

What Makes a Material Critical for Europe?

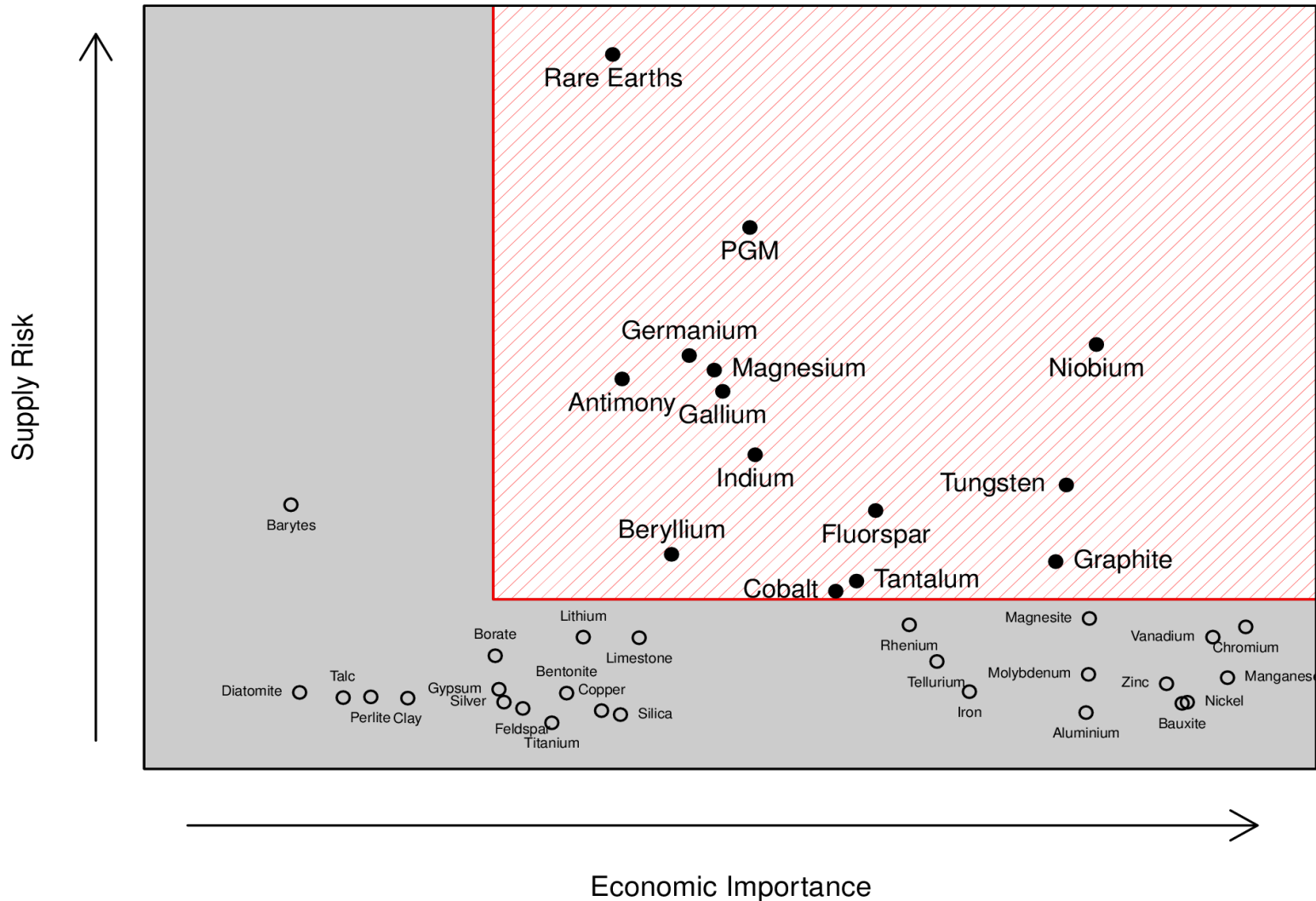
Dr Josephine Arendorf

Oakdene Hollins - Consulting on sustainability, services and clean production

Materials Security

- **Critical Raw Materials for the EU**
(Oakdene Hollins, Fraunhofer ISI and Roskill for DG ENTR, 2013)
- “Mind the gap” – resource security strategies in an uncertain world
(Oakdene Hollins’ White Paper, 2012)
- Critical raw material flows in the UK economy
(for WRAP & Defra (UK), 2013)
- Critical metals in strategic energy technologies
(with Fraunhofer ISI and HCSS for DG JRC, 2011 & 2013)
- Study on by-product metals
(International Lead & Zinc, Copper and Nickel Study Groups, 2012)
