Abiotic resource availability in the context of sustainability

Laura Schneider, Markus Berger, Matthais Finkbeiner

Technische Universität Berlin
Department of Environmental Technology
Chair of Sustainable Engineering

Availability of Abiotic Resources

Source: Rabtron, Mike Jilek, Charlie Petit

The Availability Question .. And the Answer?

LCA

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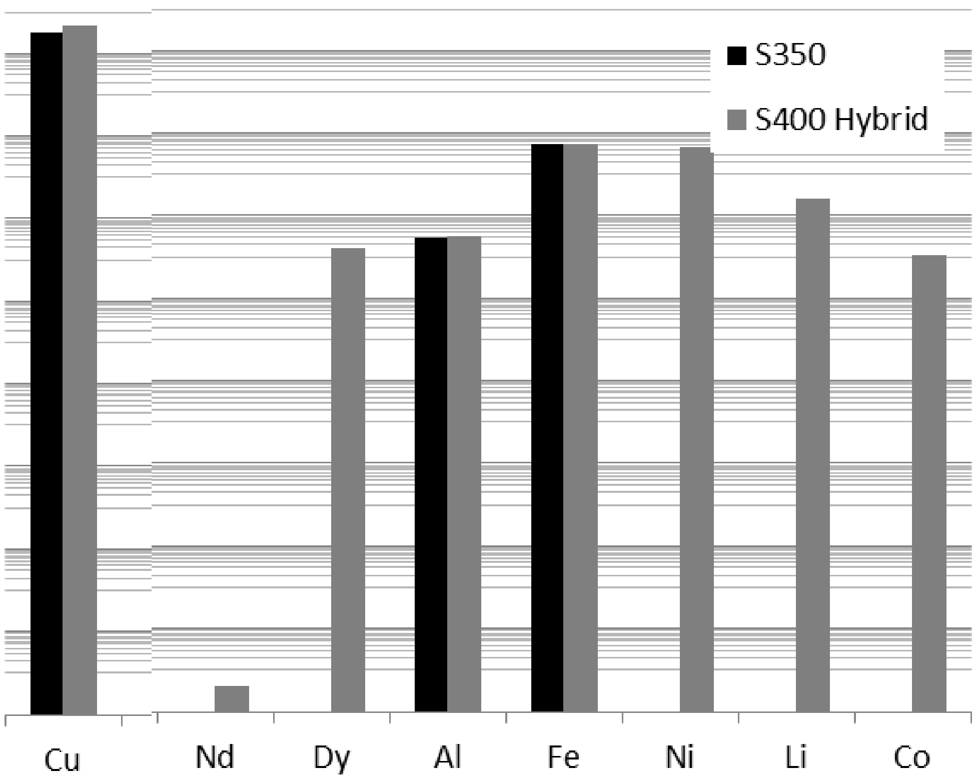
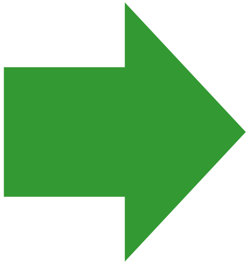
Abiotic depletion potential (ADP)





Neodymium = no problem?!

