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EUROPEAN POLICYBRIEF

polinares EU Policy on Natural Resources

Critical Raw Materials: Developing Long-Term Strategies

POLINARES is an EU-funded research project exploring global challenges in the competition for natural resources and proposing new approaches to collaborative solutions.

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INTRODUCTION

The overall objectives of the project are to identify the main global challenges relating to competition for access to oil, gas and mineral resources, and to propose new approaches to collaborative solutions for the various policy actors, including the EU.

This Policy Brief addresses the challenge of assessing and managing risks related to the supply of mineral raw materials. This is an important topic for the EU given the EU's heavy reliance on imports for a wide range of minerals and metals - the material basis for many industries.

The issue of secure supply of raw materials has regained importance in the last few years. A prominent feature of the current discussion has been the identification of "critical raw materials" and of adequate measures to reduce their "criticality". This research emphasizes the short-term nature of criticality assessments and their failure to provide a basis for long-term policy making.

A more useful approach requires an appreciation of the complex of mineral and metal markets and supply chains and of the different types of risk that arise. Only then can effective long-term counter-measures be put in place.

KEY OBSERVATIONS

Limitations of criticality studies in the long term perspective

The term “critical raw materials” has recently re-emerged to denote non-energy raw materials that combine a comparatively high economic importance with a comparatively high risk of supply disruptions. While these two dimensions have been considered in discussions of raw materials supply dating back to at least the 1970s, it is only recently that two-dimensional graphical depictions have gained popularity as a communication tool. Although the way of looking at the problem of criticality has changed little (also the angle of view changed from strategic to economic concerns regarding globalized markets), the raw materials regarded as critical have varied depending on the global political environment at the time of analysis and on the state of technological development and degree of industrialization.

Most of the minerals that historically have been classified as “critical” have in fact never caused significant problems. Some of these minerals, for instance bauxite that was classified as potentially problematic in the 1970s by the United States, have disappeared from the list. Other minerals, such as the platinum-group metals used in automotive catalysts, have remained on the criticality lists for the past few decades but no severe market disruptions have taken place. This is not to say that criticality studies had no use in avoiding problems in these resource markets. Yet it should be acknowledged that in many instances criticality studies have not been able to capture the dynamics of resources markets.

Furthermore, the resource markets which are analyzed can be quite dynamic, something that holds in particular for the smaller resource markets such as the “high-tech metals”. In such markets, the situation in terms of balance between supply and demand, as well as the sources of supply, can change relatively fast when contrasted to the much larger markets of base metals or energy resources. As a consequence, price spikes are fairly common for these high-tech metals.

The POLINARES project has identified the following limitations to most current criticality studies:

- They take insufficient account of the diversity and particular characteristics of the resource markets that are analyzed;
- They lack of predictive power beyond the short-term, and fail to distinguish between short-term and long-term problems;
- They show a bias towards technology minerals by emphasizing high-tech applications and the role of the market power of producers in small markets;
- They tend to overstate the economic impact of a possible supply disruption of “critical” minerals;
- They focus exclusively on risks related to the mining and export of raw materials, but disregard the rest of the production chain (e.g. refining, transport, and trade in semi-finished-products).

- Overlooking the issues of corporate concentration and domination particularly for the “technology metals”.

Thus, although short lists of critical raw materials are well suited for focusing the attention of policy makers, industry and the public onto pressing current issues, lumping together a variety of very different factors can in fact obscure the nature of the underlying challenges. Moreover, the necessity of a common data base for the comparison of different raw materials prevents many relevant issues from being considered in the analyses. Finally, the heavy reliance on historical data and the dynamic nature of raw material markets make criticality studies less suitable to guide long-term policy.

An alternative approach to assessing raw material security

Rather than estimating the criticality of a raw material on the basis of a single aggregate score, it is more useful for long-term policy making to understand the fundamental concerns which underlie criticality. We have identified three general risk categories:

- Risk of supply shortage is the central part of all studies and discussions on raw materials security. This dimension of criticality aims to describe the vulnerability of consumers to supply bottlenecks and shortages. This includes aspects such as the import dependence of consumer countries, the concentration of production in certain countries or companies, state control of domestic and foreign resources (e.g. engagement of Chinese companies outside China), the availability of secondary raw materials and substitutes, price volatility, success of exploration and new projects coming into production.
- Social and environmental risks associated with raw materials production, including conflict-related mineral production.
- Geological constraints, arising from the question of whether the earth can provide the resources for future global demand. Since from a geological perspective no shortages for mineral raw material reserve availability is expected in the foreseeable future, this aspect will not be discussed in detail.

