Roskill briefing paper

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Critical thinking about critical raw materials in the EU

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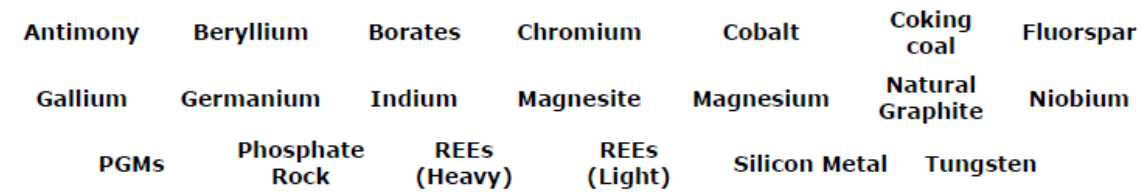
Last week, the European Union's Ad-Hoc Working Group on defining critical raw materials released a new report, the first since its original study was published in 2010. The new report uses the same quantitative methodology as the original study, which classifies materials as "critical" through analysis of two key factors: economic importance and supply risk.

The 2010 report identified 14 raw materials as critical, from a shortlist of 41. In the 2013 update, 54 materials were analysed, with REEs now divided into "heavy" and "light" subsets, and with scandium also considered separately. The **new report identifies 27 materials as critical**, including 13 of the 14 materials identified in the previous report, with only tantalum moving out of the EU list.

Results of the 2013 criticality assessment



Source: European Union

The updated EU study is one of a number of multi-commodity assessments that seek to apply certain measures to metals and minerals, allowing raw materials to be quantitatively examined and compared. Such approaches have their advantages: They are useful if you are, for example, a manufacturer, as you can compare all the metals you consume against a set of criteria – crunch the data – and generate a list of the materials most valuable, or most critical, to your organisation. This might allow you to prioritise your purchasing, or adopt a stockpiling initiative. A country or region might take such an approach, to inform policy or support key industries.

However, such approaches have their disadvantages too. The headline findings of critical raw materials studies are circulated far beyond audiences that understand the limitations of methodologies and the real implications of the findings. Creating lists and rankings can lead to scaremongering as terms like "risk" and "critical" are emotive. Defining materials in these terms can lead to misunderstandings amongst end-users, and potentially prompt unnecessary substitution.

By their nature multi-commodity assessments cannot examine everything that is relevant to particular material supply chains. This means that the headline findings of such studies can lead to misapprehensions over how "critical" or "at risk" certain materials are. In this briefing paper, Roskill explores the value in considering the wider supply chain dynamics of the raw materials outlined above in order to develop a more nuanced understanding of supply risk. Cobalt is used as an example.

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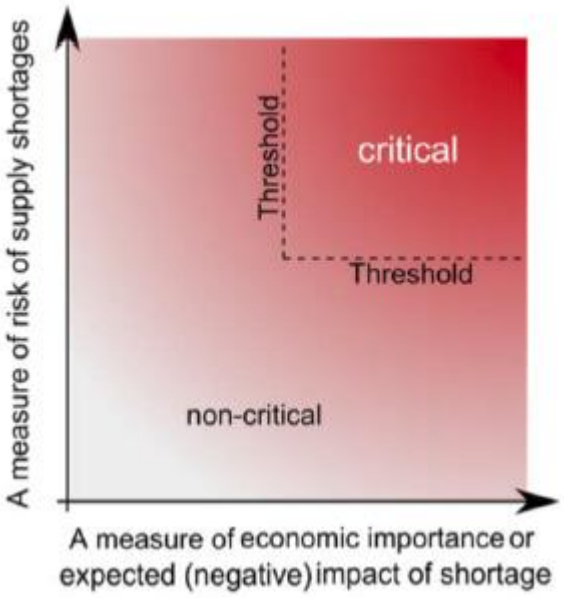
The EU methodology is comprised of two assessment components. Compound indicators are used for each of these two components and, therefore, each takes multiple factors into account.