Availability of Resources in LCA II

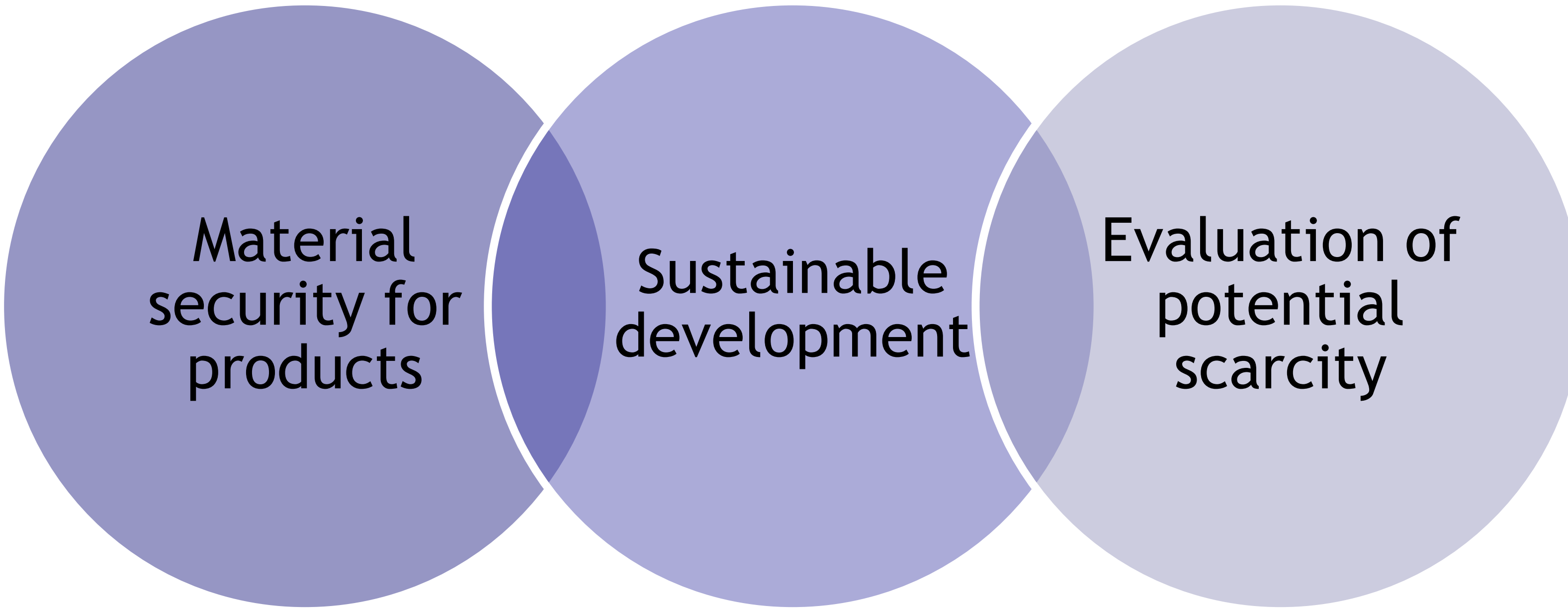
Resource characteristics → Exergy

Physical stocks → Reserves and/or annual extraction rates

Future availability/effort needed → Surplus costs, surplus energy

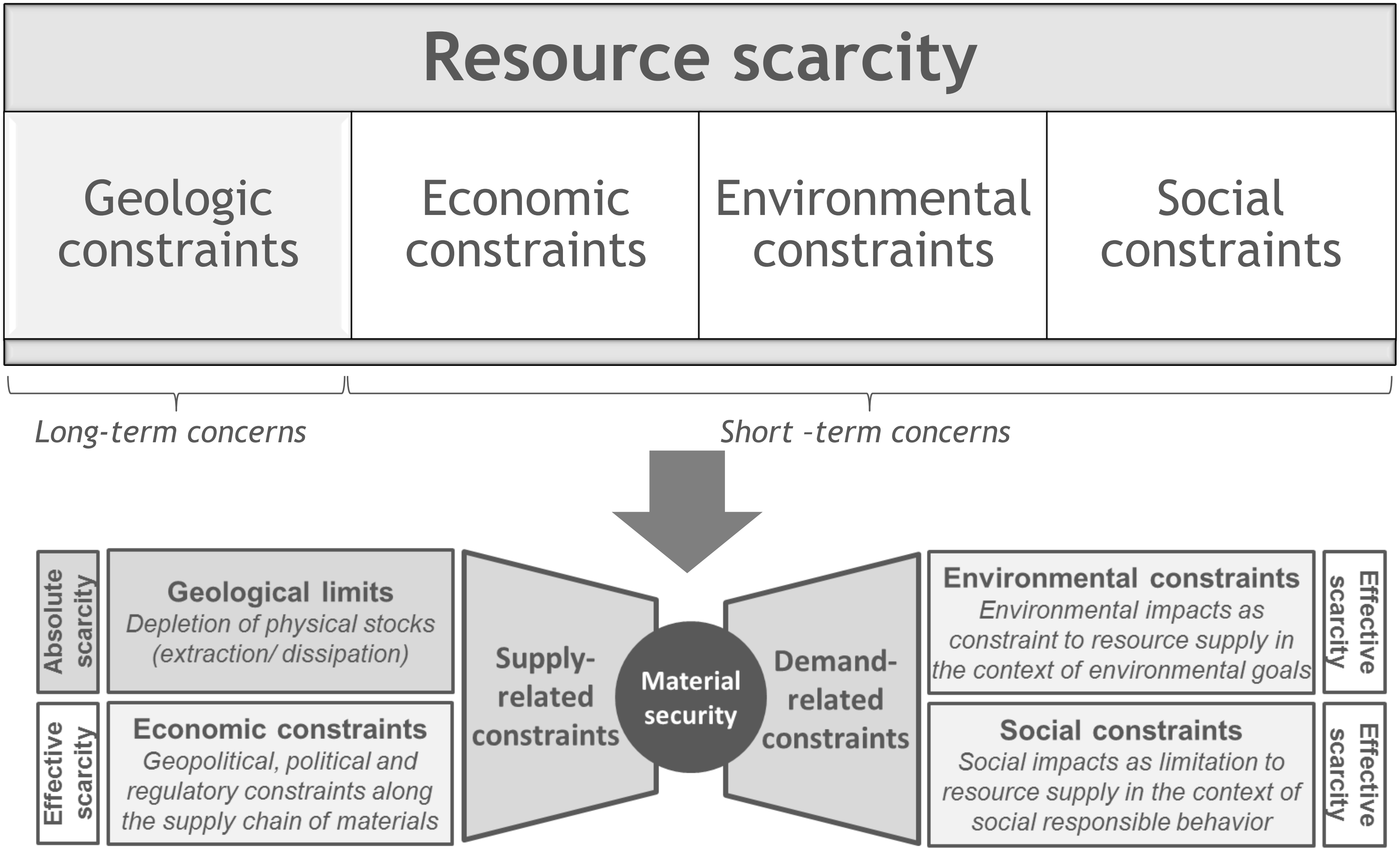
Decreasing physical availability of concern for material choices ?

Availability Assessment



- **Availability for products needs to be assessed in the context of LCSA**
- **Consideration of all 3 dimensions of sustainability**

Absolute and Effective Scarcity



Comprehensive Assessment of Resource Availability

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1. **Physical scarcity**

   → Depletion (existing LCA models and enhancement of consideration of physical availability)

2. ***Environmental scarcity***

   → *Modelling environmental risks associated with material portfolios of products (environmental impacts of extraction and processing based on LCIA methods)*

3. **Economic scarcity**

   → Modelling the supply risk associated with product inventories based on identified indicators

4. **Social scarcity**

   → Modelling social risks associated with product inventories based on Social-LCA approach

