three levels of consideration. These levels are geology, technology and site surroundings. The level "Geology" comprises five indicators, which include environmental factors inherent to the geology on site. These key influencing factors are "precondition for acid mine drainage (AMD)", "paragenesis with heavy metals", "paragenesis with radioactive components", "deposit size" and "specific ore grade". The second level is "Technology" and includes the indicators "mine type", "use of auxiliary substances", "mine waste management" and "remediation measures". The third level "Site (surroundings)" comprises the indicators "natural accident hazard due to floods, earthquakes, storms, landslides", "Water Stress Index (WSI) and desert areas", and "protected areas and Alliance for Zero Extinction (AZE) sites". Furthermore, the indicator "conflict potential with local population" focusses on the social context. The latter indicator is further developed by analysing ten case studies of which the present case study is one.

The environmental hazard potential for each indicator can be rated as low (green), medium (yellow) or high (red) (for detailed information on the method see Dehoust et al. 2017b). Table 4-1 shows the evaluation of the EHPs of the Bailadila mining complex, which are described in detail below.

The assessment of the EHPs of the Bailadila mining complex is followed by an analysis of the actual situation and impacts of the mining activities on the environment as well as the responses from the mine site operator, the responsible authorities as well as the local communities, using the DPSIR framework (Chapter 4.2).

Table 4-1: Site-related OekoRess assessment

| Level of Consideration | Indicator | Environmental hazard potentials | | |
|---|---|---|---|---|
| | | low | medium | high |
| Geology | Preconditions for acid mine drainage (AMD) | X | | |
| | Paragenesis with heavy metals | | | X |
| | Paragenesis with radioactive components | | X | |
| | Deposit size | | | X |
| | Specific ore grade | X | | |
| Technology | Mine type | | X | |

| Level of Considera-tion | Indicator | Environmental hazard potentials | | |
|---|---|---|---|---|
| Site (surroundings) | Use of auxiliary substances | | X | |
| | Mining waste management | | | X |
| | Remediation measures | X | | |
| | Natural accident hazards due to floods, earthquakes, storms, landslides | | X | |
| | Water Stress Index (WSI) and desert areas | | | X |
| | Protected areas and Alliance for Zero Extinction (AZE) sites | X | | |
| | Conflict potential with local population | | | X |

### 4.1.1 Geology

*Preconditions for acid mine drainage (AMD)*

Iron is a siderophile element, which are often present in sulphidic form, but are also extracted from oxidic deposits. This applies, above all, to deposits that were exposed to atmospheric weathering for a long time.. Sample analysis indicate that the ore is not associated with sulphidic minerals, making acid mine drainage improbable (Nova Mining 2014) (*low environmental hazard potentials*).

*Paragenesis with heavy metals*

Iron deposits are usually associated with lead and zinc, therefore the potential for heavy metal contamination is high. Measurements of the groundwater-quality in the Chhattisgarh district revealed contamination with heavy metals (Chhattisgarh Environmental Conservation Board 2004) (*high environmental hazard potential*).

*Paragenesis with radioactive components*

No information on paragenesis with radioactive components is available. In accordance with the measurement instructions, iron ore deposits are evaluated with a medium EHP, if no other information is available. This class division is based on average thorium and uranium activity levels in Chinese iron ore deposits (measurement instructions based on Hua 2011, USGS 2015) (*medium environmental hazard potentials*).

*Deposit size*

The currently exploited deposits alone are classified as large with altogether more than 1,200 million tons of ore. In addition yet unexploited deposits could significantly increase the total volume (*high environmental hazard potential*).

*Specific ore grade*

The average ore grade ranges around 66 %, which is equivalent to a high-grade iron ore in comparison to other large iron ore mines. Accordingly, the ore to waste ratio is rather good (*low environmental hazard potential*).

### 4.1.2 Technology

*Mine type*

The Bailadila mine complex is a highly mechanized open pit operation in hard rock. Hard rock open pit mining disturbs the surface to a much larger extent than underground mining. In contrast to open pit mining in alluvial or unconsolidated sediment, the disturbance only extents to the size of the ore body. Hence, the indicator is evaluated with a medium EHP (*medium environmental hazard potential*).

*Use of auxiliary substances*

The extracted ore is crushed and grinded in a number of process steps, fine fractions go through a wet screening process: water is added to a screen in order to increase its capacity and improve its sizing efficiency. The OekoRess I method distinguishes processing without additives and those processes using non-hazardous or else hazardous additives. The addition of water belongs to non-hazardous additives, resulting in a medium risk (*medium environmental hazard potential*).

*Mining waste management*

Fine fragments are dewatered and stored as slurry in tailings dam facilities. The largest source of water pollution in the area is the wash offs from the waste dumps. The waste dumps are located along the hilly slopes. These dumps cause unstable slopes at or close to the angle of repose. This unconsolidated material is therefore prone to be washed off during heavy rains (monsoon season) In this case, it causes silting and red straining (due to iron ore fines) of nearby watercourses and additionally damages the soil quality of the nearby agricultural fields. The mining authorities have taken several steps in controlling the surface wash offs by constructing check dams, buttress walls around the toe of the waste dump, etc. (Central Pollution Control Board 2007).

Due to the seasonal high rainfall and dumping of unconsolidated material along steep hilly slopes, the evaluation result for the environmental hazard potential is high (*high environmental hazard potentials*).

*Remediation measures*

NDMC already showed effort in afforesting the area. Rehabilitation plans are in place. NDMC provides a bank guarantee to cover the reclamation and biological restoration of the mined out area (Ministry of Environment, Forest and Climate Change Government of India 2011) *(low potential for environmental hazards)*.

### 4.1.3 Site (surroundings)

*Natural accident hazard due to floods, earthquake, storms, landslides*

The total natural disaster risk is assessed by analyzing four individual sub-indicators:

- The risk for earthquakes is low;
- The risk for floods is low;
- The risk for tropical storms is low;
- The risk for landslides is medium.

The evaluation is carried out in accordance with the measurement instructions, which suggest to use georeferenced data from publicly available risk maps. The results are taken directly from the given risk assessment. The indicator total is derived by the highest hazard potential of the sub-indicators.

The mine is not located within a high-risk tectonic zone. However, due to the hilly geomorphology and steep slopes, in combination with high rainfalls during the summer, the risk for landslides is increased. Accordingly, a medium potential for environmental hazards exists (*medium environmental hazard potentials).*

*Water Stress Index (WSI) and desert areas*

The WSI by Pfister et al. (2009) provides characterization factors on the relative water availability at watershed level. The indicator combines this information with an evaluation whether the site is located in a desert area. Mining operations often need large amounts of water for the operation. Depending on the hydrological situation, a competition for water between the different users can occur. The evaluation was carried out in accordance with the procedure described in the measurement instructions (Dehoust et al. 2017a). Almost all of India's land surface area suffers from water-stress. The mining area in Bailadila shows a particularly high water-stress index of 0.9 (*high environmental hazard potentials*).

*Protected areas and Alliance for Zero Extinction (AZE) sites*

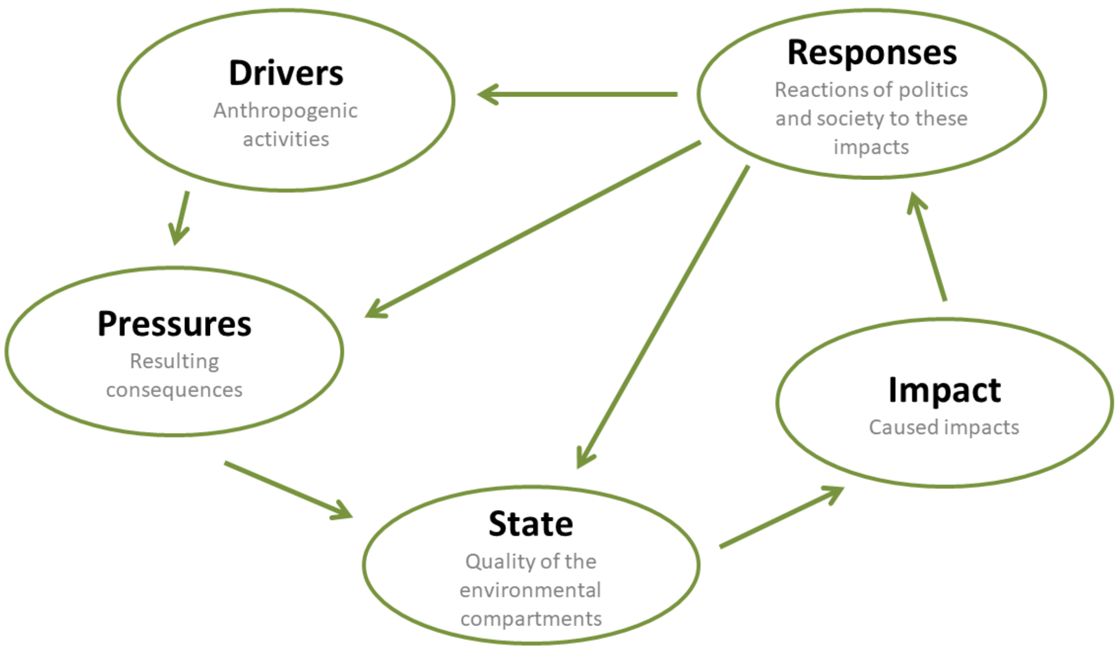
Georeferenced data for designated protected areas are used to assess hazards posed by mining extraction. The metric to evaluate EHPs corresponds to the method first described in the draft standard of the Initiative for Responsible Mining Assurance (IRMA 2014). There are no protected areas close to the operation, also no protected plant or animal species are common in the mining area (*low environmental hazard potentials*).

*Conflict potential with local population*

In 2015, the governance indicator 'Voice and Accountability' ranks 60.59 and 'Control of Corruption' 44.71. As the indicator for corruption is slightly in the lower range below 45, the potential for environmental hazards related to the conflict potential with the local population is high (*high environmental hazard potentials*).

## 4.2 Environmental impacts

Figure 4-1: DPSIR-Framework




Source: Own preparation, based on Kristensen (2004).

The DPSIR framework is a systemic analytical approach to better understand the interaction of humans and their environment in order to derive adequate policy measures. It comprehensively accounts for and visualizes the causal connections between human activities, the resulting consequences for the environment and the responses of humans. The model consists of driving forces, pressures, state, impacts and responses.[6]

This chapter mainly focuses on mining operation's impact on waterbodies and forests in the surroundings areas.

