GLOBAL OUTLOOK ON ASSESSMENTS OF CRITICAL RAW MATERIALS

Focus on socio-economic, environmental and technical implications
Criticality assessment is: .......... or was?

- A Call for Attention
- A Screening Exercise
- Prelude to Detailed Assessment

source: Roderick Eggert
Colorado School of Mines, US
International Criticality Study Groups

US NRC, 2008
International Round Table on Materials Criticality – IRTC

- Alessandra Hool, IRTC Coordinator, ESM Foundation, Switzerland

- Currently in third round:
  - 2018-2020 IRTC
  - 2020-2022 IRTC-Business
  - 2022-2025 IRTC-Training
Outlook on Criticality Assessments
EC Criticality Assessments

EC methodology

→ 2010 first release
→ 2013 update
→ 2015 revision (JRC)
EC Criticality Assessments
2017 Guidelines – Supply risk

\[ SR = \left[ (HHI_{WGI-t})_{GS} \cdot \frac{IR}{2} + (HHI_{WGI-t})_{EUsourcing} \left( 1 - \frac{IR}{2} \right) \right] \left( 1 - EoL_{RIR} \right) SI_{SR} \]

- Supply concentr. (HHI)
- Poor Governance (WGI)
- Global vs EU
- Import dependency
- Trade
- Supply chain
- Substitution
- Recycling

- Black \(\rightarrow\) already in 2014
- Red \(\rightarrow\) JRC introduced
- Blue \(\rightarrow\) JRC improved
EC Criticality Assessments
2017 Guidelines – Economic importance

\[ EI = \sum_{S} (A_S \times Q_S) \times SI \]

(1) MEGASECTORS → NACE-2
(2) allocation of RM uses (NACE-6)
(3) RM-specific substitution index
## EC Criticality Assessments
### 2023 List of Critical Raw Materials

<table>
<thead>
<tr>
<th>2023 CRMs vs. 2020 CRMs</th>
</tr>
</thead>
<tbody>
<tr>
<td>aluminium/ bauxite</td>
</tr>
<tr>
<td>antimony</td>
</tr>
<tr>
<td>baryte</td>
</tr>
<tr>
<td>beryllium</td>
</tr>
<tr>
<td>bismuth</td>
</tr>
<tr>
<td>borate</td>
</tr>
<tr>
<td>cobalt</td>
</tr>
<tr>
<td>coking coal</td>
</tr>
<tr>
<td>fluor spar</td>
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</table>

**Legend:**
- **Black:** CRMs in 2023 and 2020
- **Red:** CRMs in 2023, non-CRMs in 2020
- **Strikethrough:** Non-CRMs in 2023 that were critical in 2020
EC Criticality Assessments

2023 Foresight Report & Strategic raw materials

LIST OF STRATEGIC RAW MATERIALS

The following raw materials shall be considered strategic:

(a) Bismuth
(b) Boron - metallurgy grade
(c) Cobalt
(d) Copper
(e) Gallium
(f) Germanium
(g) Lithium - battery grade
(h) Magnesium metal
(i) Manganese - battery grade
(j) Natural Graphite - battery grade
(k) Nickel - battery grade
(l) Platinum Group Metals
(m) Rare Earth Elements for magnets (Nd, Pr, Tb, Dy, Gd, Sm, and Ce)
(n) Silicon metal
(o) Titanium metal
(p) Tungsten
Environmental Implications

Vulnerability to Supply Restriction
International Criticality Study Groups

Source: Nedal Nassar
USGS, US
US list of CRMs – 2018

Result: 35 CRMs → 50 in 2022
A risk modeling framework is used to assessing mineral commodities supply chains that pose the greatest risk to the U.S. economy.

**Disruption Potential**

**Issue**
- Likelihood of a foreign supply disruption

**Indicator**
- Concentration of production in countries that may become unable or unwilling to supply the United States

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**Trade Exposure**

**Degree of exposure to a supply disruption**

**Indicator**
- Net import reliance as a percentage of apparent consumption

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**Economic Vulnerability**

**Ability to withstand the effects of a supply disruption**

**Indicator**
- Annual expenditure on the mineral commodity by each industry relative to each industry’s profitability

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**Annual Survey of Mining Companies**

**Willingness to Supply Index**

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**United States Census Bureau**

**FRASER Institute**

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**Exports**

**Stock additions**

**Imports**

**Stock releases**

**Secondary production (recycling)**

**Primary production**

**Apparent consumption**

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For some mineral commodities, the supply risk to the United States has increased notably over the past decade.

A subset of mineral commodities pose the greatest supply risk for the U.S. manufacturing sector.
International Criticality Study Groups

JAPAN

A study of a stable supply of mineral resources
JOGMEC, Metal strategy division, Ariga Daisuke

Critical Metals in Japan

Abstract

As Japan is highly dependent on mineral resources from abroad, it is critical for Japan to secure a stable supply of them. Therefore, the Japanese government and companies have been working on exploration development, stockpiles, and recycle of the mineral resources. In this report, the degree of importance of mineral commodities in Japan in terms of economic importance and supply risk for 41 mineral commodities is evaluated based on the method for evaluating criticality of raw materials, which was released by the European Commission in 2010, in order to contribute to secure stability of mineral resources.

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<th>Criticality</th>
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<td>✓ Import partner countries</td>
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<td>✓ Producing countries</td>
</tr>
<tr>
<td>✓ Price</td>
<td>✓ Univaried distribution of reserve</td>
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Market scale of metals in Japan (EJ)

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<th>Business environment of metal industry</th>
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<td>Base metal</td>
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<td>✓</td>
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<td>Noble metal</td>
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Reported Supply Disruptions

SR are **major breakdowns** in the mineral market equilibrium

«Healthy system» → «disease»

Hatayama H., Tahara K. 2018, Adopting an objective approach to criticality assessment: Learning from the past, Resources Policy, Volume 55, 96-102
**Links between Criticality parameters and UNFC axes - discussion**

**E axis**

*E axis* assesses the sustainability of mineral development in terms of environmental and socio-economic factors.
- Backbone in most criticality assessments.
- (…)

**F axis**

*F axis* assesses the ability to extract and process a mineral economically and with available technology.
- Technological aspects.
- (…)

**G axis**

*G axis* estimates the level of understanding of a mineral resource’s quantity and quality.
- Minor aspects in criticality?
- (…)
Thank you!

Gian Andrea Blengini
Associate Professor
Politecnico di Torino
Date 25 I 04 I 2023, Geneva