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Geologic availabiltiy

-

Abiotic depletion potential

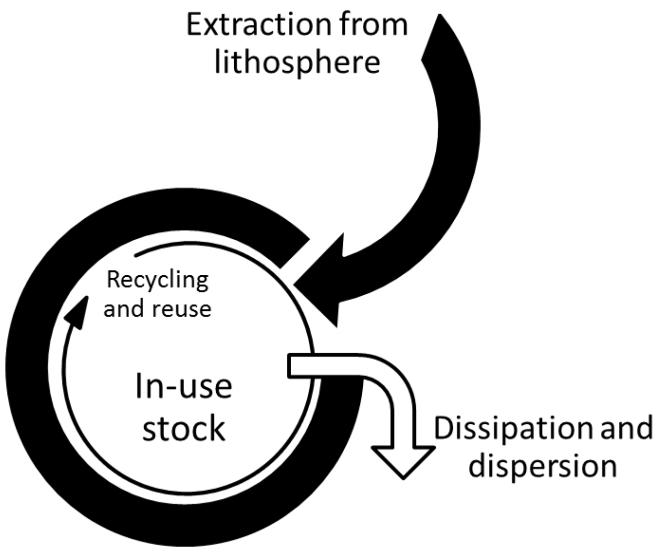
$$ADP_{i,reserves} = \frac{\text{extraction rate i}}{(\text{reserve}_\text{i})^2} \cdot \frac{(\text{reserve antimony})^2}{\text{extraction rate antimony}}$$

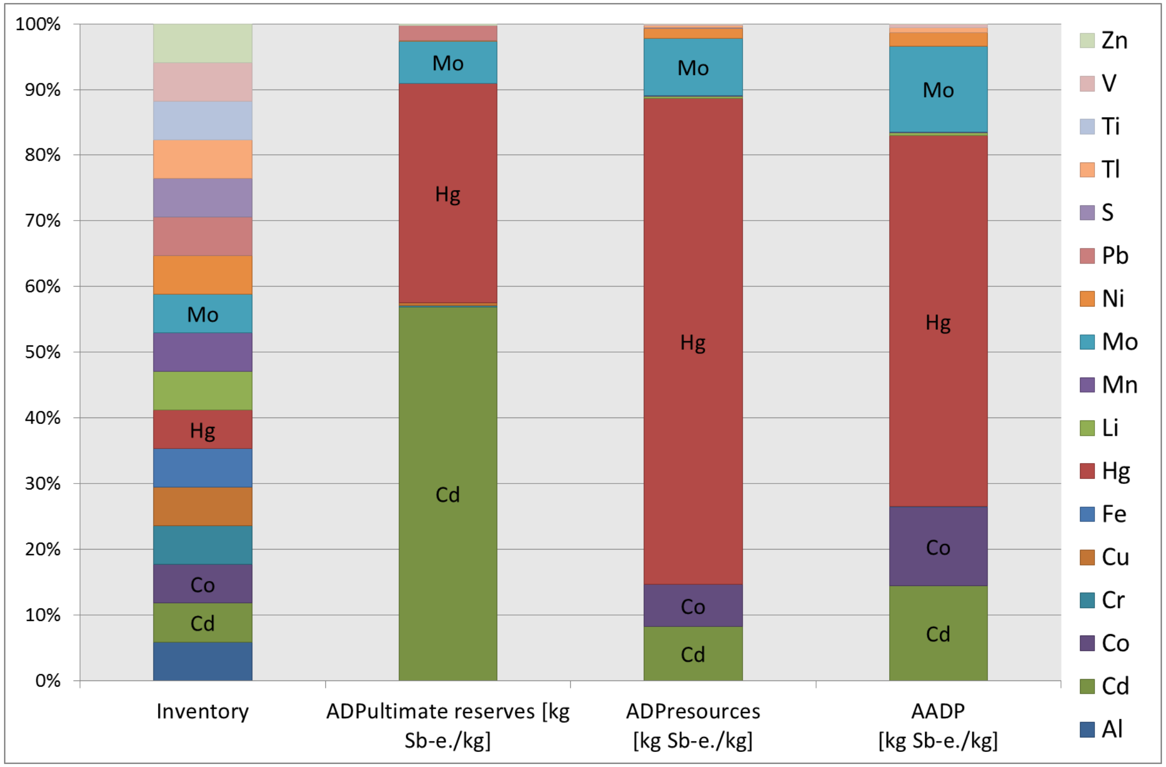
+ anthropogenic availabiltiy

Antrhopogenic stock extended abiotic depletion potential

$$\text{AADP}_{\text{i, resources}} = \frac{\text{extraction rate i}}{(\text{resources i} + \text{anthropogenic stock i})^2} \times \frac{(\text{resources antimony} + \text{anthropogenic stock antimony})^2}{\text{extraction rate antimony}}$$