### 4.2.1 Pressures


The major environmental pressures of the Bailadila mining operation are emissions of metals from tailings to waterbodies and soils, deforestation and waste generation. The operation started in 1968. Therefore, the pressures identified have affected the environment for almost 50 years (Sreenivasulu and Padmasree 2016). To date the mining operation directly and indirectly affected an area of 35,000 hectares, accompanied by a loss of biodiversity and farming land, and reduced ground water level (Putul 2007). A causal link between the iron ore mine and the degradation of the surrounding area as well as the impact on the populations' health can be drawn (PUDR 2015) which will be outlined in the following paragraphs.

### 4.2.2 State and Impacts


**Ground water**

The iron ore tailings around Bailadila are proven to be contaminated with heavy metals such as Cu, Pb, Zn, Cr, Sn, Mo and U. These potentially toxic elements also become pollutants to water (Whitacre 2010). A recent study from 2016 tested the quality of ground water collected from hand pumps in the area of the Bailadila iron ore mine and its peripherals (Jareda et al. 2016). The study concluded that the samples at several sites contain pollutants above permissible levels determined by the Indian Government and by the World Health Organisation. This was true also for heavy metals like Al, Pb and Fe. Furthermore, most of the water samples were reddish due to its high iron and salt contents (Jareda et al. 2016). Based on these measurements, water quality around the mine is rated as being very poor. The causes for this are partly natural (due to local lithology), however, it is stated that also anthropogenic sources like mining and other domestic activities are responsible for this (Jareda et al. 2016). Water from hand pumps should be treated and not used directly for domestic purposes.

Besides the contamination, the level of groundwater has been reduced in some areas due to deforestation (UNDP 2005).

**Pollution of nearby rivers**

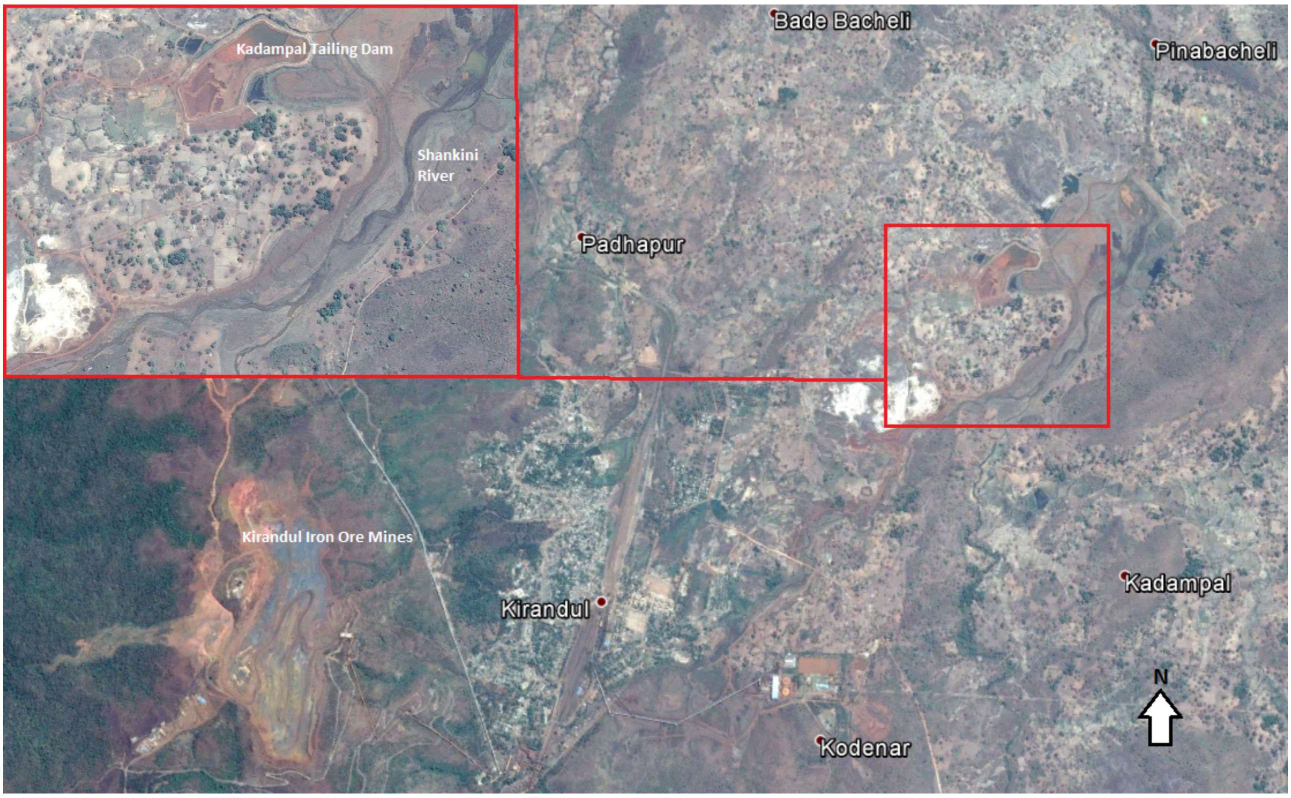
The iron ore mines at the Bailadila complex daily generate 2,700 tons of tailings. They are disposed as slurry in 7,500 $m^3$ of water with a solid content of 27 to 30 %. The slurry contains large amounts of dissolved solids equalling 250 to 1,500 ppm. In addition, the slurry has fine ore content of 95 % and a clay-silica content of 5 % (Mohanty et al. 2010). The inflow of untreated contaminated water used in the iron ore processing lowered the water quality in the river and turned it red due to dissolved iron (Putul 2007; Das 2014).

[6] For further information on the DPSIR framework and its elements see Kristensen (2004).

Furthermore, for the last 40 years, the company has been releasing tailings directly into the Shankini River, which is the nearest surface water. The water is polluted with iron ore fines and effluents used during processing. However, more specific information on the kind of contaminates is not at hand. In the nearby village Kadampal slurry is stored in a tailings dam facility which was built in 1985 after the National Human Rights Commission ordered NMDC to clean up the river. The slurry within the dam is supposed to settle to the bottom and let the cleared water flow out to the Shankini River (compare **Fehler! Verweisquelle konnte nicht gefunden werden.**2). However, the amount of waste material flowing into the storage facility leads to the necessity to dredge out the material regularly. The dredged out waste is piled up in heaps along the dam (Mitra 2006). When taking into account the periodic heavy rainfalls during the monsoon season, it seems probable that the piled up material is eroded and consequently might flow into the river or add to land degradation (Das 2014).

According to investigations of the Indian Newspaper *The Hindu*, NMDC is illegally dumping iron ore fines into the rivers Indrāvati, Shankini and Dankini (The Hindu 2014).

Figure 4-2: Overview of the mine and its surroundings – focus on pollution of Shankini River




Source: Modification of satellite imagery: CNES/Airbus 2014, downloaded from Google Earth.

### Deforestation

According to UNDP, iron ore mining in Bailadila led to the destruction and degradation of large forest areas, accompanied by the extinction of many plant varieties. In consequence, one third of Dantewada's forests areas are degraded (UNDP 2005). Deforestation results from the open pit mining itself as well as additional creation of storage facilities for the debris created by the mining activities (Das 2014; Indian Bureau of Mines 2015).

Before the mining project, thick deciduous forests covered the hills (Tata Energy Research Institute 2002). The deforestation is ongoing. In 2014 the deposit No. 4 and No. 13 in 2015 were deforested, clearing out areas of 84 and 315 hectares of forest (NMDC Limited 2016d).

**Noise and dust**

A 2009 study by Gorai and Pal (2009) on the noise exposure of residential, commercial and sensitive areas around the mining operation concluded that noise levels exceeded the standards of the Indian Central Pollution Control Board (CPCB) in almost all cases. The authors point out, that the noise probably causes the most prevalent environmental stress in the area. Blasting is identified as one of the major contributors to noise and environmental impacts. Particularly pressure waves and vibrations during the blasting process influence the surrounding areas.

With regard to dust pollution, $SO_2$, $NO_x$ and carbon monoxide levels are reported to be significantly lower than permissible levels (NMDC 2016e).

**Health**

There is no sufficient literature to assess the negative effects of the mine on health. However, groundwater is polluted with heavy metals and rivers around the mine are the most polluted ones in India (see section on ground water and rivers above). Even though scientific articles warn against the untreated use of water (Jareda et al. 2016), approximately 100 villages are dependent on the rivers as a source of drinking water and for the irrigation of agricultural areas (Das 2014). Downstream, after the Shakini feeds the Dankini, around 40,000 people are affected by the polluted rivers (Saklani 2015).

In total, 35,000 hectares of agricultural lands and forest are negatively affected by the Bailadila mine complex (CSE India n.d.; Mitra 2006), leading to farming land being infertile and decreasing agricultural productivity (Kunjam 2016; Environmental Justice Atlas 2017). Moreover, the logging of forest as described above has negatively impacted indigenous people who are dependent on the forest and its products and ascribe spiritual meaning to it as described above (Environmental Justice Atlas 2017; People's March 2006). Kaushal (2014) reports that local tribes protested against the mine because of the death of cattle and serious illnesses among the villagers. The most obvious sign for the contamination is the above mentioned red water colour.

### 4.2.1 Responses


**Reforestation**

In India, the deforestation caused by the mining operation has to be compensated by continuous afforestation at suitable slopes and in township areas (Indian Bureau of Mines 2014). Rehabilitation measures of the Bailadila mine include afforestation programs that to date afforested 1,100 ha of land with 1.6 million trees (NMDC Limited, 2016c).

**Noise**

There are noise control mechanisms in place since 2009 (NMDC Limited 2016c). If the reduction of the high noise level was successful is unknown since no information on this topic could be gathered.

**Health**

Measures to increase or reestablish conditions for a healthy environment would need to include the reduction of noise level, provision of clean drinking water and clean soils.

With regard to the latter, sprinkling of water to avoid dust is used. Nonetheless, other ways of contamination of the soil, such as inflow of contaminants through ground water and rivers are prevented this way.

UNDP (2005) highlights that communities harvest rain water to replenish drinking water. As mentioned above the establishment of a storage facility to clear the water before it flows into the river is possibly counteracted by inadequate piling up of the solid components. The reforestation mentioned above is also a pre-requisite for increasing the groundwater table. This could lead to re-opening of drinking wells. How far such measures have been successful is unknown.