- Study into the feasibility of protecting and recovering critical raw materials through infrastructure development
(for European Pathway to Zero Waste, 2011)

EU “Critical 14”



Source: Fraunhofer ISI (graphical representation).

Identification of Critical Raw Materials for the EU economy

- Key action of EU Raw Materials Initiative (2010)
- Critical raw materials based on a combination of high economic importance and high supply risk
- CRM list used as a policy tool to monitor issues of critical raw materials to identify priority actions
- Actions not limited to critical raw materials exclusively

Defining Criticality

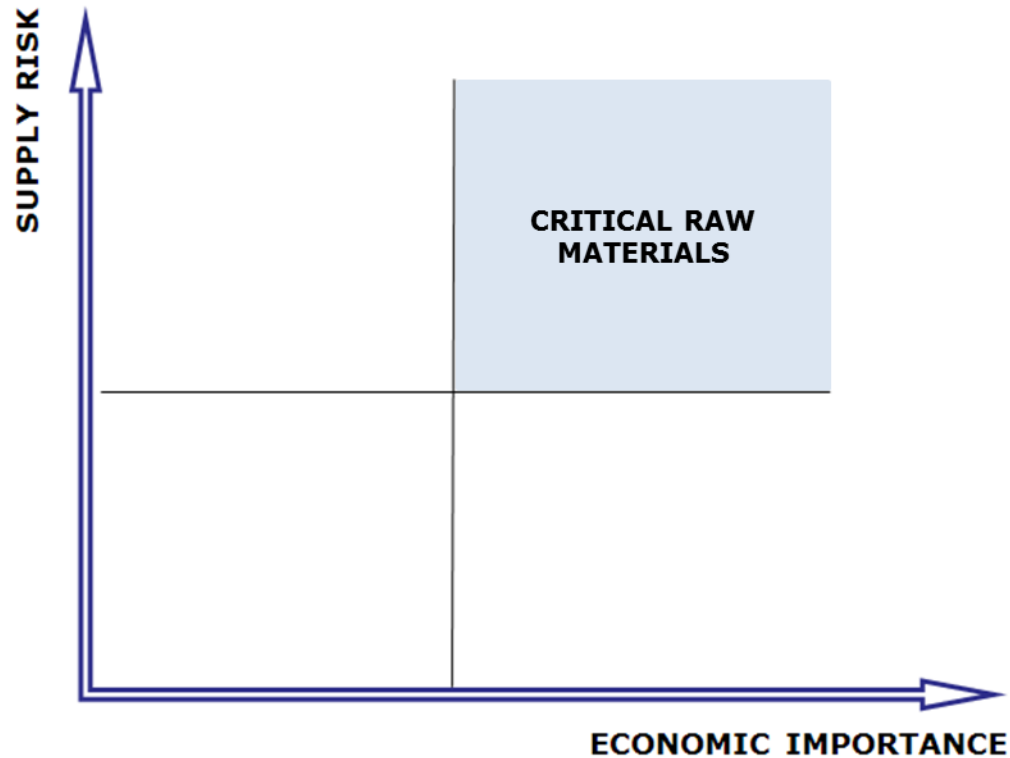
Materials which have:

- A high economic importance to the EU
- A high risk associated with their supply