1. Physical Scarcity II





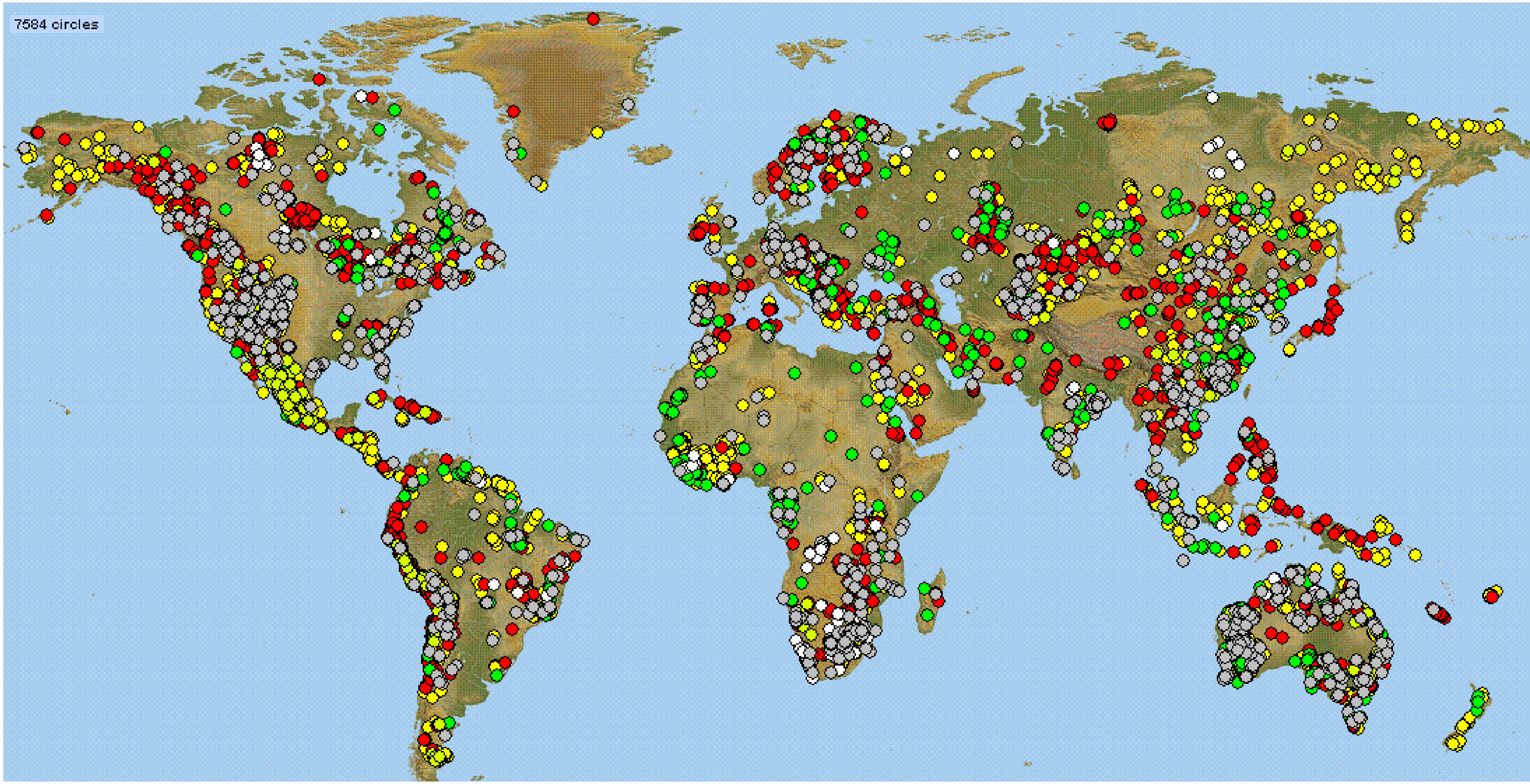
→ Effective scarcity: Methodology

- In order to assess effective scarcity, each indicator value is related to a “threshold” above which scarcity is expected

→ distance-to-target method: $$\left(\frac{current\ \ value_i}{threshold\ _i}\right)^2$$

- Individual adjustment of target level possible
- Product specific characteristics can be considered
- Easy interpretation (reference value)

Economic Scarcity Potential I



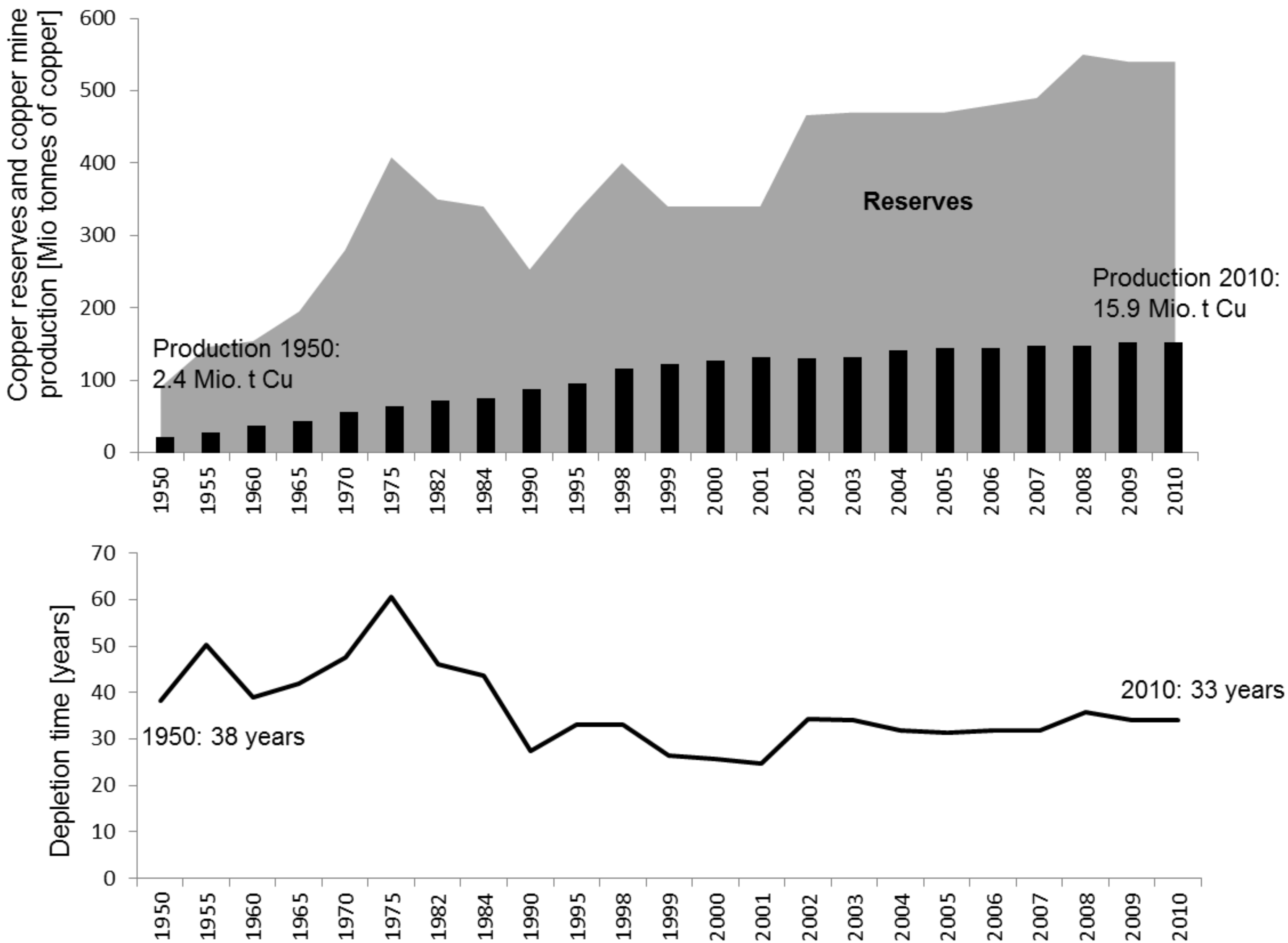
Main metal precious metals base metals (incl Ni) ferrous metals diamonds coal other