**Commitment to UN global compact principles**

NMDC is applying the United Nations Global Compact Principles. Here, in particular the principles 7 and 8 address environmental issues. The principle 7: “Business should support a pre-cautionary approach to environmental challenges” requires companies to be committed to integrate environmentally sustainable processes into their businesses. In a statement in 2016, NMDC explained how the company tries to fulfil this commitment. In general, the company aims at full compliance with all laws and regulations. NMDC is committed to monitor environmental parameters such as the quality of air, groundwater, water and soils. Moreover, detailed biodiversity conservation studies are planned. Afforestation is planned as well as reclamation of waste rock dumps. In addition, the company is committed to provide safe drinking water to the population in neighbouring villages. According to principle 8 of the UN Global Compact NDMC is committed to “undertake initiatives to promote greater environmental responsibility”. The company takes general steps to meet the principle’s requirements, e.g., training programmes on environmental awareness for employees, implementation of sustainability policy and distribution of printed versions to communities and employees, and the implementation of ISO 14001[7]. More specific steps are taken to promote greater environmental responsibility: E.g. water used for washing the ore is re-used and electricity that is generated in the downhill conveyor belts is fed back to the grid. In 2014, the company installed a sewage treatment plant at Bacheli, which treats the township’s domestic wastewater (NMDC 2016e). Applying principle 9, NMDC “should encourage the development and diffusion of environmentally friendly technologies”. The company particularly emphasizes its dust reduction strategies by usage of dust-collectors, wet drilling, water sprinkling or closed conveyor belts. $SO_2$, $NO_x$ and carbon monoxide levels are significantly lower than permissible levels in consequence.

[7] ISO14001 is the international environmental management norm to enhance the environmental performance. Focus lies on continuous optimization in an organization by usage of the Plan-Do-Check-Act (PDCA) approach.

# 5 Governance

## 5.1 Sector governance, regulation and effectiveness

In India, the central government and the state governments are responsible for the management of mineral resources (Singh and Kalirajan 2000). The framework governing India's exploration activity of non-fuel and non-coal minerals is set by India's Ministry of Mines (2016) by providing a) the institutional and administrative framework to generate baseline data and to implement exploration work, and b) the legal and regulatory framework that governs the activities of various governmental and private sector actors in the sector.

**Institutional and administrative framework**

Exploration of coal, non-fuel minerals and lignite is mainly done by the Geological Survey of India (GSI), which was established in 1851. It takes the leading role in mapping the geological conditions and in acquiring and disseminating other baseline geoscience data. In addition, some directorates of the states and public sector companies do exploration activities (Ministry of Mines 2016).

**Legal and regulatory framework**

India's legal framework governing the mining sector of all minerals other than oil and gas is mainly provided by the Mines and Mineral (Regulation and Development) Act (MMRD) from 1957, which was amended several times. There are several further regulations, such as the Mineral Concession Rules from 1960 and its amendments, which outline the procedures and conditions for obtaining a prospecting licence or mining licence, the Mineral Conservation and Development Rules from 1988, which introduce guidelines for ensuring mining on a scientific basis and the conservation of the environment (Singh and Kalirajan 2000) and the Mines Act from 1982, which regulates working safety in mines. Furthermore, the mining sector falls under the Forest Conservation Act, 1980 and the Environment Protection Act, 1986.

Until 1991, the Indian mining sector was completely state-owned with low output rates and a technical status-quo, which was far below international standards (GTAI 2017). New mining policies allowed private investments from 1993 on. However, private sector activities did not reach the desired level because licencing procedures were far too complex and the lack of infrastructure impeded the realisation of mining activities and reduced their profitability (GTAI 2017; Ministry of Mines 2016). Despite a liberalisation of investment regimes in 2006 and amendments to the regulatory framework, private investments failed to increase. Against this backdrop, a High Level Committee (the Hoda Committee) was commissioned in order to "suggest the changes needed for encouraging investment of public and private sector in exploration and extraction of minerals" (Ministry of Mines 2016). Based on the suggestions of the High Level Committee, the National Mineral Policy was revised in 2008. It spells out the strategy and outlines the action plan of the government for the exploration of India's mineral resources (Ministry of Mines 2016). It incentivises private sector investment in mining, provides a level playing field in the licencing procedures and improved transparency, and the promotion of science and knowledge-based mining and the protection of indigenous people (Ministry of Mines 2016; PRS India 2012).

In 2011, a new MMDR Bill was subsequently introduced in order to "harmonise legislation" with the National Mineral Policy 2008. The new bill sought to regulate and develop the mining sector and reduce its negative impacts by "(i) prescribing the manner of allocation of mining concessions, (ii) compensating affected families through the District Mineral Fund, and (iii) setting up of various central and state authorities and tribunals" (PRS India 2012: 2). The key changes are highlighted in Table 5-1 below. The new bill made great progress in terms of regulating compensation payments, royalties and cess, sustainable mining, penalties and the establishment of new authorities (PRS India 2012).

Table 5-1: Comparison between the provision of the 1957 Act and 2011 Bill

| Issue | 1957 Act | 2011 Bill |
|---|---|---|
| High Technology License | No provision | Licence introduced |
| Reconnaissance | Exclusive licence | Non-exclusive licence |
| Manner of grant of a concession | First-come-first-serve; competitive bidding available for captive coal mines | Competitive bidding when mineralisation is known, and First-come-first-serve in other cases |
| Compensation for persons affected by mining operations | No provision (other than the Land Acquisition Act, 1894) | Mining lease holders to pay fixed amount (% of profit or equivalent of royalty); this is in addition to the provisions of the Land Acquisition Act, 1894 |
| Renewal of licences | Licences or leases to be renewed | Licences or leases to be extended |
| Eligibility of cooperatives | Ineligible to mine | Eligible for mining of small deposits in clusters |
| Transfer of concessions | Prior approval of state government required for transfer | For all concessions except a mining lease: Prior notice of 90 days to be given to state government, after which transfer can be made.<br>Mining lease: Transferable subject to prior approval of state government |
| Regulatory Authority | No provision | National and State Mining Regulatory Authority set up to advise on royalty rates, set standards, etc. |
| Maximum area of concession | Prospecting licence: 25 $km^2$<br>Mining lease: 10 $km^2$ | Prospecting licence: 500 $km^2$<br>Mining lease: 100$km^2$ |

Source: PRS India (2012), based on MMDR Act, (1957); MMDR Bill (2011); Mineral Concession Rules (1960).

However, the MMDR Bill 2011 failed to clear as the Parliamentary Standing Committee on Coal and Steel had suggested 107 changes in the bill (The Hindu 2016a). As the acceptance of these changes would have changed the whole bill, it was never tabled to the Lok Sabha, and as a result, lapsed in 2014 and was replaced by the MMDR Bill 2015. The MMDR Bill 2015 is by some called a "distorted version of the MMDR Bill 2011" (Down To Earth 2015) as it cut some of the progressive ideas of the MMDR Bill 2011, particularly in terms of environmental and social safeguards. Others argue that the MMDR Bill 2015 "completely misses out on the major problems with mining governance - existence of poor and multiple regulations; weak institutions; discretionary decision-making powers; inadequate monitoring and feeble enforcement" (CSE India 2015). The MMDR Bill 2015 mainly introduced reforms such as the introduction of an auction mechanism for allocating mining concessions, the increase of penalties for illegal mining, the grant of mining leases for a 50 year period (instead of 30 years plus a 20 year renewal provision) and the creation of special courts to deal with mining offences (CSE India 2015). Besides being criticised for a lack of environmental and social safeguards, the 2015 bill is also criticised in terms of the effectiveness of the reforms taken. In case of the newly introduced auctioning mechanism, CSE India (2015) for example noted the lack of strong and competent institutions to carry out transparent and functioning auctions. Furthermore, the auctioning is criticised because it does not take into account social and environmental safeguards (CSE India 2015). With regard to illegal mining, the law does not cover the need of improved governance and regulations in the mining sector in order to implement the suggested reforms.

Overall, India's regulation of the mining sector is poor and complex, its institutions are weak, decision-making powers are discretionary, monitoring is inadequate and enforcement weak (CSE India 2015). Serious institutional reforms and the building of strong institutions were part of the 2011 bill, but are now largely overlooked. As one of many voices, Bhushan (Down To Earth 2015) underlines that the 2015 reforms "display a bias towards short-term growth and fail to take into account the need for deep reforms to improve mining governance and tackle the irregularities associated with it".

**Environmental legislation**

The environmental legislation in India covers several areas, from the protection of biodiversity, the conservation of the environment and effective mine closure to environmental impact assessments (EIA). The key environmental legislations that regulate the mining industry in India (permits are required) are (according to CSE India (2012):

- The Water (Prevention and Control of Pollution) Act, 1974 (amended in 1988)
- The Air (Prevention and Control of Pollution) Act, 1981 (amended in 1988)
- The Environment (Protection) Act, 1986 (with rules 1986 and 1987) (EPA), including the provisions of Environmental Impact Assessment Notification 2006.
- The Forest (Conservation) Act, 1980 (amended in 1988)
- The Wildlife (Protection) Act, 1972 (amended in 1991)
- The Hazardous Wastes (Management and Handling) Rules 1989

Furthermore, the Minerals Concession Rules of 1988 cover the establishment of mining plans, which incorporate environmental management plans. In addition, the Hoda Committee (see p. 26) promoted the development of a Sustainable Development Framework (SDF) (Ministry of Mines 2011), which contains "guidelines for the formulation of scientific, environmentally sustainable and socially sustainable mining practices", mentioned in the MMDR Act 2015. With these regulations in place, India seems to govern the environmental issues of the mining sector well, even though India made a step back in terms of environmental safeguards when replacing the MMDR Bill 2011 in 2014. However, many criticise India's environmental legislations for being poorly designed and, above all, for weak implementation and corruption (see e.g. Human Rights Watch 2012; CSE India 2015; TERI 2012). An example for this is the way in which EIAs are conducted.

EIAs have to be conducted for every mining project covering more than 50 hectares[8] and include a screening, scoping and public consultation prior to the approval (TERI 2012). However, this process is fraught with inherent challenges (TERI 2012; Human Rights Watch 2012). One of these challenges is for instance that EIAs are commissioned and payed for by the project proponent (companies) and implemented by consultants, which often leads to a conflict of interest and suspicion of bias (TERI 2012). There is no government or independent institution to carry out EIAs. Still, clearances are given or denied mainly based on the EIA. An additional often-cited problem lies in the quality of EIAs, which often miss crucial facts, reproduce old information or include inaccurate data. In India, EIAs are for example often conducted during the dry season, and water bodies or watercourses are ignored, even though they are relevant during the rainy season (TERI 2012; Human Rights Watch 2012). False or missing information is then often not checked, due to a general lack of expertise in mining related issues, no capacity of appraising and due to underequipped monitoring authorities. Human Rights Watch (2012) states that only "a few dozen officials across India are responsible for monitoring thousands of mines and other projects nationwide and are rarely able to make site visits to any of them". TERI (2012) adds that there is simply no capacity to conduct or monitor EIAs in India. Under these conditions, "mining projects are almost never denied environmental clearance" (Human Rights Watch 2012).