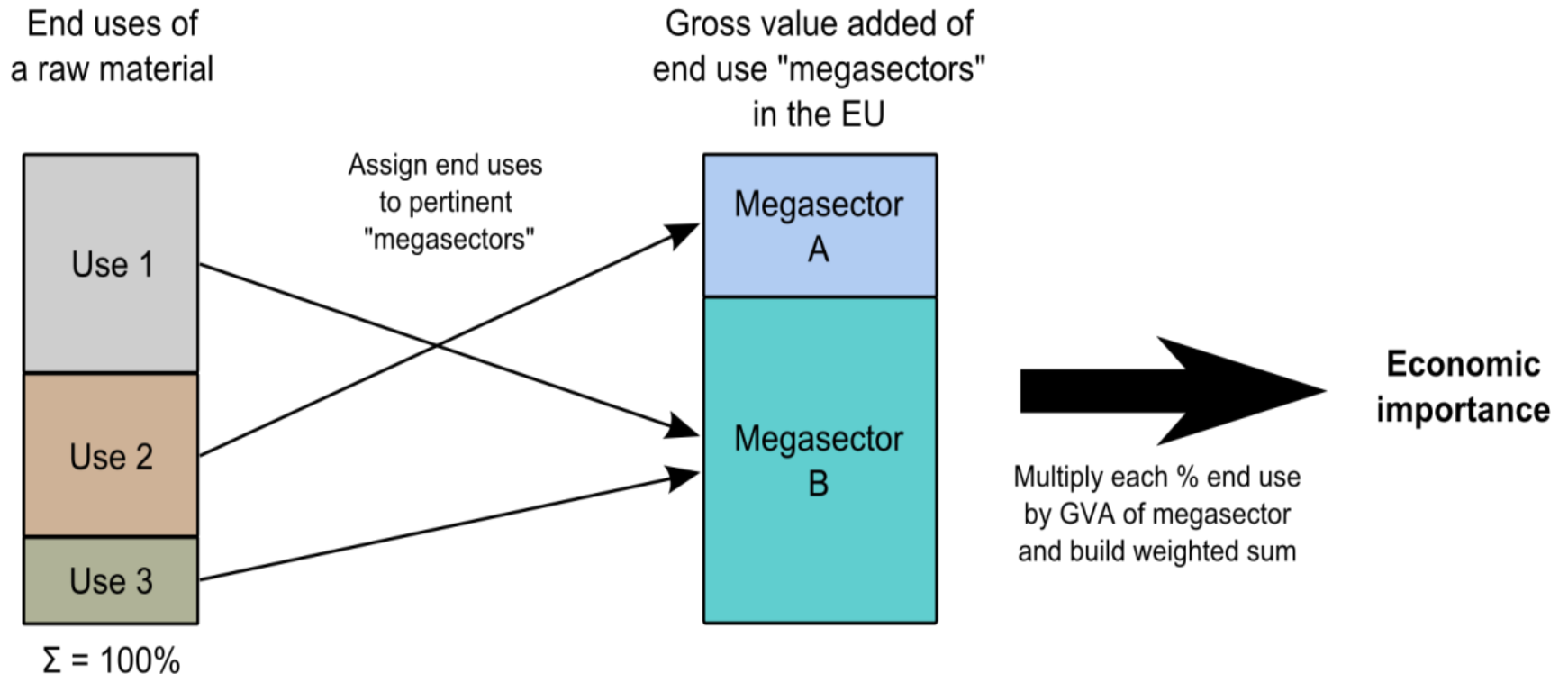
‘Criticality’ ≠ Geological Scarcity

Determining Criticality

Two axes: Economic Importance & Supply Risk

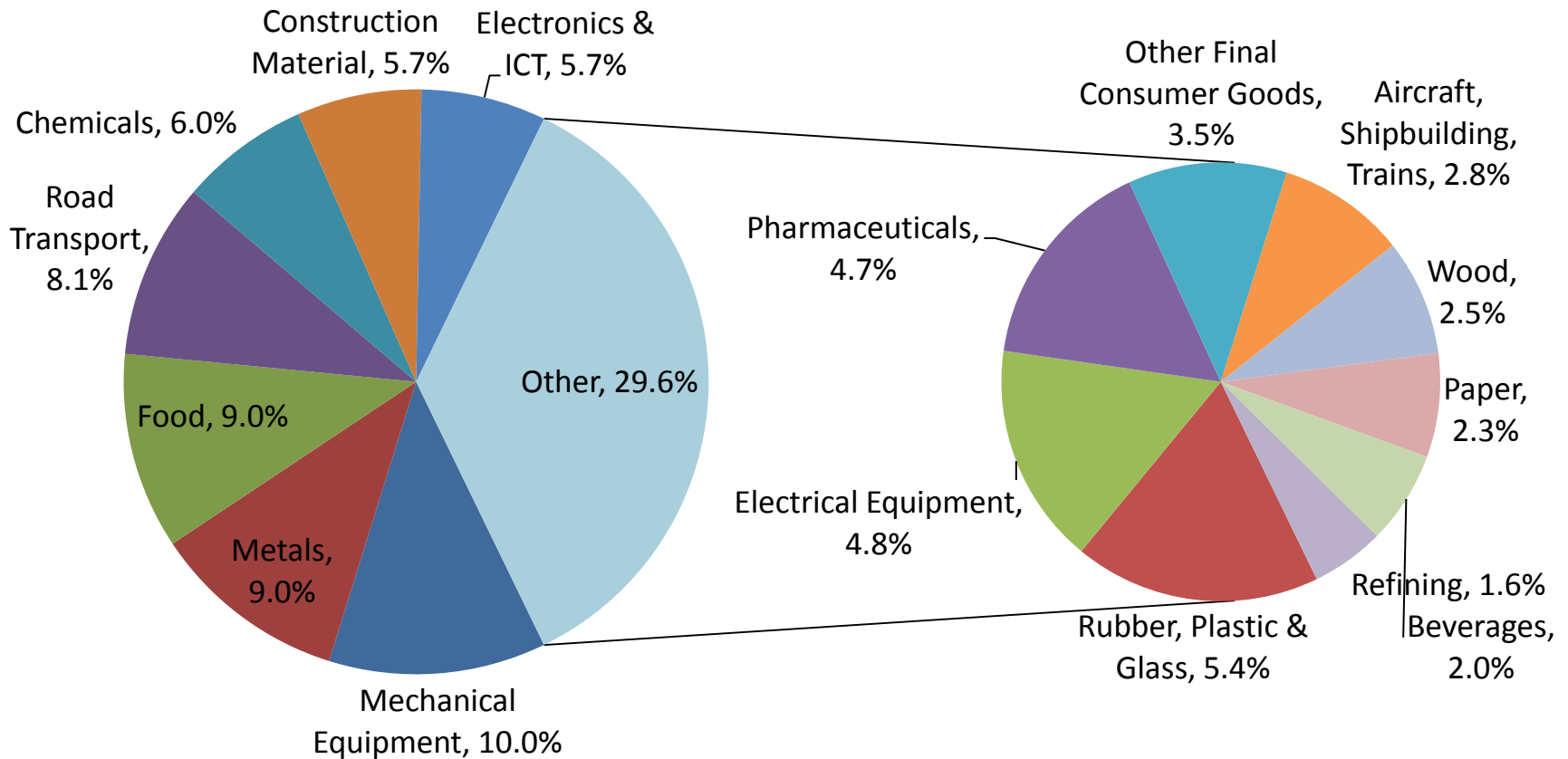


Calculating Economic Importance



Economic Importance: Mega-Sectors

Share of EU Manufacturing Value Added, 2010



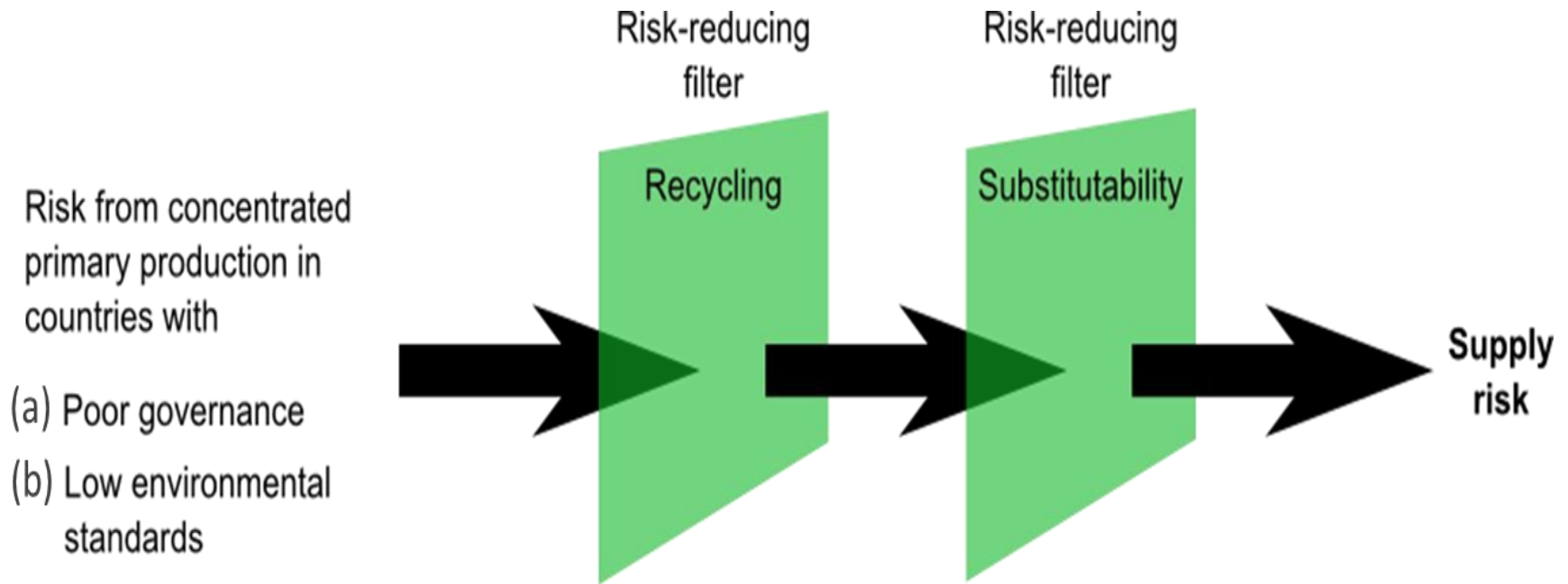
Calculating Supply Risk

Assessed using 3 components:

1. **Production concentration risk** - Two measures calculated using similar methodology
 - Modified Herfindahl-Hirschmann Index used for both
 - HHI Scaled with
 - a) World Governance Index for Governance Measure
 - b) Environmental Performance Index for Environmental Standards Measure
2. **Recycling rate** – percentage of supply as input from end-of-life recycling
3. **Substitution** – weighted sum, scaled based on proportion of and assessment for application

Supply Risk

Visualisation of the 3 components:



Update to EU Critical Raw Materials List

- 2013 revised criticality analysis for all raw materials
- Same methodology, indicators and thresholds
- Updated data
- Wider range of materials
- Additional influences to criticality discussed

Project Team

OAKDENE HOLLINS

RESEARCH & CONSULTING



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Materials Scope

- Non-energy, non-food raw materials
- 54 candidate materials, important to the EU's economy, including 3 biotic materials