Analysis of **economic importance** is achieved by assessing the proportion of each material associated with industrial "megasectors" (groupings of sectors) at an EU level. These proportions are then combined with the megasectors' gross value added (GVA) to the EU's gross domestic product (GDP). This total is then scaled according to total EU GDP to define an overall economic importance for a material.

Analysis of **supply risk** involves a combination of several factors, including substitutability, end-of-life recycling rates and concentration of producing countries with poor governance. Increased recycling is assumed to reduce overall supply risk, as it can provide an alternative to primary production. Substitution is assumed to influence risk in a similar way as if a raw material can be substituted, the risk to supply is lowered. Country-level data on production is taken from various sources, including Roskill. Poor governance data is sourced from the World Bank's World Governance Indicator (WGI) which contains several metrics, including voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law and control of corruption.

General scheme of the criticality concept projected into two dimensions



Source: European Union

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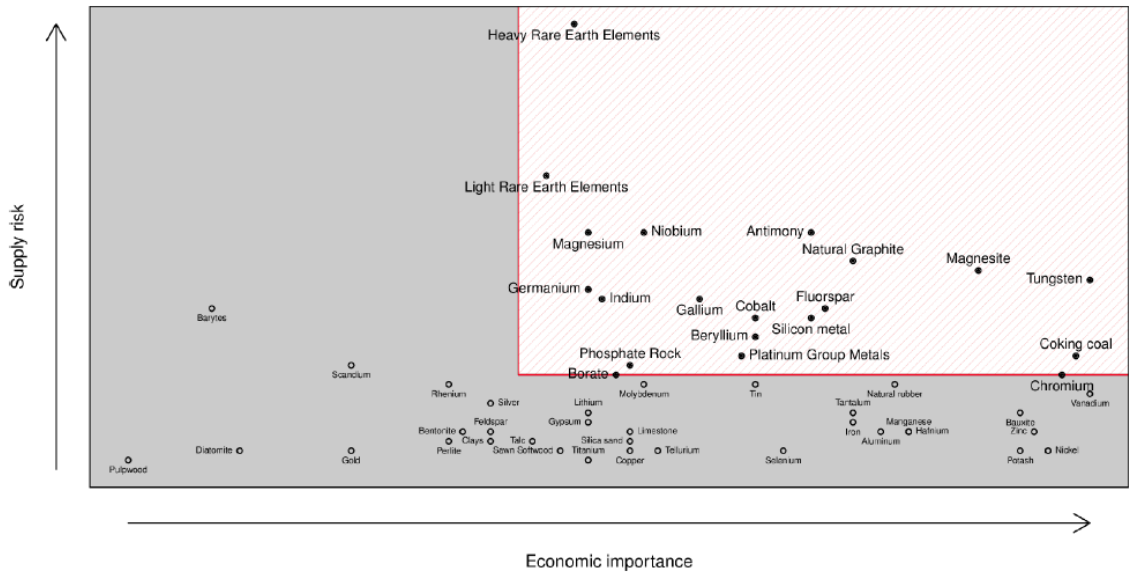
The results of the new study are defined by the thresholds of the 2010 analysis, to ensure comparability of results. The overall results of the 2013 criticality assessment are shown below; critical raw materials are found in the red shaded section.

Results of the 2013 criticality assessment



Source: European Union

The 2013 list includes all of the materials identified in 2010, with the exception of scandium and tantalum. Scandium, classified along with REEs in 2010, is not considered critical on its own merits. The adjustment in tantalum's classification reflects changes in the concentration of tantalum primary production. The Democratic Republic of the Congo (DRC) accounted for a higher proportion of primary tantalum supply in 2010, before Australian mines re-opened (they have since closed again), and Brazil emerged as an important tantalum supplier.

Six new materials are included, three of which were included in the 2010 analysis (borates, chromium and magnesite) and three of which are new to the study (coking coal, phosphate rock and silicon metal).