[8] According to Ministry of Mines, "the mandatory environment and forest clearance involves various levels leading to delay in project disposition. To mitigate this issue MoEF&CC [Ministry of Environment, Forest and Climate Change] has recently amended the EIA notification of 2006 on 15.01.2016. Mining projects of less than 50 hectare have been classified under category 'B2' which does not require and Environment Impact Assessment Report" (Ministry of Mines 2016). Before that, mining projects covering more than 5 hectare did require an EIA.

A further point of criticism is that through the MMDR Bill 2015, mine leases have been extended from 30 to 50 years. Critics voice serious concern because the effective environmental management is often dependent on the progressive closure and rehabilitated of a mine. According to CSE India (2015), there is “little incentive for mining companies to invest in progressive mine closure” when mines can operate for 50 years. Furthermore, they argue that environmental performance of mine sites is often only controlled at the beginning of the project and at the point when the mine lease has to be extended. With longer mine leases, the environmental monitoring could become even less effective and appropriate financial guarantees for mine closure will be harder to estimate and to establish (CSE India 2015). According to the same source (CSE India 2015), the latter could lead to so called orphaned mines as the closure date is so far ahead when starting the operation, that financial reserves for mine rehabilitation might not be available anymore when closure plans are put into practice. Already today, the number of abandoned mines or mines without proper closure is “perilously high” in India (CSE India 2015).

Another important challenge leading to a huge gap between regulations and their implementation is the overlap in the responsibility of institutions (CSE India 2015). There are four institutions governing the environmental (and health) sector, which are the Union Ministry of Environment, Forest and Climate Change (MoEF&CC), the Indian Bureau of Mines, the State Pollution Control Boards and the Directorate General of Mines Safety. One example of overlapping responsibilities is that both the MoEF&CC and the Indian Bureau of Mines can clear EIAs. Reforming these Institutions in order to reduce overlap and strengthen the implementation of environmental legislations was an aim of the MMDR Bill 2011, but was dropped with the adoption of the MMDR Bill 2015.

**Illegal mining and corruption**

In order to combat illegal mining and corruption, multiple regulations and regulatory authorities exist, but are poorly designed and, above all, their implementation is failing. This means that the sector “is still marred by illegality and controversies” (CSE India 2015: 53). Common problems are “operation beyond lease periods and without proper permits, mining over permissible limits of quantity and time, illegal transport and sale of minerals and unscientific mining practices” (CSE India 2015). Official numbers underline these findings, with over 82,000 cases of illegal mining in 2010 alone (Human Rights Watch 2012). Unregulated or illegal mining results as well as the mismanagement of revenues result in a direct loss of revenue for the government (Human Rights Watch 2012).

**Indigenous rights**

In India, the governance of the mining sector cannot be discussed without taking into account indigenous people. Adivasi, which can be translated to “the first people”, is the political term of self-reference used by most Indigenous people in India (Ministry of Tribal Affairs 2014). The Government of India does not acknowledge this term – it rather uses the term tribal communities (Ministry of Tribal Affairs 2014). According to official numbers, there are 104.3 million Adivasi people belonging to 705 ‘Scheduled Tribes’ (ST) and make up 8.3 % of the total Indian population (Ministry of Tribal Affairs 2013).

India’s minerals are mostly located in tribal areas (CSE India 2012; CSE India 2015). This is also the case in the area of the Bailadila mine complex: Whereas 30.6 % in Chhattisgarh state are identified as Adivasi people, they form the majority – 76.8 % – in the Dantewada district where the Bailadila mine complex is located (Directorate of Census Operations Chhattisgarh 2011). Several laws and policies grant special rights to this group of people. The most important ones for the mining sector are described below.

Although there is no formal constitutional recognition of Adivasi people, the Constitution of India grants a special status to various Adivasi groups, including those on the ST list, which was created together with the Schedule V of the Indian Constitution by the Scheduled Castes and Scheduled Tribes Orders (Amendment) Act in 1976. Schedule V stipulates, amongst others, directives for protection of land of ST (Ministry of Tribal Affairs 2014). For instance, Adivasi cannot transfer land to non-Adivasi (e.g. private mining industries) (Ministry of Tribal Affairs 2014). In addition, in Article 46 of the Constitution it is stipulated that the state should "protect [Scheduled Castes and Scheduled Tribes] from social injustice and all forms of exploitation" (Constitution of India 2016). Enforcement of Adivasi rights is often insufficient or non-existent. Concerning the implementation of Schedule V, the report of a government-appointed high-level committee finds that "state governments did enact legislations, but in connivance with the state machinery, loopholes were exploited for defrauding tribal people of their land and illegal alienation of tribal land by non-tribal people continued as an ongoing process" (Ministry of Tribal Affairs 2014: 252).

In addition to the Schedule V in 1976, the 1990s saw a number of important legal developments. In 1993-94, amendments to the Constitution endowed the so-called Panchayats (elected village representative) with powers to govern local development, extended by the Panchayats (Extension to Scheduled Areas) Act (PESA) in 1996 (Amnesty International 2010; Amnesty International 2016). The PESA stipulates, that Adivasi tribes included in the ST list have to be consulted before land for development projects, as mining projects, is acquired or resettlements are being planned (Amnesty International 2010; Amnesty International 2016). The consultation should be led by the Panchayat or the Gram Sabha[9] (Amnesty International 2010). Yet, the PESA just stipulates that affected Adivasi groups should be consulted, but not to what extend exactly and what consequences a project rejection would have (Amnesty International 2010). Furthermore, the PESA Act is also not implemented properly. Decisions of the Gram Sabha and the Panchayat get overruled frequently (Amnesty International 2010) and Adivasi communities are reported to being excluded from decision processes (Amnesty International 2016).

Another law supporting the rights of Adivasi is the Environment Protection Act (EPA) of 1986 (see section on the environmental legislation), which was amended and extended several times. It requires as part of EIAs for industrial projects commissioned by the company and state-level authorities to consult with local communities if a planned project could have negative environmental impacts (Amnesty International 2016). These consultations and public hearings have to be advertised in advance – if necessary with drum beatings in very rural areas without access to newspapers (Amnesty International 2016). Moreover, detailed public plans of the discussed projects have to be distributed in English and the local languages (Amnesty International 2016). However, even when being included, it is often criticized that when drafts of EIAs are publicly shared in accordance with the EPA Act, they are often overly complex and extremely technical on purpose (Amnesty International 2016). As a result, land acquisition in connection with mining activities is often enforced against the will of the local communities (Amnesty International 2010).

Another act, the Scheduled Tribes and Other Traditional Forest Dwellers Act, known as the Forest Rights Act (FRA, see above), was adopted in 2006, because "historical injustices (faced by tribal communities with regard to their land and livelihoods) needed correction" (Ministry of Tribal Affairs 2016). It enables the Adivasi to claim their traditional lands against the state or others (Amnesty International 2016; Chakma and Shimray 2016). Moreover, it again confirms the need of approval by Gram Sabhas in any case of forestland diversion by the state Ministry (Amnesty International 2016; Chakma and Shimray 2016). In case of land diversion, the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, enacted in 2013, stipulates that consent of 70 % of the affected people has to be expressed (Amnesty International 2016). Similar challenges as with EPA exist regarding the FRA: After ten years, only 86.6 % of all land claims by Adivasi have been approved by the government (Chakma and Shimray 2016). Overall, "between 1950 and 1991, mining is estimated to have displaced close to two million people in the country – and only one-fourth of these displaced people have been resettled" (CSE India 2012; Chakma and Shimray 2016: 333). Moreover, people who struggled against resettlements have been harassed by forest officials and only little compensation was payed (Chakma and Shimray 2016). The government admits that tribal people are dis-

[9] Head of a local self-government in Indian villages.

proportionately affected by displacements (Chakma and Shimray 2016: 334). Furthermore, protests against mining activities in India are often met with brutality and violence by the state (Human Rights Watch) and overall only 18 per cent of all protests against the expansion of mining activities are crowned with success in India (Dasgupta 2016). This poor granting of rights and the negative effects of the mining activities are major reasons for why many tribal leaders oppose mining in general (Shay 2016).

**Governance challenges around the Bailadila mine complex**

In the case of Bailadila mine complex, the NMDC was criticized because of unfair compensation and for raising expectations of the local population in terms of infrastructure and the developmental effects mining activities will have for the region as a whole. The company stated that it "has (sic) unique privilege of bringing remote areas to the main stream of civilization" (NMDC Limited 2012). In their "peripheral development program" they promise the construction of educational and medical facilities, an expansion of water and power supply, the improvement of the general infrastructure, cash awards and jobs in the Bailadila iron ore mine-complex (NMDC Limited 2012; Tata Energy Research Institute 2002: 57f). Local population groups accuse the NMDC that these promises have not been fulfilled and in particular the Adivasi do not receive enough benefits (People's March 2006). As in other parts of the countries, employment opportunities for Adivasi at the mine seem to have been limited (Eye Art Collective 2015; CSE India 2015).

## 5.2 Social context of mining and conflicts

**Mining conflicts**

India is described as one of the countries with the highest number of social and environmental conflicts in the world, with many of them being related to mining activities in rural areas (Dasgupta 2016).

As outlined above nearly half of all mineral production value (including oil and gas) in India is generated by only seven of the 29 Indian states (FICCI 2013), Chhattisgarh being one of them. In Chhattisgarh, a region where 40 % of the people are living below the poverty line and with 30.6 % of inhabitants being identified as Adivasi people, the NMDC is operating over a dozen of mines since the 1960s (CSE India 2015: 11; Environmental Justice Atlas 2017).

NMDC founded the Bailadila mine complex in Chhattisgarh in the 1970s. In 2016, the mine received the Federation of Indian Mineral Industry (FIMI) Golden Jubilee Award by the government for its social and environmental awareness (The Economic Times 2016). At the same time, the NMDC announced their plans to further increase the iron ore production capacity of the mine-complex by obtaining additional mining licenses (The Pioneer 2017). Despite being awarded for its social and environmental awareness, NMDC's expansion plans were sharply criticized by local communities and tribal leaders (Shay 2016).

