Sustainable mining: how to quantify social issues in the mining industry and metals supply chain

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Social LCA – Challenges and solutions in application and implementation
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Framework

MINERALS AND METALS

ENVIRONMENTAL PROTECTION

BUSINESS AND ECONOMICS

SOCIAL FAIRNESS

LEGAL FRAMEWORK

PRESSURES IN MINING
Challenges – social issues

- **Dynamic**, cause-effect relations among social and socio-economic risks and impacts
- How to understand the **local context**
- **Complementarity** with the other sustainability dimensions
- How to measure issues expressed in a **qualitative** way
- Data quality
Challenges – social issues in mining

- How to **balance** business, environmental protection and social fairness
- **Positive** and **negative** impacts
Challenges – social issues in mining

- **Positive** and **negative** impacts

- **Job creation**
- **Poor working conditions**

- **Infrastructure construction**
- **Rise of the cost of living**

- **Local development**
- **Resettlement, limited access to resources**

- **Economic and income growth**
- **Unfair distribution of the profit**

- **Population growth**
- **Social tensions and matters**

- **Human health and safety issues**
- **Discrimination**
Challenges – social issues in mining

- How to balance business, environmental protection and social fairness
- Positive and negative impacts
- How to approach local communities
- Collaboration with the mine sites/companies
- Data collection
- How to measure risks/impacts in the supply chain
Integrated Mineral Technologies for more Sustainable Raw Material Supply

- H2020 issue “Sustainable selective low impact mining”
- 3 years: 1.6.2017 – 31.5.2020
- 7.9 M€ budget
- 16 partners

**Sustainable mineral supply in the EU**

**ITERAMS project**

- **EFFICIENT WATER RECYCLING**
  - Reduction of water consumption by >90%
  - Water quality optimization for each process step
  - Recovery of valuable constituents from water solutions
  - Efficient and economical water treatment methods

- **TAILINGS VALORIZATION**
  - Geopolymerisation for water and oxygen tight covers on deposited tailings
  - Waste rock and tailings as hardening mine fill or sold as products
  - All remaining tailings safely deposited as a filter dry cake

- **MINIMIZATION OF ENVIRONMENTAL FOOTPRINT**
  - No effluents to environment
  - No fresh water intake
  - No dam failures
  - Area conserved
  - Enhanced mining
  - Enhanced tailings value

**WATER**

**TAILINGS**

**ENVIRONMENT**
The ITERAMS project

- **Sustainability assessment**
  - Environmental
  - Cost
  - Social

- **Local communities**
  - Social perception
  - Communication channels
  - Communication action plan

1st step

Social hotspots screening

- Literature research
- Qualitative modeling
- Social LCA
Understanding – a qualitative model
Understanding - the context of mining

• Vulnerability of local communities, e.g. their dependence on local water reserves
• Availability and quality of water and mineral resources
• Conflicts with other industries
• Importance of mining for the local/national economy
• Risks on a national scale (not sector-specific)
• Steadiness of risks/impacts
SLCA screening – a first quantification

- Country: Finland, Portugal
- Database: PSILCA
- IAM: Social Impacts Weighting Method in PSILCA
- Process: Mining of metal ores

SLCA screening steps:
1. Define social risks (without upstream chain)
2. Calculate social risks and impacts over the life cycle
3. Compare results with an average country sector
4. Explore relations between social impacts and governance and human development
1. Social risks in the sector

**Social aspects for the process Mining of metal ores, Finland, from PSILCA database**

<table>
<thead>
<tr>
<th>Name</th>
<th>Raw value</th>
<th>Risk level</th>
<th>Activity variable</th>
<th>Data quality</th>
<th>Comment</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Community</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Respect of indigenous rights</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presence of indigenous population</td>
<td>1 [Y/N]</td>
<td>Medium risk</td>
<td>0.00563033842697635</td>
<td>(1;7;1;1:n.a.)</td>
<td>Data from: 2015; Lass...</td>
<td>FAO 2017: Present...</td>
</tr>
<tr>
<td>Human rights issues faced by indigenous people</td>
<td>3 [Score]</td>
<td>Medium risk</td>
<td>0.00563033842697635</td>
<td>(2;3;1;1:n.a.)</td>
<td>Ratification of ILO C...</td>
<td>ILO 1989: Indigenous...</td>
</tr>
<tr>
<td>Access to material resources</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extraction of ores</td>
<td>3.3552 [t/cap]</td>
<td>Very low risk</td>
<td>0.00563033842697635</td>
<td>(2;7;4;1:n.a.)</td>
<td>Data from: 2013; Lass...</td>
<td>SERI/ WU Vienna...</td>
</tr>
<tr>
<td>Extraction of industrial and construction minerals</td>
<td>22.3624 [t/cap]</td>
<td>Very high risk</td>
<td>0.00563033842697635</td>
<td>(2;1;4;1:n.a.)</td>
<td>Data from: 2013; Lass...</td>
<td>SERI/ WU Vienna...</td>
</tr>
<tr>
<td>Extraction of biomass (related to population)</td>
<td>10.2463 [t/cap]</td>
<td>High risk</td>
<td>0.00563033842697635</td>
<td>(2;1;4;1:n.a.)</td>
<td>Data from: 2013; Lass...</td>
<td>SERI/ WU Vienna...</td>
</tr>
<tr>
<td>Level of industrial water use (related to renewable water resources)</td>
<td>1.930909091 [% of renewable]</td>
<td>Low risk</td>
<td>0.00563033842697635</td>
<td>(2;2;5;1:5)</td>
<td>Data from: 1995; Lass...</td>
<td>FAO 2017: Water...</td>
</tr>
<tr>
<td>Certified environmental management systems</td>
<td>6.360856259 [# per 10k empl.]</td>
<td>Medium risk</td>
<td>0.00563033842697635</td>
<td>(1;1;2;1:2)</td>
<td>Value calculated with...</td>
<td>ISO 2017: CEMS</td>
</tr>
<tr>
<td>Level of industrial water use (related to total withdrawal)</td>
<td>32.3 [% of total]</td>
<td>High risk</td>
<td>0.00563033842697635</td>
<td>(2;2;5;1:5)</td>
<td>Data from: 1995; Lass...</td>
<td>FAO 2017: Water...</td>
</tr>
</tbody>
</table>
1. Social risks in the sector