Comparison of EU critical raw materials from 2010 and 2013

2010 only	Both	2013 only
Tantalum	Antimony	Borates
Scandium*	Beryllium	Chromium
	Cobalt	Coking coal
	Fluorspar	Magnesite
	Gallium	Phosphate Rock
	Germanium	Silicon Metal
	Indium	
	Magnesium	
	Natural Graphite	
	Niobium	
	PGMs	
	Rare Earths (Heavy)	
	Rare Earths (Light)	
	Tungsten	

Source: European Union
*Note: * classified with REEs in the 2010 study but separately in 2013*

Whilst the EU study has its merits, its headline findings have the potential to lead to misunderstanding and could be taken out of context. **It is imperative that industry and policy makers understand the limitations and value of the EU's methodology before implementing changes based upon its results.**

The recommendations of the new report include "…review[ing] the quantitative methodology and carefully consider[ing] possible modifications while maintaining comparability over time". Roskill supports the notion of exploring revision of the methodology in order to take into account other factors that could have a bearing on criticality.

Roskill believes that a broad assessment of material supply chain dynamics, taking into account some factors not considered in the EU methodology, is essential, in order to adequately assess the economic importance, and particularly the supply risk, of raw materials. In order to demonstrate this, the example below shows how some in-depth analysis of the cobalt supply chain points to the fact that the metal is perhaps not as critical, or at least, subject to supply risk, as some might think.

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Case study: Cobalt as a critical material

The inclusion of cobalt on the EU list is a result of several key factors. In terms of economic importance, cobalt's use in key sectors, such as automotive, aerospace and construction, underpin its position. In terms of supply risk, it is the DRC's large share of world production, as well as the limited options for substitution, that contribute to cobalt's critical classification. The DRC, unsurprisingly, performs poorly in the World Bank's WGI.

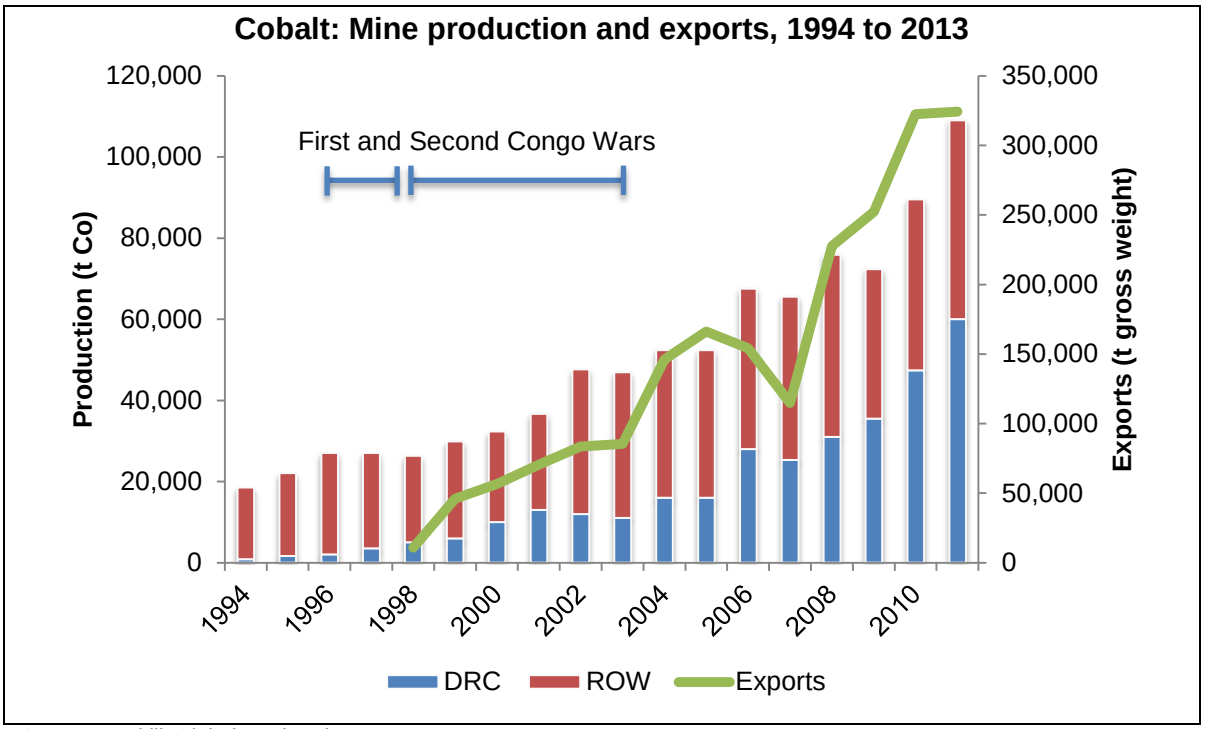
According to Roskill data, the DRC accounted for 57% of cobalt mine production in 2013 – roughly 60,000t Co. Fears that supply might be disrupted as a result of domestic instability and violence, through government action, or as a result of poor infrastructure, are legitimate:

- Civil war has dramatically impacted the DRC's cobalt production facilities, although the most significant impact has been on domestic refined capacity, much of which has fallen into disrepair;

- The government is known to want to increase domestic refining of copper and cobalt to increase income from its rich mineral resources. It threatened a ban on the export of ores and concentrates in 2007, 2010 and 2013. Last year's ban was postponed and an increase in export taxes was implemented instead;

- Power disruptions and regular power outages continue to negatively impact production in the country and the DRC's restrictive railway and road infra-structure, particularly in Katanga province, also stifles the economy.

Nevertheless, **the supply risk situation in the DRC must not be taken out of context.** A volatile state does not necessarily result in volatile levels of raw material exports. Whilst domestic refining of cobalt has been affected by the DRC's internal difficulties, domestic mine production has not been impacted to the same extent. During the main periods of conflict (1996 to 2003) mine production grew at a CAGR of 28%py. Exports also increased substantially over this period (see chart), and continue to do so, fluctuating mainly in line with international demand rather than as a result of domestic factors.



Source: Roskill, Global Trade Atlas

Despite, therefore, appearing to be a less than dependable source of cobalt ores, concentrates and intermediate products, the DRC has consistently exported cobalt to the world market for decades. Of course, this could all change – although despite the government's appetite to restrict the exports of raw materials, there are other actors with significant influence, that are likely to want to maintain the status quo.

The image below demonstrates the international nature of the DRC cobalt mining sector, in which foreign companies dominate ownership of cobalt producing mines, albeit with the state-owned company Gécamines usually holding a share. In today's globalised world it is increasingly important to think of supply in both corporate, as well as regional, terms.

With metals and oil making up 95% of total export revenue and mining and quarrying accounting for about 12% of GDP, it is unlikely that the DRC government would seek to implement policies that would negatively impact these companies, which are significant providers of employment and infrastructure.

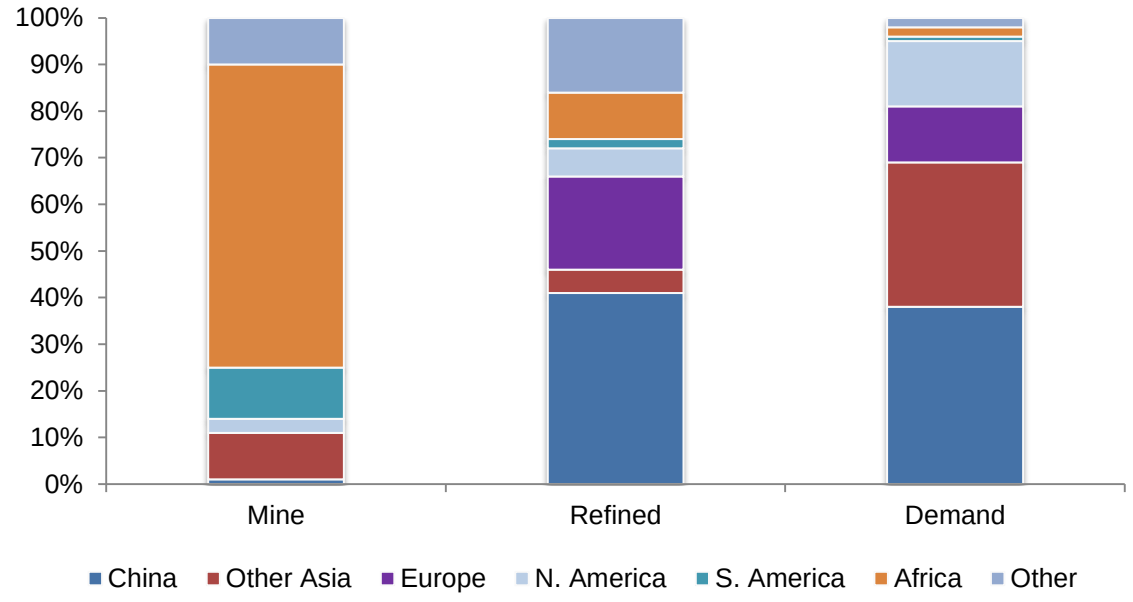
Cobalt: Ownership of key DRC mine production assets