Since the founding of the mine-complex in the 1960s, the region has seen multiple conflicts around mining activities. Most of them were and still are closely linked to indigenous rights and the larger conflict with and the rise of a non-state armed group called the Naxalites. The Naxalites is a Maoist group which grew out of riots of peasants and Adivasi in Naxalbari located in the north east of India in the late 1960s. Led by leaders of the left wing Communist Party of India (Marxist-Leninist) (CPI(ML)), the Naxalites spread to the regions around Chhattisgarh in the 1980s (Bhattacharya 2016) where they could built upon a 150-year-long history of revolts and protests around the Dandakaranya forest, which surrounds the Bailadila mine-complex (People's March 2006). The Naxalites supported Adivasi people and helped them to establish village militias to fight against industrial and economic exploitation of the region (Bhattacharya 2016; People's March 2006). Today, they are active in a wide area in eastern India called the red corridor and the region around the Bailadila mine-complex is called a "hotbed" of the Naxalites (The Times of India 2017a). In 2015 alone, there have been 300 fatalities related to the Naxalite insurgency (Shay 2016). Therefore, the Naxalites have been called the biggest internal security threat faced by the Indian government (Human Rights Watch 2008; Eye Art Collective 2015). Direct attacks of the Naxalites on the facilities, vehicles, and personnel of the NMDC's Bailadila mine complex occur on a regular basis (The Hindu 2016b). In addition, attempts to rob explosives from NMDC mining vehicles and take employees as hostages have been reported (The Times of India 2017b). Furthermore, facilities of the NMDC's Bacheli iron ore mine have been attacked and destroyed by Naxalites (The Times of India 2016; Sarkar 2016).

The Naxalites still see themselves as defenders of the poor, the landless, the dalitas ("untouchables"), and tribal communities and fight for their "jal, jangal, jameen" ("water, forest and land"). (Human Rights Watch 2008; Bhattacharya 2016). However, support from the local population and indigenous groups have decreased after the government of Chhattisgarh launched the Operation Salwa Judum in 2005 to diminish the Naxal influence in the Chhattisgarh region (Human Rights Watch 2008). Villagers in the Chhattisgarh region were armed in order to form paramilitary units. This led to a wave of violence and an overall increase in fighting and attacks also on non-combatants, who were suspected to be sympathizers of the opposite fraction (Chakma and Shimray 2016: 332). This made civilian neutrality impossible, resulting in the constant danger of being attacked by one of the two sides (Human Rights Watch 2008). Local communities suffer both from attacks by the Naxalites and government and policy brutality (Ghose 2016; Chakma and Shimray 2016; Bhattacharya 2016). Although the influence of the Naxalites has been decreasing, an expansion of the mining activities in the region is feared to spread Naxalites influence and fuel further conflicts (Shay 2016; Kumar 2009).

Besides the conflict around the Naxalites, there are several other conflicts around the Bailadila mine complex. As described above, there are regulations, laws and constitutional amendments which adjudge rights of participation to the Adivasi, but in many cases these rights are not being regarded by miners and the government (Eye Art Collective 2015; Kunjam 2016; Ghose 2017). This seems to be also partly the case with regards to the Bailadila mine complex. Indigenous activists have accused the government and the NMDC for ignoring their rights repeatedly. For instance, the Union environment ministry permitted a forest clearance in connection with an expansion of the mine complex in 2014 against protests by the Adivasi (Environmental Justice Atlas 2017). However, in a different example the NMDC in 2015, as stipulated by the laws, tried to get permission for building a slurry pipeline through villages by local communities first. The plans were rejected, because the Adivasi demanded compensations, water treatment facilities and a general reduction of water pollution which the company was not willing to supply (Environmental Justice Atlas 2017; Bhattacharya 2016).

In another case, villagers in Dantewada accused NMDC for not involving them in the decision process of the planned expansion (Kunjam 2016). There was a public hearing organized by the NMDC. However, the traditional leaders of the nearby villages claimed that no prior public notice was given. In addition, the expansion was not approved by the gram sabha (Kunjam 2016). Therefore, the results of the hearing are criticized for being unconstitutional according to Schedule V of the Indian Constitution (Environmental Justice Atlas 2017). The case took place in the end of 2016 and no further information regarding the outcomes was available.

The conflicts between the local inhabitants and the NMDC expressed themselves in a blockade of the roads of the NMDC Bailadila mine complex organized by several villages in 2015 to protest against the general lack of participation and the planned expansions (Eye Art Collective 2015). Overall, direct protests against the mine-complex by the Adivasi are increasing. As Ramesh Samu, a leader of Adivasi protests stated: "We will not tolerate this anymore […]. The mining corporation has fooled us by promising jobs. Our children are dying because of the polluted water. Our field (sic) are becoming barren and the cattle are dying too. The mining must stop" (Kaushal 2014).

**Conflict Management**

As a reaction to the recent Naxalites attacks, Raman Singh, the current Chhattisgarhi chief minister, announced that "[a] massive combing operation is on to flush (the Naxalites) out" (The Times of India

2017a). A decrease in conflict intensity and a demilitarization of the region are therefore unlikely. It is being criticized, that the government still refuses to define the situation as an “internal armed conflict” in accordance to international human rights law (Bhattacharya 2016; Eye Art Collective 2015). This would permit international observers to visit the region and ensure the abidance of the Geneva Protocol by all parties. Instead, the region was militarized by the deployment of governmental security forces, which was not agreed with Indigenous representatives (Eye Art Collective 2015).

In terms of direct conflicts between the local communities and the NMDC, compensations are being paid by the NMDC for environmental damages. However, they are criticized for being too little and too few (Kunjam 2016). Furthermore, it is criticized that villagers often have to fight for months and years in order to being awarded compensations. In addition, it is not clear when compensation claims are being granted or denied by NMDC. In general, the compensations are not perceived as a permanent solution for the mining conflicts (Kunjam 2016).

# 6 Conclusion and comparison of the analysis with existing governance indices

In this final chapter, the findings of chapter 4 (Overview of environmental hazard potentials and environmental impacts) and chapter 5 (Governance) are analysed to answer the following research questions:

- Does the assessment of the environmental hazard potentials adequately point to the actual environmental impacts?
- Are existing governance indices and indicators able to adequately reflect the governance capability to cope with the challenges arising around the environmental hazard potentials and environmental impacts of mining? In other words, are the identified governance gaps reflected in existing governance indices and indicators?

In order to answer the second question, a number of indices and indicators (see Table 6-1) were chosen based on a screening of a wide range of existing governance, environmental governance, and peace and conflict indices.

The results of this case study will be compared with the results of nine additional case studies that are conducted as part of this project as well as the case studies conducted in UmSoRess and OekoRess I. By comparing the findings of the case studies, a set of governance indicators will be identified that can be used to improve the assessment approach to analyse the environmental hazard potentials of the OekoRess I project.

**Does the assessment of environmental hazard potentials adequately point to the actual environmental impacts?**

The main environmental impacts outlined in this study were the pollution of groundwater and rivers, deforestation, high noise levels and impacts on people’s health. The site-related OekoRess methodology includes several indicators that reflect these environmental hazard potentials. The indicators for water stress and paragenesis with heavy metals showed a high environmental hazard potential and therefore adequately reflected the actual environmental impacts. Moreover, the indicator on mine type showed a medium environmental hazard potential, which also reflected the actual impacts: The Bailadila mine complex is an open pit mine and therefore affects large areas of surface, and leads to deforestation and a high noise level.

However, the indicator on protected areas showed only a low environmental hazard potential as the forest ecosystems around the Bailadila are not categorised as protected areas. Nevertheless, these ecosystems are of high importance as they for example improve the water storage capacity of the area, serve as a habitat for plant and animal species and provide livelihoods and income for indigenous people. Furthermore, the indicator on mine closure plan shows a low environmental hazard potential because the mining company has a mine closure plan in place. However, as the governance analysis showed, India has a major problem with abandoned mines or mines without proper closure, which points to the fact that having a mine closure plan in place does not mean than mine closure is put into practice or is done responsibly. This is a problem related to management-based indicators since they only measure the existence of certain plans and strategies and not their implementation as performance-based indicators do. In order to assess the implementation of plans, strategies and policies using performance-based indicators qualitative analyses like this case study or surveys are necessary.

**Main findings of the governance analysis**

India’s mining-sector suffers from complex and overlapping regulations and sometimes poorly designed regulations. Another major challenge are weak and underequipped institutions which often have overlapping responsibilities and generally lack of expertise in mining related issues. Therefore, the sector is in a great need to improve its regulations and strengthen its institutions in order to tackle the irregularities and challenges in the mining sector as well as to attract private sector investment. Furthermore, the sector is marred by illegality and corruption, which is prevalent in private companies and the public sector. There is a lack of transparency and participation in mining decisions. These challenges make conflicts around mining common, in some cases with the involvement of non-state armed groups.

**Do existing governance indicators reflect India's governance gaps and challenges?**

India's overall weak sector governance is reflected well in key governance and development indices: India's Human Development Index (HDI) is low showing India's overall low level in key dimensions of human development (HDR 2014). The used set of Worldwide Governance Indicators (WGI) also ranks India low. Nevertheless, the different WGI vary (World Bank 2015):

India has its lowest values in case of the WGI Political Stability and Absence of Violence, with a percentile rank of 16.7. This reflects the situation in Chhattisgarh well. However, there are various data sets and indicators used to create the WGI indicators, which all describe different types of conflicts. Therefore the WGI indicator does not only reflect internal conflicts like the ones around mining and the Adivasi in Chhattisgarh, but also terrorism, external conflicts, violent demonstrations, and armed conflicts. No specific information could be found how those indicators are combined and weighted. Thus, it is not clear if this indicator reflects the internal mining conflicts or the conflicts with non-state armed groups. Moreover, the indicators account for the whole country, and are not able to reflect on subnational differences.

Most of the other WGI indicators also reflect the situation in India well: India's second lowest value is the WGI Regulatory Quality, with a value of -0.39, and a percentile rank of 39.9. This indicator describes the ability of the governments "to formulate and implement sound policies and regulations" that also promote private sector development. As the governance analysis has shown, this is a clear weakness and thus the indicator reflects the situation in India well.

India's third-lowest value is the WGI Control of Corruption with a value of -0.38 and a percentile rank of 44.2. In this case, the indicator reflects the situation well. Both, the indicator on Government Effectiveness and on Rule of Law reached values around 0 (0.1 and -0.06), reflecting the situation in India well. The indicator on Government Effectiveness has a percentile rank of 56.3, the indicator on Rule of Law of 55.8.

The best-rated WGI in case of India is the indicator of voice and accountability, with a value of 0.39, with a percentile rank of 60.6. The indicator includes for instance the possibility to vote, the freedom of expression and free media. However, the indicator does not reflect the very specific challenges around the participation of citizens in decision-making processes in the mining sector.