Economic Scarcity Potential II

Economic Scarcity Potential III

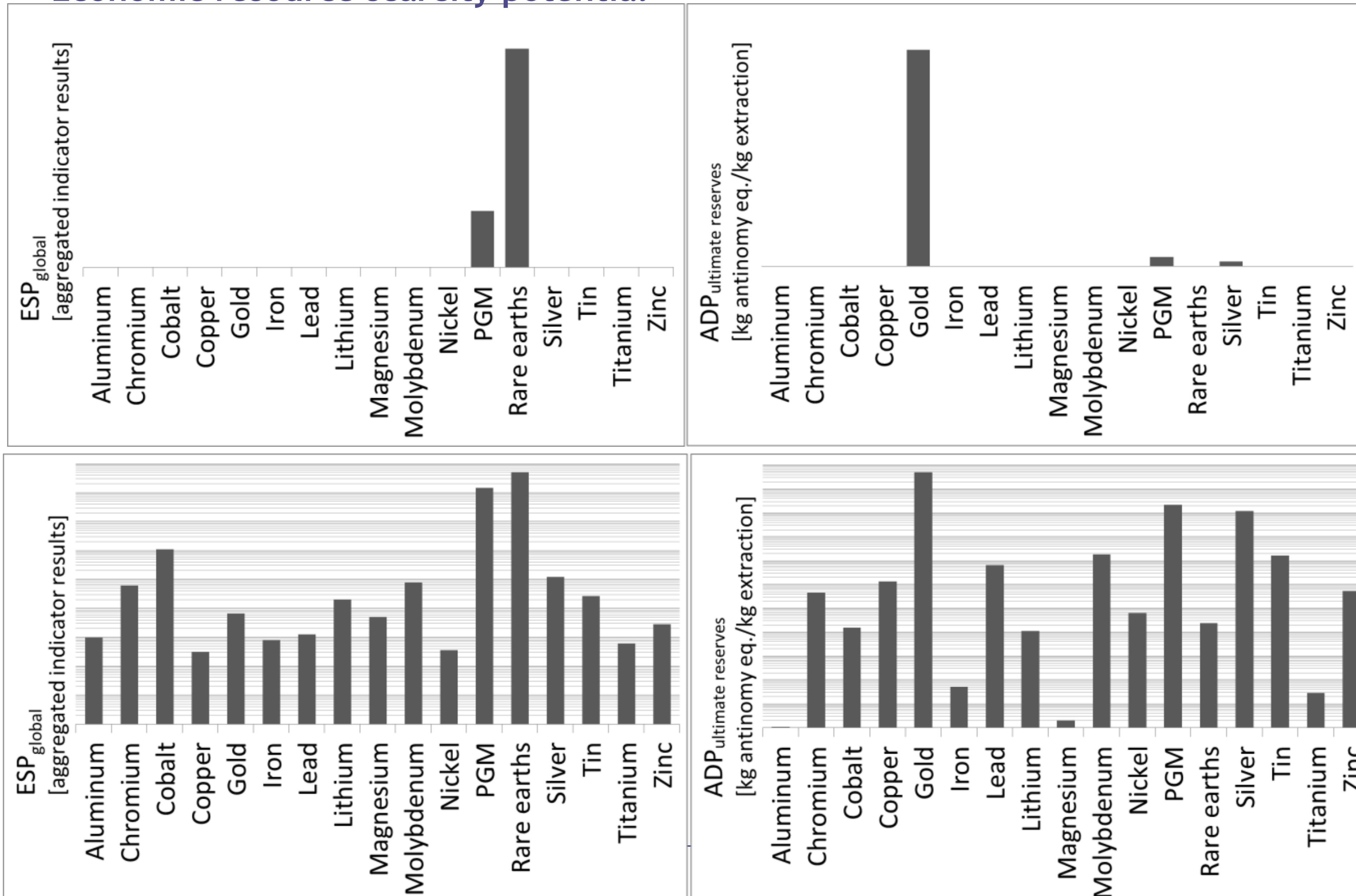
Aspect	Indicator
Reserves	1/depletion time
Secondary production	New material content
Country concentration	Herfindahl Index (HHI)
Stability	World Governance Indicators (WGI), scaled
Company concentration	Herfindahl Index (HHI)
Trade barriers	%-share of production under trade barriers
Demand growth	% per year until ...
Companion Metal Fraction	% produced as by-product