China Railways Resources Group
Guang'an Cota Metal
ENRC
Metorex (Jinchuan Group)
Freeport-McMoRan/ Lundin Mining
Sino-Congolais des Mines (Sicomines)
Glencore Xstrata
Zhejiang Huayou Cobalt
Groupe Forrest International

Sources: Roskill, company websites

The EU methodology looks at mine/primary production to establish supply risk. For many end-users, analysis of refined production would also be beneficial. The chart below shows that whilst the world is reliant on the DRC for mined supply, Europe actually produces more refined cobalt than it uses. The same is true of China and Africa, suggesting that certain regions might consider themselves more exposed to supply risk than others.

Cobalt: Supply and demand by region, 2012



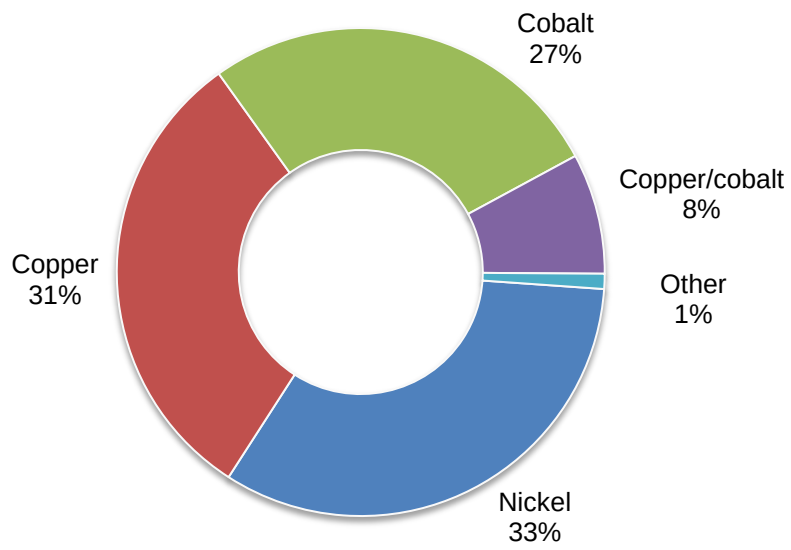
Source: Roskill

These three brief examinations serve to highlight that when historical production and trade patterns, corporate ownership, and refined production availability are considered together, cobalt supply appears more stable than at first glance.

However, other factors also warrant consideration. In particular, by-production dynamics must also be taken into account when analysing cobalt supply risk.

According to Roskill estimates, around two-thirds of cobalt is produced at operations that primarily produce copper and nickel (see chart). As such, levels of cobalt production at these mines are heavily influenced by copper and nickel markets. Despite cobalt's abundance, a drop in demand for nickel or copper could have profound implications on cobalt supply.

Cobalt: Mine production by primary product, 2012



Source: Roskill

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While the EU study is a highly useful contribution, this briefing paper has attempted to demonstrate the merits of in-depth, commodity specific analysis of raw material supply chains. It is only through such a holistic approach that the real issues underpinning the criticality of particular materials can be examined, identified and subsequently addressed.

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