An index that aims at specifically capturing participation in environmental decision-making processes is the Environmental Democracy Index (EDI). The EDI indicates the "degree to which countries have enacted legally binding rules that provide for environmental information collection and disclosure, public participation across a range of environmental decisions, and fair, affordable, and independent avenues for seeking justice and challenging decisions that impact the environment" (World Resource Institute 2016). Here, India ranks $20^{th}$ out of 70[10], with a score of 1.75 (good). Within the EDI, India scored well on the justice pillar and the access to information pillar, and fair on the participation pillar. Thus, this indicator seems to point towards the issues on participation outlined in the governance analysis. However, the overall score for the country seems to overrate India's performance by far and does not reflect the very specific challenges in the mining sector.

With regard to the Environment Performance Index (EPI) which displays India's performance concerning the protection of human health and protection of ecosystems, India ranks 141 out of 178, scor-

[10] Canada ranked 35 out of 70 with an only fair scoring.

ing 53.58 out of 100 (Yale University n.d.). This index seems to assess India's overall weak performance well. The index measures a countries performance in several areas such as health impacts, air quality, water and sanitation, agriculture and forest. Unlike the WGI, the EPI uses scientific data in order to analyse a country's performance, not existing indicators, which are then combined to a new index. Furthermore, it does not measure for example legislations in place to protect the human health and ecosystems, but a country's performance regarding the success or the failure to achieve specific thresholds.

India's sector governance and its associated problems are very well reflected in the Fraser Investment Attractiveness Index surveyed yearly by the Fraser Institute. The index is an overall investment attractiveness index, which is based on a country's geologic attractiveness and a measurement of the effects of government policy on attitudes towards exploration investment (Fraser Institute 2016). India ranks only 97th of 104 countries in the world in terms of attractiveness for mining investment and has one of the least attractive policy environments of all countries assessed (rank 88 out of 104). Interestingly, the assessment particularly points towards weaknesses identified in the governance analysis in terms of uncertainties concerning the administration, interpretation and enforcement of existing regulations as well as regulatory duplication and inconsistencies and a weak legal system. This higher granularity in reflecting the actual situation in India might be a result of the type of data the Fraser Index uses to measure the attractiveness of the policy environment it uses perception data. This means that the ranking of the country is based on a survey which is "distributed to approximately 2,700 managers and executives around the world in companies involved in mining exploration, development, and other related activities" in order to "capture the opinions of managers and executives about the level of investment barriers in jurisdictions with which their companies were familiar" (Fraser Institute 2016: 4). This expert estimation of professionals actually working in the mining sector on 15 policy factors seems to reflect the actual sector-governance situation in India the most accurate.

The Global Peace Index (GPI) displays a country's level of peacefulness according to a ranking in three domains: ongoing and internal conflicts, levels of harmony or discord within a nation and a country's militarisation. India is rated low (on a scale from very high to very low) which seem to reflect the country's peacefulness well (IEP 2016). However, the index accounts for the whole country, and is not able to reflect subnational differences and regional or sector-specific conflicts. For example, India's rating has improved during the last years due to better relations with neighbouring countries. Moreover, even with a focus only on the domain of ongoing domestic and international conflicts, the indicators taken into account for this domain of the index are that diverse and numerous, that no sector-specific or regional conclusion can be drawn.

**Conclusion**

India's overall weak sector governance is well reflected in key governance and development indices like the HDI or the WGIs. However, the existing indices and indicators show in some cases a limited ability to reflect the specific and nuanced governance challenges of India. Furthermore, even though all indicators showed India's overall weakness regarding its governance, based on these indicators it is much harder to assess how weak India's performance within the category of weak countries actually is. This is particularly true for indicators, which do not provide a ranking between the assessed countries. One way of addressing this weakness would be to normalise these indices based on the case studies and expert judgement in order to being able to better compare values across indices and possibly define thresholds for the classification of the governance indicators in the OekoRess methodology.

The Fraser Index was the index that reflected the specific challenges of India's sector governance best, which might be explained by it being a perception index based on an expert survey. Conclusive evidence to this end will have to be tested as part of the following eight case studies. Furthermore, the case study underlines, that even with legislations in place, a country can fail in effectively control its mining sector. Particularly in India, deep reforms and better capacities are needed in order to improve mining governance and tackle the irregularities associated with it.

Table 6-1: Overview of governance indicators

| Indicator | India | Year | Indicator measures… | Applicability |
|---|---|---|---|---|
| Human Development Index (HDI) | 0.609 (rather low human development, rank 130) | 2014 | Average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and have a decent standard of living. The HDI is the geometric mean of normalized indices for each of the three dimensions | Reflects well the overall rather low development and standard of living in India. |
| Environmental Performance Index (EPI) | Rank 141 of 178, Score 53.58 (out of 100) | 2016 | The protection of human health and protection of ecosystems. | Reflects well the overall weak governance in the environmental sector.<br>Limited ability to reflect the specific and nuanced governance challenges of India. |
| Fraser Investment Attractiveness Index | Investment Attractiveness Index:<br>Score 39.11 (out of 100)<br>rank 97 (out of 104)<br>second least attractive region in the world (rank 8 out of 9)<br>Policy perception Index:<br>Score 41,52 (out of 100)<br>Rank 88 (out of 104)<br>Last attractive region in the world (rank 9 out of 9) | 2016 | The overall investment attractiveness which is based on a country's geologic attractiveness and a measurement of the effects of government policy on attitudes towards exploration investment | Reflects very well the overall weak governance in the mining sector. Particularly the index on policy perception (Fraser Policy Perception Index) has a high granularity and reflects well the actual situation in India's mining sector. It particularly points towards weaknesses, which were identified in the governance analysis. |
| Environmental Democracy Index (EDI) | Rank 20 of 70, Score 1.75 (good) | 2015 | The degree to which countries have enacted legally binding rules that provide for environmental information collection and disclosure, public participation across a range of environmental decisions, and fair, affordable, and independent avenues for seeking jus- | Does not reflect the specific challenges in the Indian mining sector. The overall score for the country seems to overrate India's performance by far. However, the indicator points towards the issues on participation, which were outlined in the governance analysis. |

| Indicator | India | Year | Indicator measures… | Applicability |
|---|---|---|---|---|
| | | | tice and challenging decisions that impact the environment | |
| Voice and Accountability (WGI) | 0.39 (estimate between -2.5 and 2.5)<br>60.6 (percentile rank terms from 0 to 100, with higher values corresponding to better outcomes) | 2015 | Voice and Accountability captures perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. | Reflects well the governance performance in this specific area.<br>However, the indicator does not reflect the very specific challenges around the participation of citizens in decision-making processes in the mining sector. |
| Political Stability and Absence of Violence (WGI) | -0.9 (estimate between -2.5 and 2.5)<br>16.7 (percentile rank terms from 0 to 100, with higher values corresponding to better outcomes) | 2015 | Political Stability and Absence of Violence/Terrorism measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism. | Reflects well the overall weak governance and India's political instability and violence.<br>However, it has a very limited ability to reflect the very specific and regional challenges. It accounts for the whole country, including extraterritorial conflicts, and is not able to reflect on sub-national differences. |
| Government Effectiveness (WGI) | 0.10 (estimate between -2.5 and 2.5)<br>56.3 (percentile rank terms from 0 to 100, with higher values corresponding to better outcomes) | 2015 | Government Effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. | Reflects well the overall weak governance.<br>Limited ability to reflect the very specific and regional governance challenges of India. |
| Regulatory Quality (WGI) | -0.39 (estimate between -2.5 and 2.5)<br>39.9 (percentile rank terms from 0 to 100, | 2015 | Regulatory Quality captures perceptions of the ability of the government | Reflects well the overall weak governance. |

| Indicator | India | Year | Indicator measures… | Applicability |
|---|---|---|---|---|
| | with higher values corresponding to better outcomes) | | to formulate and implement sound policies and regulations that permit and promote private sector development. | The governance analysis showed that the implementation of sound regulations and the promotion of private sector development is a clear weakness and thus the indicator reflects the situation in India well. |
| Rule of Law (WGI) | -0.06 (estimate between -2.5 and 2.5)<br>55.8 (percentile rank terms from 0 to 100, with higher values corresponding to better outcomes) | 2015 | Rule of Law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. | Reflects well the overall weak governance.<br>Very limited ability to reflect the very specific and regional governance challenges of India. |
| Control of Corruption (WGI) | -0.38 (estimate between -2.5 and 2.5); 44.2 (percentile rank terms from 0 to 100, with higher values corresponding to better outcomes) | 2015 | Control of Corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as “capture” of the state by elites and private interests. | Reflects well the overall weak governance.<br>Very limited ability to reflect the very specific and regional governance challenges of India. |
| Global Peace Index (GPI) | 2.566 (low, scale of 1-5, overall rank 141) | 2016 | Countries’ level of peacefulness | Reflects the situation in India well. However, the index accounts for the whole country, and is not able to reflect subnational differences and regional or sector-specific conflicts |

# 7 References


Amnesty International (2010): India: Don't Mine Us Out Of Existence: Bauxite Mine And Refinery Devastate Lives In India. Online:https://www.amnesty.org/en/documents/ASA20/001/2010/en/ (05.04.2017).

Amnesty International (2013): India: Landmark Supreme Court ruling a great victory for indigenous rights. Online:https://www.amnesty.org/en/latest/news/2013/04/india-landmark-supreme-court-ruling-great-victory-indigenous-rights/ (05.04.2017).

Amnesty International (2016): When Land Is Lost, Do We Eat Coal? Coal Mining and Violations of Adivasi Rights in India. Karnataka. Online: http://www.amnestyusa.org/sites/default/files/report_final.pdf (06.04.2017).

Behera, B., M. Das, A. Chanda (2013): Assessment of ground water quality in and around Bacheli and Kirandula area, Dantewada district, Chhattisgarh, India. In: International Journal of Environmental Sciences Volume 3, No 6, pp. 2224-2235.

Bhattacharya, A. (2016): There Is No War In Bastar, Only Battles. In: The Caravan. August 22, 2016. Online: http://www.caravanmagazine.in/vantage/no-war-bastar-battles-bhadrimau# (16.03.2017).

Central Pollution Control Board (2007): Comprehensive Industry Document on Iron Ore Mining. Development of Clean Technology for Iron Ore Mines and Development of Environmental Standards. Online: http://www.cpcb.nic.in/upload/NewItems/NewItem_105_iron_ore_mining_31.07.08.pdf (02.02.2017).

Chakma, T. and Shimray, Gam A. (2016): India. In: International Work Group For Indigenous Affairs: The Indigenous World. IGWIA, Copenhagen 2016. Online: http://www.iwgia.org/iwgia_files_publications_files/0740_THE_INDIGENOUS_ORLD_2016_final_eb.pdf (06.04.2017).

Chhattisgarh Environmental Conservation Board (2004): Environmental Status Report. http://www.enviscecb.org/soer.htm (08.03.2016).

