Exploring competing demand for critical materials and its impact on identification and mitigation of materials criticality

Yulia Lapko¹,²
¹Politecnico di Milano, Milan, Italy
²KTH, Royal Institute of Technology, Stockholm, Sweden
yulia.lapko@polimi.it
Resources and competition

- Nationalization of resources
- Protection of own resource base
- Use of resources for political purposes
- Distortion of international trade and industrial competitiveness

Materials criticality

The current discourse on materials criticality lacks proper consideration and examination of:
- interconnections / interdependence between applications of the same material
- interrelations between companies across industries/supply chains that utilize the same critical material
Lack of empirical evidence

How do manufacturers of different applications interact for obtaining the same critical material?

How do other applications influence a manufacturer’s criticality perception and mitigation?
REE Case study

SIEMENS

Application: wind turbines
Key REE: neodymium, praseodymium, and dysprosium.

Johnson Matthey

Application: automotive catalytic convertor
Key REE: cerium

Data collection

- Company’s webpage
- Annual reports
- Press releases
- Presentations
- Sustainability reports
- Secondary data 2009-2016

Data analysis

Drivers of competitive behavior (Chen, 1996)
- Awareness
- Motivation
- Capability

Competitive strategies (Capron and Chatain, 2008)
- Focal firm resource oriented
- Competitor’s resource oriented
- Actions taken

Application: wind turbines
Key REE: neodymium, praseodymium, and dysprosium.

Application: automotive catalytic convertor
Key REE: cerium
Overview of actions taken over time

- Experience of addressing price volatility of other minerals (e.g. platinun group metals)
- Financial instruments (hedging, contractual)

2010

- Peak of attention and mitigation effort
- Multiple different mitigation actions taken in parallel:
  - sourcing,
  - substitution,
  - material efficiency,
  - manufacturing process optimization,
  - raising awareness and transparency,
  - financial instruments (hedging, contractual),
  - relational instruments (long term relations, trust, reputation)

2012

- The risk management system was extended to incorporate risks related to materials criticality
- Improved monitoring (In case of Siemens: development of corporate criticality assessment methodology)
- Research projects and collaborations (e.g. REE recycling)
- Joint ventures and collaborations with suppliers
Do the companies compete for REE?

- **Awareness**: companies do not take into consideration REE use in other applications
- **Motivation**: companies do not consider demand for REEs from other industries as a potential threat
- **Capability**: companies do not have enough capability to take actions that would affect other applications

Orientation towards competition at the product market

Lack of consideration of demand for REEs from other industries exposes company to additional risks

**Focal firm resource oriented strategies**: resource efficiency, optimizing product designs and searching for substitutes

**Competitor’s resource oriented strategies**: no sufficient evidence

**Indirect impact of actions taken**: long-term contracts with REE suppliers limit availability of REE material to other companies

**Indirect impact of actions provides evidence for interdependency of REE applications**
• Materials criticality analysis should incorporate:
  • Interconnection of applications of the same critical material
  • Interrelations of companies across supply chains and industries
• Policy-makers should raise awareness in companies about operations in the broader supply chain and across supply chains
• Policy-makers should provide support and incentives for industries that have strategies importance for society, but might not be able to compete with other applications for critical materials.

• If companies want to secure their positions at a resource market, it is indispensable to broaden the scope of consideration to include cross-application interconnections
• More empirical evidence is required to identify particularities of cross-application mechanisms and their impact on identification and mitigation of materials criticality
• Further research is needed to examine interplay of competition at product and resource markets, how interrelations of companies across industries impact supply chain operations