The basic objective regarding resource supply security, whether it concerns energy or non-fuel minerals, is commonly defined as “ensuring an adequate supply at a reasonable cost”, since a functioning supply chain is the basis of any economy. Consequently, the primary concerns arise from the potential impact of supply disruptions and extreme price increases, caused either accidentally or intentionally. These concerns fall into four main categories:

1. Accidental or unintentional supply disruptions or price hikes (C1)

Supply disruptions and ensuing price hikes may result from events such as a natural disasters, technical failures, strikes or political instability in a major producing country. Those events resulting in physical shortages are usually not foreseeable and would hence hit consuming counties more or less unprepared. An example of a crisis causing a physical shortage is the cobalt supply crisis caused by the civil war in Angola in 1978, which halted cobalt exports coming from Zaire (now Democratic Republic of the Congo) – then accounting for 63% of the world's supply.

2. **Intentional supply disruptions through the use of exports or pricing as a political instrument (C2)**

Raw materials can be used as a deliberate instrument by certain actors. Those in control of production or exports could use raw materials to gain political or economic power, for example by issuing embargoes, restricting exports or price gouging. In such cases an artificial supply crisis (either real or feared) could place political pressure on other countries and cause disadvantages for the industries of countries depending on raw materials imports. Examples include the oil embargo of 1973, the Russian-Ukrainian disputes over gas prices in which led to supply disruptions in 2006 and 2009, and the Chinese export quotas for rare earth metals, or the dominance over the iron ore market by the "Big 3"(BHP Billiton, Rio Tinto and Vale).

3. **Unequal market conditions, causing an uneven economic playing field (C3)**

Tensions can arise when market conditions for the participating stakeholders vary. This need not necessarily lead to supply shortages but can cause unequal opportunities for companies from different countries, influencing economic competitiveness. Examples include:

- Unequal access to markets or investment opportunities (e.g. countries deter foreign companies from investments);
- Different pricing of the same resource for different countries (e.g. rare earth prices in China and abroad);
- Unequal access to crisis mechanisms, such as stockpiles, in case of a supply disruption or unequal impact of a price hike, which obviously would hit consumers more than raw material producers.

4. **Governance issues related to the resource sector (C4)**

In certain locations, extraction and production activities can be responsible for severe environmental degradation and serious social and human rights problems. This can undermine the quality of national governance and contribute to the escalation of armed conflict and illicit trade, as well as enhancing supply risk to Europe. An example is the concern about the role of the resource sector in some of the resource-rich countries, particularly in Africa. Governance problems, leading e.g. to an unequal distribution of welfare, might more indirectly create social tensions. These aspects do not necessarily provoke supply constraints, but contradict standards or ethics in western industrialized states.

Examples of long-term consequences

This alternative approach to assessing raw material security has allowed us to identify a number of consequences for mineral availability, of which a few selected examples will be examined relating to the different concerns listed above.

1. Time lags between demand and supply (C1, above)

The impacts on material supply of natural disasters, accidents, industrial action and short-term political instability are relatively well understood, and are clearly more pronounced if production of the specific mineral is geographically concentrated. Less well appreciated are the unavoidable time lags between demand and supply which are an endemic feature of the minerals industry.

Long and increasingly so lags in the supply response of mining and metals are one of the defining characteristics of the mining industry. There is a clear delay between price peaks and investment peaks. This follows naturally from the fact that it takes time for companies to respond to higher prices and to commit to new capital expenditure. Not only do companies have to be convinced that higher prices are likely to persist, but it takes time to bring projects to a point where they can be financed and money spent on them. Using copper as an example, the gap between a rise in price and growth of production tends to be about 7-8 years.