Constitution of India 2016, http://lawmin.nic.in/olwing/coi/coi-english/coi-4March2016.pdf. (06.04.2017).

CSE India (n.d.): Mining: A Guide to India's Wealth, Its Resource Curs. Online: http://cseindia.org/mining/3districts_chattisgarh.htm (27.01.2017).

CSE India (2012): CSE Media Briefing – Mining in India. Online: http://www.cseindia.org/userfiles/Mining_in_India.pdf (06.04.2017).

CSE India (2015): "Losing Solid Ground: MMDR Amendment Act, 2015 and the state of the mining sector in India." New Dehli. By: Bhushan, C. /S. Banerjee. Online: http://www.cseindia.org/webinar/losing-solid-ground-mining-report.pdf (22.01.2019).

CSE India (2015): The Mines and Minerals (Development and Regulation) Amendment Act 2015. Online: http://www.cseindia.org/userfiles/MMDR%202015_will%20it%20improve%20the%20mining%20sector%20practices.pdf (06.04.2017).

Das, B. (2014): Environmental impact due to iron ore mining in Chhattisgarh. In: Recent Research in Science and Technology 2014, 6(1): 27-29. Online: http://scienceflora.org/journals/index.php/rrst/article/viewFile/1156/1141 (06.04.2017).

Dasgupta, S. (2016): India has most cases of social and environmental conflict, according to environmental justice atlas. In: Mongabay. Online: https://news.mongabay.com/2016/02/india-has-most-cases-of-social-and-environmental-conflict-according-to-environmental-justice-atlas/ (06.04.2017).

Dehoust, G.; Manhart, A.; Möck, A.; Kießling, L.; Vogt, R.; Kämper, C.; Giegrich, J.; Auberger, A.; Priester, M.; Rechlin, A.; Dolega, P. (2017a): Erörterung ökologischer Grenzen der Primärrohstoffgewinnung und Entwicklung einer Methode zur Bewertung der ökologischen Rohstoffverfügbarkeit zur Weiterentwicklung des Kritikalitätskonzeptes (OekoRess I) - Methode für einen standortbezogenen Ansatz. Umweltbundesamt, Dessau-Roßlau.

Dehoust, G.; Manhart, A.; Möck, A.; Kießling, L.; Vogt, R.; Kämper, C.; Giegrich, J.; Auberger, A.; Priester, M.; Rechlin, A.; Dolega, P. (2017b): Discussion of the environmental limits of primary raw material extraction and development of a method for assessing the environmental availability of raw materials to further develop the criticality concept (OekoRess I). Umweltbundesamt. Dessau-Roßlau.

Directorate of Census Operations Chhattisgarh 2011: Census of India 2011, Chhattisgarh. District Census Handbook. Dkshin Bastar Dantewada. Villiage and Town Wise Primary Census Abstract (PCA), Online: http://www.censusindia.gov.in/2011census/dchb/2217_PART_B_DCHB_DAKSHIN%20BASTAR%20DANTEWADA.pdf (06.04.2017).

Down To Earth (2015): Why the new Mining Bill Needs a Relook. By: Bhushan, C. Online: http://www.downtoearth.org.in/news/why-the-new-mining-bill-needs-a-relook-49040 (06.04.2017).

Environmental Justice Atlas (2017): Iron ore mining in Dantewada, Chhattisgarh, India. January 1, 2017. Online: https://ejatlas.org/conflict/iron-ore-mining-in-dantewada-jharkhand (06.04.2017).

Eye Art Collective (2015): Has India betrayed its Indigenous Peoples, the Adivasis? December 12, 2015. Online: http://www.eyeartcollective.com/has-india-betrayed-its-indigenous-peoples-the-adivasis/ (16.03.2017).

FICCI - Federation of Indian Chambers of Commerce & Industry (2013): Development of Indian Mining Industry – The Way Forward. Non-Fuel Minerals. Online: http://ficci.in/spdocument/20317/Mining-Industry.pdf (16.02.2017).

Fraser Institute (2016). Annual Survey of Mining Companies, 2015. By: Jackson, T. and K.P. Green, Fraser Institute. Online: https://www.fraserinstitute.org/sites/default/files/survey-of-mining-companies-2016.pdf (16.02.2017).

Geological Survey of India (2005): Geological and mineral map of Chhattisgarh. Compiled by Samaresh, S. Online: https://lccn.loc.gov/2007344357 (06.04.2017).

Ghose, Dipankar (2017): Chattisgarh: Villagers walk 30 km to protest 'fake encounter' killing of two in Dantewada. In Adivasi Resurgence. February 18, 2017. Online: http://www.adivasiresurgence.com/chhattisgarh-villagers-walk-30-km-to-protest-fake-encounter-killing-of-two-in-dantewada/ (16.03.2017).

Gorai A.K. and Pal, A.K..(2009): Methodology of the community noise environmental quality assessment: A case study of Indian iron ore mining complex. In: Journal of Geology and Mining Research 1.10 (2009): 214-223. Online: https://www.academia.edu/26323466/Methodology_of_the_community_noise_environmental_quality_assessment_A_case_study_of_Indian_Iron_ore_mining_complex (05.04.2017).

Gorai, A.K., A.K. Mukhopadhya., A.K. Pal (2006): Control of noise problems in the Bailadila iron ore mine, India. In: Journal of Mining and Geology vol. 42(2): 175-185. Online: https://www.ajol.info/index.php/jmg/article/view/18857 (06.04.2017).

Government of India: List of notified Sheduled Tribes. Online: http://censusindia.gov.in/Tables_Published/SCST/ST%20Lists.pdf (22.01.2019).

GTAI (2017): Bergbau Indien. Online: https://www.gtai.de/GTAI/Navigation/DE/Trade/Maerkte/Branchen/branchenueberblick,t=bergbau-indien-2017,did=1656850.html (02.03.2017).

Haglund, D., A. Roe, M. Ericsson, A.Hodge (2014): The role of mining in national economies (2nd edition). Mining's contribution to sustainable development. Oxford Policy Management, Raw Materials Group, ICMM. Online: https://www.icmm.com/website/publications/pdfs/8264.pdf (16.02.2017).

HDR (2014): Human Development Index (HDI) – United Nations Development Reports. Online: http://hdr.undp.org/sites/default/files/hdr14-report-en-1.pdf (22.01.2019).

Hua, L. (2011): The Situation of NORM in Non-Uranium Mining in China. China National Nuclear safety Administration. http://www.icrp.org/docs/Liu%20Hua%20NORM%20in%20Non-Uranium%20Mining%20in%20China.pdf (22.01.2016).

Human Rights Watch (2012): Out of Control. Mining, Regulatory Failure, and Human Rights in India. Human Rights Watch, New York 2012.

IEP - Institute for Economics & Peace (2016): Global Peace Index 2016. – Institute for Economics & Peace. June 2016. Online: http://economicsandpeace.org/wp-content/uploads/2016/06/GPI-2016-Report_2.pdf (24.04.2017).

Indian Bureau of Mines (2015): Indian Minerals Yearbook 2013 (Part III: Mineral Reviews). Online: http://ibm.nic.in/writereaddata/files/07302015125623IMYB2013_Iron%20Ore.pdf (02.03.2017).

IRMA – Initiative for Responsible Mining Assurance (2014): Standard for Responsible Mining Draft v1.0. Online: https://responsiblemining.net/wp-content/uploads/2018/09/IRMA_Standard_Draft_v1.007-14.pdf (09.12.2019).

Jareda et al. (2016): Water quality index and heavy metal pollution index of Bailadila iron ore mine area and its peripherals. In: International Journal of Engineering and Applied Sciences (IJEAS), Volume- 3, Issue 12, December 2016.

Kaushal, P. (2014): Dantewada tribals say no to polluting mine. In: Tehelka Magazine, Volume 11 Issue 23. Online: http://www.tehelka.com/2014/05/dantewada-tribals-say-no-to-polluting-mine/# (02.03.2017).

Kristensen, P. (2004): The DPSIR Framework. National Environmental Research Institute, Department of Policy Analysis European Topic Centre on Water, European Environment Agency. Denmark. Online: https://greenresistance.files.wordpress.com/2008/10/dpsir-1.pdf (06.04.2017).

Kumar, B.B. and A. Rustan (1996): Critical analysis of problems related to blasting of hard and massive steel grey hematite occurring at Bailadila Deposit-No. 5 Mine, India. In: Ayres de Silva, L.A. A.P. Chaves and W.T. Hennies (editors.) Mine Planning and Equipment Selection 1996.

Kumar, S. (2009): Maoists threaten iron ore mining in Bastar. In: Thaindian News. August 28, 2009. Online: http://www.thaindian.com/newsportal/business/maoists-threaten-iron-ore-mining-in-bastar_100239363.html (16.03.2017).

Kunjam, Mangal (2016): Villagers in Dantewada protest against NMDC's unconstitutional public hearing. In: Adivasi Resurgence. November 18, 2016. Online: http://www.adivasiresurgence.com/villagers-in-dantewada-protest-against-nmdcs-unconstitutional-public-hearing/# (16.03.2017).

Martínez-Alier,J. L. Temper, F. Demaria (2014): Social Metabolism and Environmental Conflicts in India. In: Indialogs – Spanish Journal of India Studies No. 1 - 2014 (Felicity Hand edt.). Online: revistes.uab.cat/indialogs/issue/download/v1/pdf_10 (02.03.2017).

McKinsey (2014): Putting India on the growth path: Unlocking the mining potential. Online: http://mckprod.mckinsey.com/global-themes/india/putting-india-on-the-growth-path-unlocking-the-mining-potential (06.04.2017).

Ministry of Mines (2011): Sustainable Development Framework (SDF) for Indian Mining Sector. Final Report. Online: http://mines.nic.in/writereaddata/UploadFile/Sustainable_Development_Framework.pdf (06.04.2017).

Ministry of Mines (2016): Skill Plan for the Mining Sector (2016-2022). Online: http://mines.nic.in/writereaddata/UploadFile/Final%20Skill%20Plan%20for%20the%20Mining_Last%20Skill.pdf (06.04.2017).

Ministry of Environment, Forest and Climate Change Government of India (2014): F. No. 8-05/2011-FC Online: http://forestsclearance.nic.in/writereaddata/AdditionalInformation/AddInfoSought/2016_7_71111126121118052011FCFactsheet.pdf (06.04.2017).

Ministry of Tribal Affairs (2013): Statistic Profile of Scheduled Tribes in India 2013. Online: http://tribal.nic.in/WriteReadData/userfiles/file/Statistics/StatisticalProfileofSTs2013.pdf (06.04.2017).