Economic Scarcity Potential IV



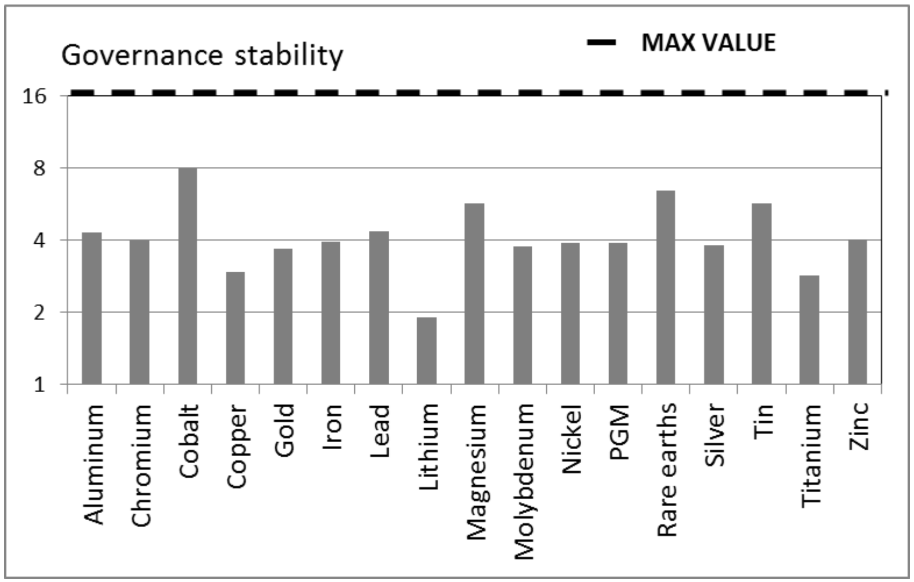
Economic Scarcity Potential V

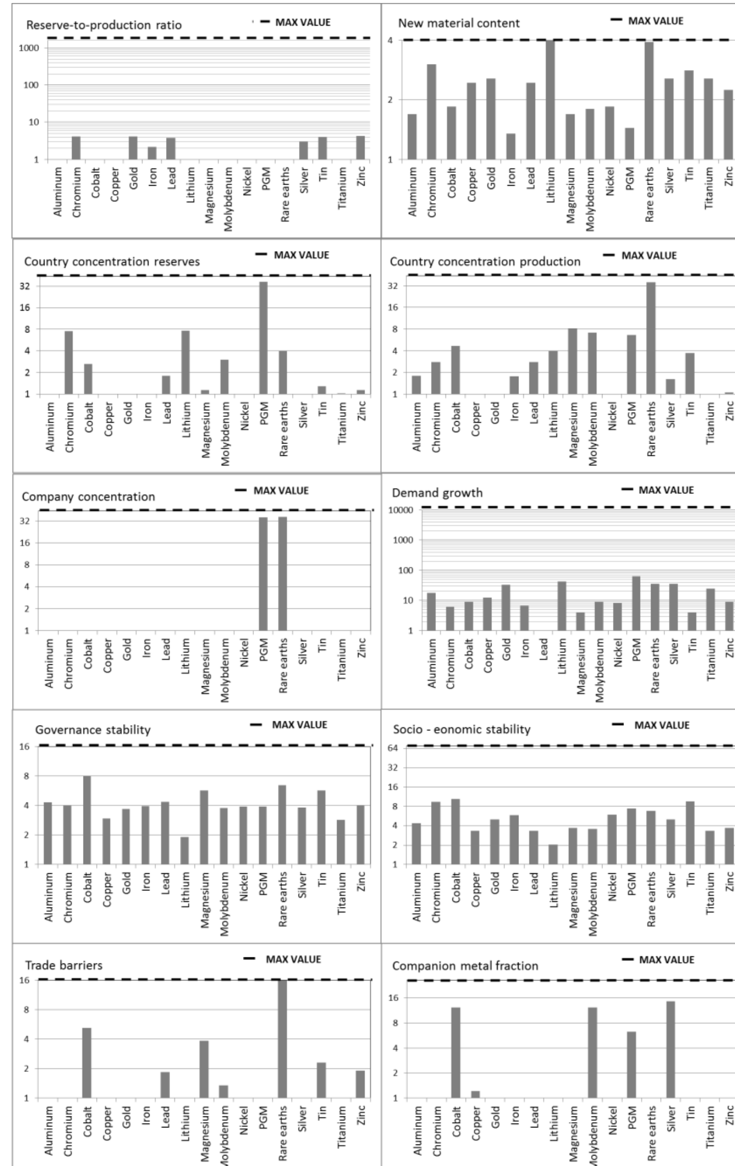
Economic resource scarcity potential



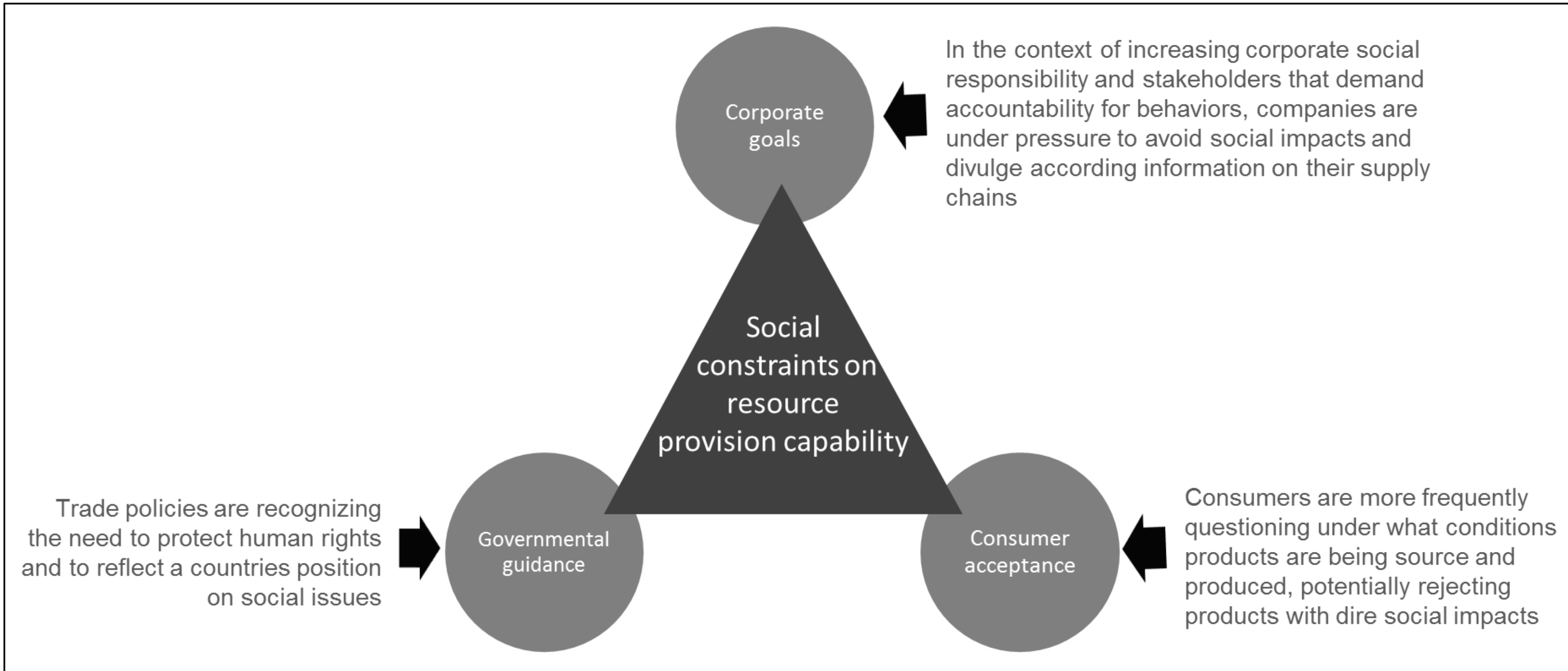
