SECURITY OF SUPPLY, CRITICALITY AND LCA

Workshop Mineral Resources in LCIA
London, 14 October 2015
Business Unit Systemic Risks
Themes and selected clients (raw materials)

- Raw materials policy and security of supply
  - Clients include: European Commission (DG Enterprise and Industry, DG Research), Office of Technology Assessment at the German Bundestag, German Federal Ministry of Education and Research (BMBF)

- Dynamic material flow modeling
  - Clients include: International Copper Association, Volkswagen, German Federal Ministry of Education and Research (BMBF)

- Influence of technological change on the demand for raw materials
  - Clients include: European Commission (DG Research, DG Joint Research Centre), Volkswagen, German Federal Ministry of Education and Research (BMBF)
Criticality
Impact on resources – Depletion
- (very) long-term
- Global context

Criticality: Impact on supply chain
- Short-term
- May only last for a certain time
- Positionality / concernment
Definition of criticality with general risk matrix

- Raw material criticality may be interpreted as the “systemic risk” for an economy due to disturbances in raw material supply.
Some features of „criticality“

- Criticality is a **relative** concept
- Criticality has **at least two dimensions**
  - Some sort of risk – generally risk of supply interruptions
  - Some sort of impact – generally economic
- At least two dimensions are connected by a logical „**AND**“
- Raw materials are not critical in themselves, they are critical to somebody (for some reason or set of reasons) at some point in time
  - Countries or group of countries
  - Parts of countries
  - Sectors
  - Companies
- Instrument to highlight current issues and inform policy or business decisions
<table>
<thead>
<tr>
<th>Title</th>
<th>Focus</th>
<th>Commissioners / reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Design in an Era of Constrained Resources”</td>
<td>GE corporation</td>
<td>General Electric (Duclos et al., 2008)</td>
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<tr>
<td>Critical Raw Materials for Germany”</td>
<td>German industry</td>
<td>KfW bank group (Erdmann et al., 2011)</td>
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<td>“Criticality space (matrix enhanced by the third dimension of “environmental implications”)”</td>
<td>“Criticality of the Geological Copper Family”</td>
<td>U.S. economy and global level</td>
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Three reasons why some materials may be considered critical:

- "first, they have a significant economic importance for key sectors,
- second, the EU is faced with high supply risks […]
- and third, there is currently a lack of substitutes."

Need to define metrics for each in order to determine criticality.


Indicators from “Critical raw materials for the EU” (Ad-hoc working group on defining critical raw materials, 2010)
Methodology: Economic importance

End uses of a raw material

End uses of a raw material:
- Use 1
- Use 2
- Use 3

Gross value added of end use "megasectors" in the EU

Assign end uses to pertinent "megasectors"

Megasector A
Megasector B

Multiply each % end use by GVA of megasector and build weighted sum

Economic importance

\[ \Sigma = 100\% \]
Methodology: Supply risk

Material properties are not included!

Risk from concentrated primary production in countries with
(a) Poor governance
(b) Low environmental standards

Risk-reducing filter
Recycling
Risk-reducing filter
Substitutability

Supply risk
Critical raw materials for the EU: Update 2014 (SR\textsubscript{WGI})

“Critical raw materials for the EU” (Ad-hoc working group on defining critical raw materials, 2014)
Perspective of Criticality Assessment

**Upstream**

- **Concentrate**
  - 900 kt
- **Blister Anodes**
  - 420 kt

**EU28 (2013)**

- Stock in use 89 200 kt
- Manufacturing 3 770 kt
- Net imports 1 010 kt
- Scrap 260 kt
- 270 kt Semis
- 220 kt Finished products

**Downstream**

- Supply Chain
- Consumption and impact on national economy/value added

- **No** standardised norm and **no** strict definition, what to concentrate on in the supply chain (raw material vs. intermediate product)
- Static (only image of status quo)
- **Relativ** assessment
- „Subjectiv“ thresholds through experts
The four phases of LCA

1. Goal and Scope definition
   - Resource extraction
   - Production
   - Use
   - Disposal

2. Inventory analysis
   - Technical inputs and outputs of all processes
   - Emissions (to air, water, and soil)
   - Resource use (land, water, fossils, metals)

3. Life-cycle impact assessment
   - Climate change
   - Ozone depletion
   - Photochemical ozone creation
   - Human toxicity
   - Ecotoxicity
   - Eutrophication
   - Acidification
   - Land stress
   - Water stress
   - Resource depletion

4. Interpretation

The expanding nature of LCA applications

Approaches to assess resource in Life Cycle Impact Assessment (LCIA):

- Models based on reserves of a resource (Scarcity)
- Exergy consumption
- Future consequences of resource extraction
- Marginal cost of resource extraction
- Distance to target
- Willingness to pay
- ...

Perspective of LCA

**Upstream**
- Whole supply chain is of interest
- Established **standardised norm** (ISO 14040/44)
- **Discreet** assessment possible
- „Scintifical“ thresholds

**Downstream**
- Impact on environment
The three dimensions of Life Cycle Sustainability Assessment (LCSA)

Environment
- Life Cycle Assessment (LCA)
  - Acceptable
  - Sustainable
  - Viable

Social
- Social Life Cycle Assessment (sLCA)
  - Acceptable
  - Sustainable
  - Viable

Economic
- Life Cycle Costing (LCC)
  - Equitable
  - Viable

Challenge is independency of Criteria

United Nations (2005)
Impact on supply chain as part of Sustainability Assessment

Important questions to ask here are:

- What is the aim of each method, why were they developed?
- What is the additional value of integration?
  - If integration is wanted, what do the methods contribute to each other?
  - **CRM → LCA:**
    - It may help to improve the LCA data base,
    - But it is not an environmental impact itself
  - **LCA → CRM:**
    - Indirect contribution (like EPI) on a more detailed level?
    - **Independency of criteria:** Criticality already included in LCC
  - **Criticality as an extra dimension** in SLCA by Including Life Cycle Thinking in criticality assessments?
Thank you for your attention.

Dipl.-Ing. Torsten Hummen

Sustainability and Infrastructure Systems
Fraunhofer Institute for Systems and Innovation Research ISI
Phone +49 721 6809-497
E-Mail: torsten.hummen@isi.fraunhofer.de