The price spikes arising from this production lag can be especially marked for the so-called “technology metals”. These metals (e.g. tantalum, tellurium or the rare earths) are often enablers, providing functionality currently unattainable by other means or attainable only at the expense of diminished performance. At the same time, the markets for technology metals are small and often not transparent, making them prone to overreaction to changes in both supply and demand. An increased demand for a certain high tech metal will commonly result in a sharp price peak. These price spikes can be accentuated in magnitude and duration if the metal is produced as a by-product of another, economically more important metal.

2. Import dependency and production concentration (C2, above)

The European economy is highly dependent on primary metal imports, since they provide the basis for the EU’s industrial production. Only a minor amount of the European metal consumption is mined within the EU or can be recovered from secondary resources. For several metals, including such as rare earths, vanadium, magnesium, cobalt and platinum group metals, to name just a few, the EU countries completely rely on imports.

China also suffers a serious import dependence for copper, iron ore, nickel, phosphate, potash and other major metals, and it is highly unlikely that that this dependence will diminish substantially in the next one or two decades. At the same time, the concentration of global production of certain metals is growing in countries such as Russia, Brazil, and South Africa, as well as China.

This situation of growing import dependency and growing concentration of production has the potential to lead to political or economic conflict, but might also provide opportunities for multinational cooperation, especially for those raw materials on which China is import dependent.

3. Resource nationalism (C3, above)

Perhaps the biggest unresolved issue for future mineral availability - and perhaps the one that should be the primary focus of attention for policy-makers in consuming countries - is how far the governments of mineral producing countries will turn towards resource nationalism.

As commodity prices have revived in recent years, so too has the incidence of direct government intervention in the affairs of the mining industry. Bolivia, for example, embarked on a programme of nationalisation for the mining industry in 2005. Guinea stripped Rio Tinto of some of its permits to mine iron ore in 2008 on the grounds that they were not advancing the projects quickly enough, while the government of DR Congo in 2010 expropriated two mines belonging to First Quantum Minerals. Nor should it be supposed that such interventionism is confined to developing countries. The Australian government blocked the purchase of the Prominent Hill mine by China Minmetals in 2009, while the Canadian government blocked BHP Billiton's proposed take-over of the Potash Corporation of Saskatchewan in 2010.

4. Governance in resource-rich countries (C4, above)

For many Sub-Saharan African countries minerals and fuels are important export products and metals, metal ores and concentrates can provide more than two-thirds of total merchandise. Several South American countries are also highly dependent on their raw material exports. Examples are Venezuela's oil exports, and Chile's copper exports. This dependency on resource revenues not only encourages rent-seeking, corruption and other practices which undermine good governance, but it also renders the national economies highly sensitive to international prices. There is however also a growing understanding of that it is possible to use mineral resources as a lever for economic development and at the same time deal with these problems, examples are the Nordic countries for example.

Artisanal and small-scale mining (ASM) occurs in many of these resource-rich countries, and in the case of high value metals such as gold, tin and tantalum, ASM significantly adds to their world supply. The artisanal and small-scale mining sector, which provides livelihood for millions of people in the world, is part of the informal and often illegal trading chain of minerals. Mining in Central Africa has been associated with violent conflict, mistreatment of artisanal miners, illegal trading and the diversion of state funds. Tantalum is an example of a mineral fuelling local conflict when functioning state institutions are absent.

RECOMMENDATIONS FOR POLICY-MAKERS

Whilst lists of critical raw materials can indicate which minerals face risks in the short-term, they do not provide a sound basis for long-term policy making. To support the formulation of long-term policy, we recommend instead that effort be spent on understanding and documenting a number of key concerns and underlying trends which will determine the nature of future risks. This will allow a more effective appraisal of possible strategies to mitigate these risks.

The European Union has already taken steps to identify key priorities through its Raw Materials Initiative and the Initiative for a Resource Efficient Europe. The former emphasises three aims:

- Fair and sustainable supplies from global markets;
- Fostering sustainable supply from within the EU;
- Boosting resource efficiency and promoting recycling.

This project values and supports these approaches but seeks to supplement them and identifies four main categories of task:

- Information gathering and analysis on raw materials (availability and trade);
- Improved supply chain management;
- Promotion of exploration and production (inside and outside the EU);
- Dialogue and collaboration with other mineral importing countries and with exporters.