Economic Scarcity Potential VI

- Identification of bottlenecks
- Target determines perception of risk

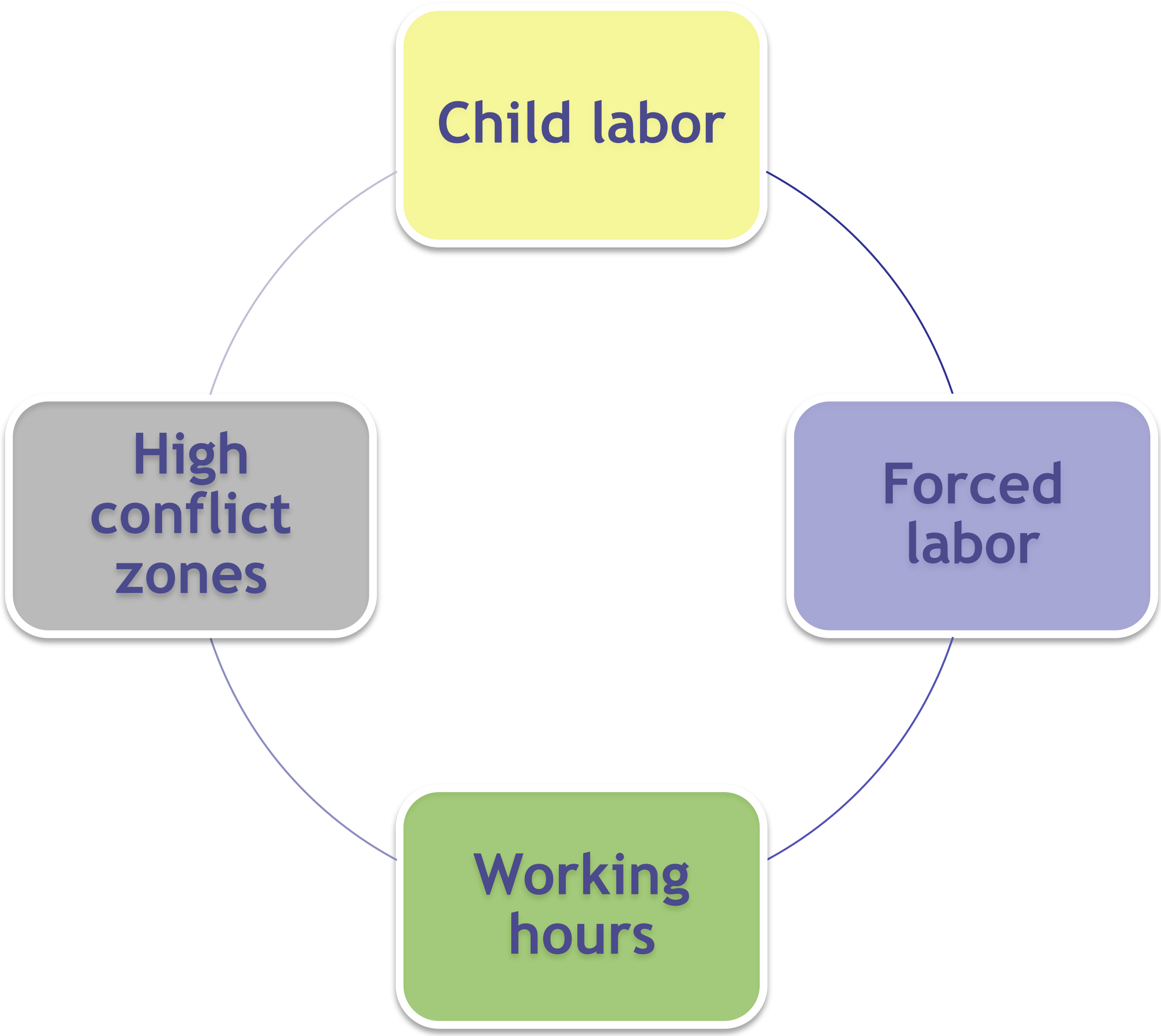




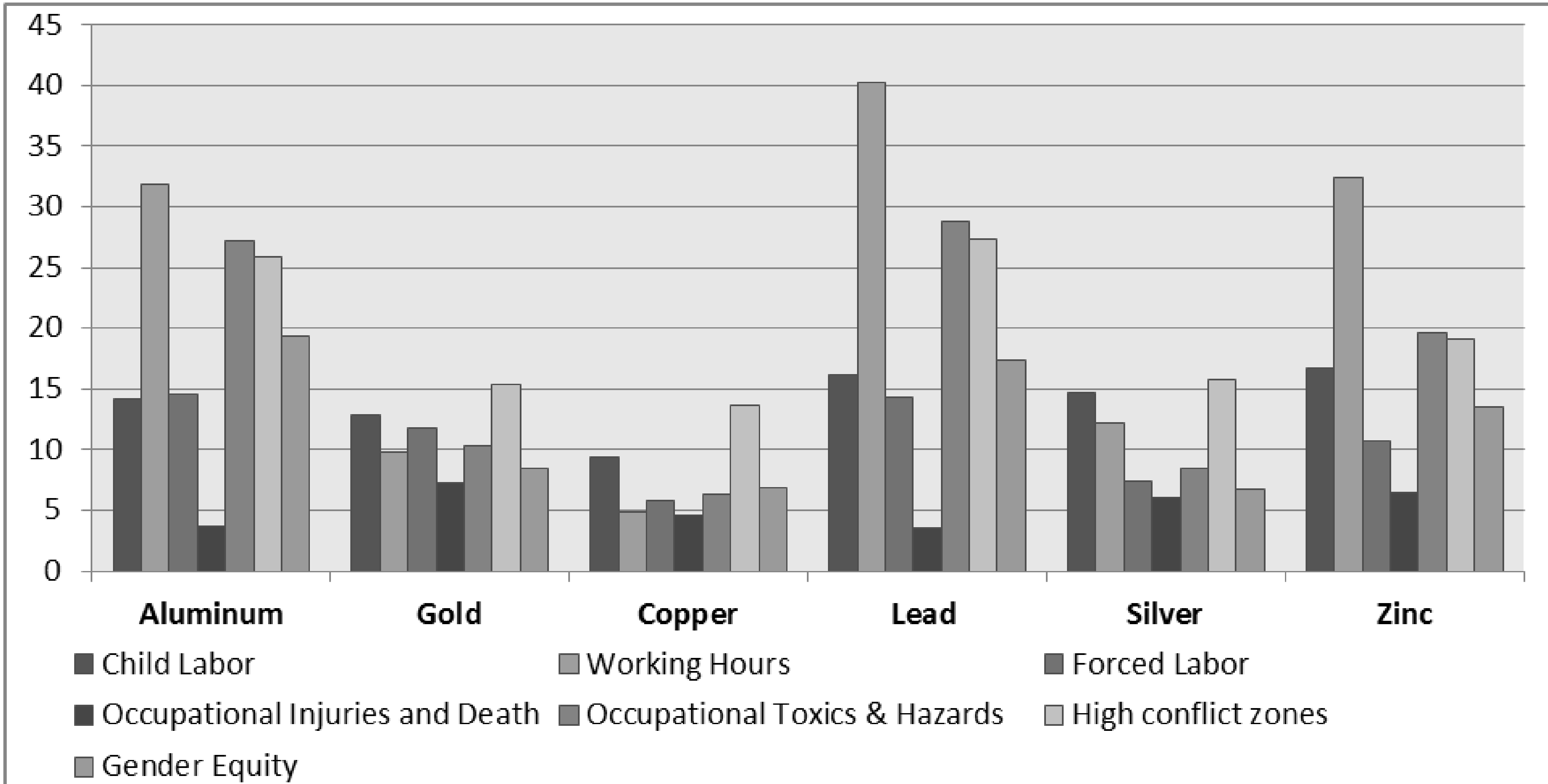
Social Scarcity Potential I



Social Scarcity Potential II



Social Scarcity Potential III



Results

Physical risk

Environmental risk

Economic risk

Social ris

Informed materials choices in the context of sustain
development

The END