- Minerals extraction
- Not socially responsible along the supply chain
- Industrial water use
- Insufficient living wage
- Violation of trade union rights
- Corruption and bribery
- Anti-competitive business practices
- Non-fatal accidents
- Fatal accidents
- Women discrimination

Risk levels:
- NR: no risk
- VLR: very low risk
- LR: low risk
- MR: medium risk
- HR: high risk
- VHR: very high risk

- Finland: VHR
- Portugal: NR
2. Results: S-LCA screening

- Metal ores, Finland, PSILCA (1 USD output)

<table>
<thead>
<tr>
<th>Environmental Load</th>
<th>MEDIUM RISK HOURS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contribution</td>
<td></td>
</tr>
<tr>
<td>Social responsibility along the supply chain</td>
<td></td>
</tr>
<tr>
<td>Public sector corruption</td>
<td></td>
</tr>
<tr>
<td>Certified environmental management system</td>
<td></td>
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<tr>
<td>Minerals consumption</td>
<td></td>
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<tr>
<td>Industrial water depletion</td>
<td></td>
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<tr>
<td>Sanitation coverage</td>
<td></td>
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<tr>
<td>Trade unionism</td>
<td></td>
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<tr>
<td>Safety measures</td>
<td></td>
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<tr>
<td>Non-fatal accidents</td>
<td></td>
</tr>
</tbody>
</table>
2. Results: S-LCA screening

• Industrial water depletion, metal ores mining sector, Finland

Direct process contribution to industrial water depletion
2. Results: S-LCA screening

- Metal ores, Portugal, PSILCA (1 USD output)
2. Results: S-LCA screening

- Non-fatal accidents, metal ores mining sector, Portugal
3. Comparison with an average country sector
### 4. Social and governance situation

<table>
<thead>
<tr>
<th>Worldwide Governance Indicators</th>
<th>Finland</th>
<th>Portugal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voice and Accountability</td>
<td>1.55</td>
<td>1.21</td>
</tr>
<tr>
<td>Political Stability and Absence of Violence/Terrorism</td>
<td>1.07</td>
<td>1.08</td>
</tr>
<tr>
<td>Government Effectiveness</td>
<td>1.94</td>
<td>1.33</td>
</tr>
<tr>
<td>Regulatory Quality</td>
<td>1.82</td>
<td>0.91</td>
</tr>
<tr>
<td>Rule of Law</td>
<td>2.03</td>
<td>1.13</td>
</tr>
<tr>
<td>Control of Corruption</td>
<td>2.22</td>
<td>0.87</td>
</tr>
</tbody>
</table>

“Estimate of governance ranges from approximately -2.5 (weak) to 2.5 (strong) governance performance” (World Bank 2017)
Primary data collection and creation of the foreground model

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Data source and description of the value</th>
<th>Overall value</th>
<th>Ore mining</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reference year</strong></td>
<td></td>
<td>2017</td>
<td>2018</td>
</tr>
<tr>
<td><strong>Non-fatal accident rate</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of workers</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Number of cases of non-fatal accidents</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk of non-fatal accidents (qualitative assessment)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fatal accident rate</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Number of cases of fatal accidents</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk of fatal accidents (qualitative assessment)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Spending on locally based suppliers</strong></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

**General information: Rate of non-fatal accidents at workplace**

**Additional information**

- **Unit of measurement**: #/yr and 100k empl.
- **Evaluation schema**:
  - 0-<750 = very low risk
  - 750-<1500 = low risk
  - 1500-<2250 = medium risk
  - 2250-<3000 = high risk
  - >3000 = very high risk; no data

**Outputs**

<table>
<thead>
<tr>
<th>Flow</th>
<th>Amount</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public sector corruption; very low risk</td>
<td>0.00563</td>
<td>h</td>
</tr>
<tr>
<td>Rate of fatal accidents at workplace; very high risk</td>
<td>0.00563</td>
<td>h</td>
</tr>
<tr>
<td>Rate of non-fatal accidents at workplace; high risk</td>
<td>0.00563</td>
<td>h</td>
</tr>
<tr>
<td>Right of Association; no risk</td>
<td>0.00563</td>
<td>h</td>
</tr>
</tbody>
</table>
The way forward

- Involve local communities in data collection
- Study of background situations

- To be able to quantify social impacts we should first understand what there is behind
- **Context** is crucial
- **Collaboration** is needed between all parties involved
- The choice of the **tools** used for the assessment influences the data collection approach
References

• Tuusjäärvi, M., From a mine to you – Sustainability of the Finnish mining sector in the context of global supply chains of metals (2013) Department of Geosciences and Geography A23, Helsinki


• Ecological status of surface water in Portugal, slide 6. Available at: https://snirh.apambiente.pt/index.php?idMain=1&idItem=1.5. Last accessed: 15.08.18

• Ecological status of surface waters in Finland, slide 6. Available at: http://www.ymparisto.fi/en-US/Waters/State_of_the_surface_waters. Last accessed: 15.08.18


• Picture slide 1: https://unsplash.com/photos/lutqINJUAts

• Pictures slide 2:
Thank you!

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