Ministry of Tribal Affairs (2014): Report of the High Level Committee on Socio-Economic, Health and Educational Status of Tribal Communities of India, Online: http://www.indiaenvironmentportal.org.in/files/file/Tribal%20Committee%20Report,%20May-June%202014.pdf (06.04.2017).

Ministry of Tribal Affairs 2016: Annual Report 2015-16. Online: http://tribal.nic.in/WriteReadData/CMS/Documents/201606060452201526687EnglishAR.pdf

Mitra, M.N. (2006): Rivers Shankhini and Dankini in Chhattisgarh run dirty. Online: http://www.downtoearth.org.in/coverage/rivers-shankhini-and-dankini-in-chhattisgarh-run-dirty-8894 (27.02.2017).

Mohanty, M., N.K. Dhal, P. Patra, B. Das, P. Sita, R. Reddy (2010): Phytoremediation: A Novel Approach for Utilization of Iron-ore Wastes. In: Reviews of Environmental Contamination and Toxicology, Reviews of Environmental Contamination and Toxicology 206: 29-47, Editor: D.M. Whitacre. Online:https://www.researchgate.net/publication/45283626_Phytoremediation_A_Novel_Approach_for_Utilization_of_Iron-ore_Wastes (23.02.2017).

Mukherjee, A., R.P. Mondal, R. Wadhwa, G. Prabhakar (2010): Disposition Of Banded Iron Formation Of Bailadila Range South Bastar District, Chhattisgarh:Its Implications On Exploration. In: Journal of Applied Geochemistry Vol. 12 No. 3, pp. 469-477.

NDMC Limited (2017): Corporate Presentation. Online: http://dipam.gov.in/sites/default/files/NMDC%20Roadshow%20Presentation.pdf?download=1 (03.02.2017).

NMDC Limited (2010): JORC Reserve Statement. Online: https://www.nmdc.co.in/Docs/Reserve%20Details/JORC%20Reserve%20Statement.pdf (03.02.2017).

NMDC Limited (2015): Concept Note on Climate Change. Online: https://www.nmdc.co.in/Docs/Environment/Concept%20Note%20Climate%20Change%20NMDC_23rd%20Sept%202015.pdf (03.02.2017).

NMDC Limited (2016a): Company Information. Online: https://www.nmdc.co.in/Introduction.aspx (03.02.2017).

NMDC Limited (2016b): Kirandul Complex. Online: https://www.nmdc.co.in/KirandulComplex.aspx (03.02.2017).

NMDC Limited (2016c): Environmental Management. Online: https://www.nmdc.co.in/EnvironmentalMgmt.aspx (03.02.2017).

NMDC Limited (2016d): 58th Annual Report 2015-16. Online: https://www.nmdc.co.in/Investor%20News/Handlers/DownloadFile.ashx?ID=1a4c4f03-2c30-46dd-a356-5386798ad77d (03.02.2017).

NMDC Limited (2016e): United Nations Global Compact – Statement of NMDC. Online: https://www.unglobalcompact.org/system/attachments/cop_2016/302031/original/COP_OF_NMDC_2015-16.pdf?1468851824 (27.02.2017).

No author (2014): Chapter III Chhattisgarh: A Resource Abundant but Turbulent Land. Online: http://shodhganga.inflibnet.ac.in/bitstream/10603/55404/11/11_chapter%203.pdf (27.02.2017).

Nova Mining (2014): Bailadila Iron Ore Mines. Online: http://www.novamining.com/knowledgebase/mining-database/state-wise-data/chhattisgarh/featured-mines/bailadila-iron-ore-mines/ (17.02.2016).

Oxfam India (2015): Implementing the Forest Rights Act: Lack of Political Will? Policly Brief No. 15, November 2015, Online: https://www.oxfamindia.org/sites/default/files/PB-implementing-forest-rights-act-lack-of-political-will-261115-en.pdf (22.01.2019).

People’s March (2006): The Forest is Our" - Assert the indigenous Adivasi inhabitants of Dandakaranya and the vast hinterland of India. Online: http://www.bannedthought.net/India/PeoplesMarch/PM1999-2006/archives/2006/Jan2k6/DK.htm# (16.03.2017).

Pfister, S., Koehler, A., Hellweg, S. (2009): Assessing the Environmental Impacts of Freshwater Consumption in LCA. In: Environmental Science & Technology. Vol. 43, No. 11, pp. 4098–104.

PRS India (2012): Legislative Brief The Mines and Minerals (Development and Regulation) Bill, 2011. Online: http://www.prsindia.org/uploads/media/Mines/MMDR%20Brief.pdf (05.04.2017).

PUDR - People's Union for Democratic Rights (2015): War and the Lightness of Being Adivasi Security camps and villages in Bijapur, Chhattisgarh. Online: http://www.pudr.org/sites/default/files/pdfs/PUDR%20Bas%20total%20with%20cvr.pdf (27.02.2017).

Putul, A.P. (2007): No Man’s Land. In: Caterpillar and the Mahua Flower. Tremors in India’s Mining Fields. Editor:R. Kalshian. New Delhi. Online: http://www.panosnetwork.org/attachments/article/146/Caterpillar%20and%20the%20Mahua%20Flower.pdf (06.04.2017).

Rasheed, A. (2014): Environmentally Sustainable World: Apprehensions and Actions. In: The International.

Saklani, S. (2015): Life in a conflict zone: an ethnographic study of children in Chhattisgarh: Chapter III Chhattisgarh: A Resource Abundant but Turbulent Land. Online: http://shodhganga.inflibnet.ac.in/bitstream/10603/55404/11/11_chapter%203.pdf (27.02.2017).

Shay, C. (2016): Expansion of mining risks a Naxalite resurgence in India’s Red Corridor. In: ISS Voices. May 4, 2016. Online: https://www.iiss.org/en/iiss%20voices/blogsections/iiss-voices-2016-9143/may-12f3/mining-and-naxalites-b551 (16.03.2017).

Singh, K. and Kalirajan, K. (2000): A decade of economic reforms in India: The mining sector. Online: https://ccep.crawford.anu.edu.au/acde/asarc/pdf/papers/conference/CONF2001_08.pdf (07.04.2017).

Sreenivasulu, P. and P. Padmasree (2016): Environmental Ethics and Mineral Legislations in India for Sustainable Development. In: International Journal for Research in Biology & Pharmacy Research 52 Vol 2 Issue 3 March 2016 Paper 5.

Tata Energy Research Institute (2002): Overview of Mining and Mineral Industry in India. In: Sustainable Development. No.185.

TERI (2012): Governance of mining in India: responding to policy deficits. Online: http://www.teriin.org/policybrief/index.php?a=5 (07.04.2017).

The Economic Times (2016): NMDC’s Bailadila Iron ore mine-Bacheli Complex bags FIMI Golden Jubilee Award, By Rakhi Mazumdar. Online: http://economictimes.indiatimes.com/industry/indl-goods/svs/metals-mining/nmdcs-bailadila-iron-ore-mine-bacheli-complex-bags-fimi-golden-jubilee-award/articleshow/54700840.cms (07.04.2017).

The Hindu (2014): ‘Red water’ muddies life for Dantewada villagers. Online: https://www.thehindu.com/news/national/other-states/red-water-muddies-life-for-dantewada-villagers/article6183876.ece (07.07.2014)

The Hindu (2016a): Mineral bill providing share in profit all set to lapse. By: Mehdudia, S. Online: http://www.thehindu.com/business/mineral-bill-providing-share-in-profit-all-set-to-lapse/article5656839.ece (05.04.2017).

The Hindu (2016b): Naxal attack on Bacheli iron ore mine complex not to hit output: NMDC. Online: https://www.thehindubusinessline.com/companies/naxal-attack-on-bacheli-iron-ore-mine-complex-not-to-hit-output-nmdc/article8560148.ece# (05.04.2017).

The Pioneer (2017): NMDC to Seek ADDL Mining Leases to Meet Higher Iron Ore Output Target. January 3, 2017. Online: http://www.dailypioneer.com/state-editions/nmdc-to-seek-addl-mining-leases-to-meet-higher-iron-ore-output-target.html (16.03.2017).

The Times of India (2017a): Maoists ambush CRPF men in Bastar, 12 killed. March 12, 2017. Online: http://timesofindia.indiatimes.com/city/raipur/maoists-ambush-crpf-men-in-bastar-12-killed/articleshow/57599840.cms (16.03.2017).

The Times of India (2017b): Chattisgarh: Maoists attack national Mineral Development Corporation vehicles. February 7, 2017. http://timesofindia.indiatimes.com/videos/news/chhattisgarh-maoists-attack-national-mineral-development-corporation-vehicles/videoshow/57027262.cms (16.03.2017).

Tribal Cultural Heritage in India Foundation (2011): India's support for UN Declaration on the Rights of Indigenous Peoples. March 28, 2011. Online: https://www.indiantribalheritage.org/?page_id=259 (22.01.2019).

UNDP (2005): Chhattisgarh Human Development Report. Online: http://www.undp.org/content/dam/india/docs/human_develop_report_2005_chhattisgarh_full_report.pdf (27.02.2017).

UNDP 2012: Panchayat Raj (Extension to Scheduled Areas) Act of 1996: Policy Brief, http://www.undp.org/content/dam/india/docs/UNDP-Policy-Brief-on-PESA.pdf (27.02.2017).

United Nations (2007): General Assembly Adopts Declaration on Rights of Indigenous Peoples; 'Major Step Forward' Towards Human Rights for All, Says President. September 13, 2007. Online: http://www.un.org/press/en/2007/ga10612.doc.htm (22.01.2019).

United Nations (2008): United Nations Declaration on the Rights of Indigenous Peoples. 61/295. Adopted on September 13, 2007. Online: http://www.un.org/esa/socdev/unpfii/documents/DRIPS_en.pdf (22.01.2019).

USGS (2015): Mineral Commodity Summaries 2015. US Geological Survey, Washington. Online: https://s3-us-west-2.amazonaws.com/prd-wret/assets/palladium/production/mineral-pubs/mcs/mcs2015.pdf. (09.02.2017).

USGS (2016): Mineral commodity summaries 2016. US Geological Survey, Washington. Online: https://minerals.usgs.gov/minerals/pubs/mcs/2016/mcs2016.pdf (09.02.2017).

Vimta Labs (2015): Environmental Impact Assessment. Online: http://enviscecb.org/221/English.pdf (03.02.2017).

World Bank (2015): Worldwide Governance Indicators. – World Bank. Online: http://data.worldbank.org/data-catalog/worldwide-governance-indicators (22.01.2019).

Yale University (n.d.): Environmental Performance Index – USA. Online: https://epi.envirocenter.yale.edu/epi-country-report/USA (21.01.2019).