Information gathering and analysis

A European and Transatlantic/multinational effort is needed to greatly enhance the quality and quantity of global information gathering, analysis and dissemination for minerals and metals which lags far behind that in the energy sector, for example:

- Collation of worldwide data on raw material reserves and primary production and control, as well as on refining capacity and output, trade flows between mines, refineries and customers
- Analysis of investments in the resource sector;
- Assessment of raw material flows throughout the entire lifecycle of products (including secondary raw materials);
- Analysis of markets and use of long term scenarios;
- Monitoring of political developments in resource rich countries (including resource nationalism and other relevant factors influencing the market);
- Analysis of technological developments influencing supply or demand.

Such a complex and wide ranging set of tasks will require a new cooperative structure of stakeholders or a new institution to continuously provide sound data and analysis to the EU.

Improved supply chain management

Consideration of raw material supplies and risks should be integrated in the process of product design. This would involve an early analysis of raw material availability and the potential for the use of secondary raw materials. Resource efficiency and potential for substitution should be monitored along the entire supply chain.

Promotion of exploration and production

The EU and its member states should encourage exploration and investments in future mining projects. Mine production in Europe could directly supply European demand and thus be another pillar to enhance the European raw material security. Mineral production by European companies outside Europe should be encouraged and supported as well, since this would add to the global raw material supply.

These measures must be sustainable and ethical and should comply with existing EU legislation and voluntary initiatives like the Kimberley process and EITI.

Dialogue and collaboration with other raw material importing and exporting countries

The mineral sector has no equivalents of institutions in the energy sector such as the International Energy Agency and the International Energy Forum. There is a great need for multilateral collaboration on all the items mentioned above with international stakeholders from governments, industry, and research organisations. A permanent exchange with the relevant institutions and partners around the world (including those from resource rich countries) is needed to ensure a stable raw material flow to the European industry. Dialogue with and support to resource rich developing countries should be an integrative part of the EU's policy one example is the African Mining Vision and the African Mineral Development Centre, which being set up to support this Vision.

Knowledge Infrastructure

Implementing these four sets of tasks may need support from a new institution and should be complemented by initiatives in complementary policy spheres such as business, climate change, finance and tax.

RESEARCH PARAMETERS

Objectives of the research

The issue of increased competition and conflict over access to oil, gas and minerals has risen up the political agenda throughout the past decade. The threat of conflict and instability has added urgency to the search for collaborative and cooperative solutions to ensure secure and equitable access to these vital natural resources.

POLINARES has two key goals: first, to identify the main global challenges relating to competition for access to oil, gas and mineral resources; and second, to propose new approaches to collaborative solutions for a range of policy actors in the EU and elsewhere.

The formal objectives of the research are :

1. To develop a better understanding of how global interactions and interdependencies relating to oil, gas and minerals have been changing and are likely to change, and what their implications are for global economic, social, institutional and security relations.

2. To identify principles which can underpin the development of new policies, new policy-making processes, and new networking systems which, in turn, can assist in promoting an appropriate balance between competition and collaboration with respect to access to oil, gas and minerals in a manner which minimises conflict and promotes sustainable economic development.

The aim of Work Package 2 was to carry out a critical assessment of various market variables influencing supply and demand, develop supply and demand scenarios for these resources and possible supply risks, in order to refine and calibrate the theoretical models and in order to assist in the identification of sources of possible future tension and conflict.

Scientific approach / methodology

The POLINARES research work plan combines theoretical and empirical analysis to enhance our understanding of the challenges and how they may be addressed. We are examining historical experience going back as far as the 1920s and will look forward to the year 2040. The research is inter-disciplinary, drawing on the fields of international relations, economics, law, political science, geology, resource evaluation, and technology.

The global situation for the critical raw materials was analyzed in detail, including regional aspects of resources and reserves, of production, of consumption and of commodity market trends. A large number of supply risk and demand factors were analyzed.

These analyses, the integration of long-term data sets and the comparison of existing and historical criticality studies, before the background of the theoretical framework defined in Work Package 1 (historical regimes), lead to the approach discussed in this policy brief.

It has to be acknowledged that the approach on long-term criticality developed from scientific discussions and from close collaboration between Work Package 2 and Work Package 3.

PROJECT IDENTITY

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