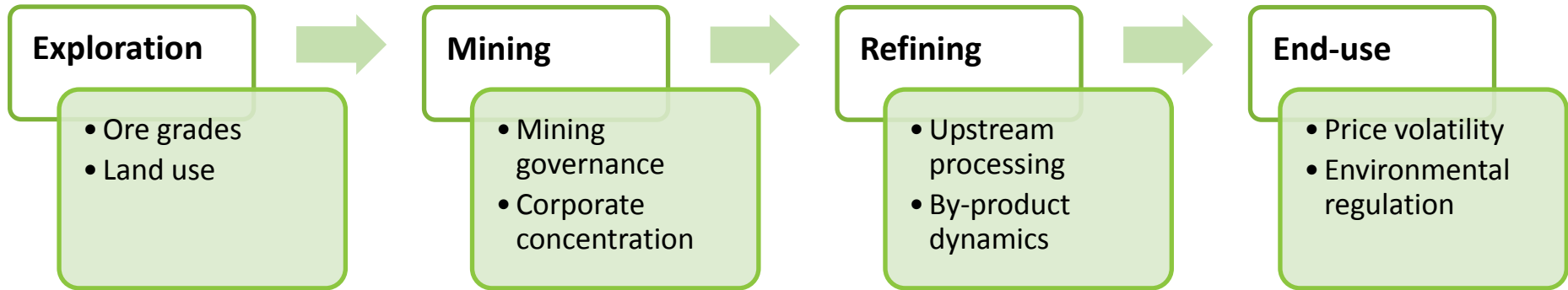
Aluminium	Antimony	Barytes	Bauxite	Bentonite	Beryllium	Borates	Coking Coal	Chromium
Clays (and kaolin)	Cobalt	Copper	Diatomite	Feldspar	Fluorspar	Gallium	Germanium	Gold
Gypsum	Hafnium	Indium	Iron ore	Limestone (high grade)	Lithium	Magnesite	Magnesium	Manganese
Molybdenum	Natural Graphite	Natural Rubber	Nickel	Niobium	Perlite	Phosphate Rock	Platinum Group Metals	Potash
Pulpwood	Rare Earth Elements - Heavy	Rare Earth Elements - Light	Rhenium	Sawn Softwood	Scandium	Selenium	Silica Sand	Silicon Metal
Silver	Talc	Tantalum	Tellurium	Tin	Titanium	Tungsten	Vanadium	Zinc

Biotic Materials

- Scope extended to include renewable biological resources: i.e. biotic materials
- These materials are also of key importance to the EU economy
- 3 Exemplars of biotic materials chosen:
 - Natural rubber
 - Pulpwood
 - Sawn Softwood

Additional Influences to Criticality

Eight possible influences on criticality examined, linked to supply chain stages:



Additional Influences: Biotic Materials

Possible additional influences on criticality identified:

- Competition for land use
- Intensity of resource use
- Climatic conditions and natural disasters
- Competition for use from energy and food
- Effect of biological threats on supply

Comparison of Criticality Studies

- Critical metals in strategic energy technologies
with Fraunhofer ISI and HCSS (for DG JRC, 2011 & 2013)
- Resource Security Action Plan: Making the Most of Valuable Materials
Defra and BIS (2012)
- Critical Materials Strategy
US Department of Energy (2011)
- Critical Metals for Future Sustainable Technologies and their Recycling Potential
Öko-Institute (2010)
- Plans for Stable Procurement of Rare Metals
Korean Government (2010)
- Research Priorities for More Efficient Use of Critical Materials from a U.S. Corporate
Perspective
General Electric (2010)
- Raw Materials for Emerging Technologies
Fraunhofer & IZT (2009)

Comparison of Criticality Studies

Key differences in scope:

- Quantitative and qualitative approaches
- General or application/industry specific focus
- Geographies covered: EU, single country, regions
- Snapshot or forecasts
- Bottom-up or top-down methodology

Comparison of Criticality Studies

Issues examined:

- Geophysical scarcity
- Production limitations
- Supply concentration
- Political risk
- Import dependency
- Environmental risk
- Price fluctuations
- Importance to industry or sector
- Substitutability
- Demand growth
- Recycling

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European Raw Materials Information & Brokerage Event,