

European Policy Brief

STRADE

Strategic Dialogue on Sustainable Raw Materials for Europe (STRADE)
No. 02 / 2017

EU raw material import flows – acknowledging non-EU environmental and social footprints

February 2017

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Funded by the
Horizon 2020 Programme
of the European Union

STRADE is an EU-funded research project focusing on the development of dialogue-based, innovative policy recommendations for a European strategy on future raw materials supplies. In a series of policy briefs and reports, the project will offer critical analysis and recommendations on EU raw materials policy.

This policy brief analyses the European import flows of metals in various processing states and the connections with specific environmental and socio-economic issues in resource-rich countries. It proposes the generation of 'profiles of raw material import footprint' which document the socio-economic and environmental footprint of the EU's material imports including opportunities for an increasing net-benefit of mining countries.

1. Introduction

Resource-rich countries and Europe's downstream companies are frequently connected by complex raw material flows. Highly import-dependent Europe imports raw materials in different degrees of fabrication. In the metal sector, Europe not only imports large amounts of ores and concentrates, but also high amounts of refined metals, processed metal compounds and alloys, as well as intermediate and end products.

This policy brief builds on the analysis of various environmental and socio-economic challenges in ore mining explored in the previous policy briefs No. [04/2016](#) [1] and [05/2016](#) [2]. The starting point of their analysis are the opportunities created from mining activities such as economic growth, increase in government revenues, employment and poverty reduction in resource-rich countries. At the same time, the associated various socio-economic and environmental negative impacts call for improvements, particularly in regions with weak governance. Consequently, European raw material imports are at least partly connected to pressing issues such as human right concerns, environmental hazards and shortcomings in gaining socio-economic development from mining in many developing countries.

The policy brief [01/2017](#) [3] analysed the distribution of roles and responsibilities along the value chain and the specific responsibilities of EU companies, the EU and its Member States. This policy brief complements this analysis of the basic principles of responsibility sharing with an analysis of the European import material flows of metals. It analyses the import structure of six selected metals – iron, aluminium, copper, tin, platinum and lithium – and the links between specific resource-rich countries and the EU. The policy brief proposes the generation of a supporting tool, 'Profiles on raw material import footprints', which documents the socio-economic and environmental footprint of the EU's material imports, hereby using synergies with other EU and international raw material data provision activities and considering challenges as well as opportunities.

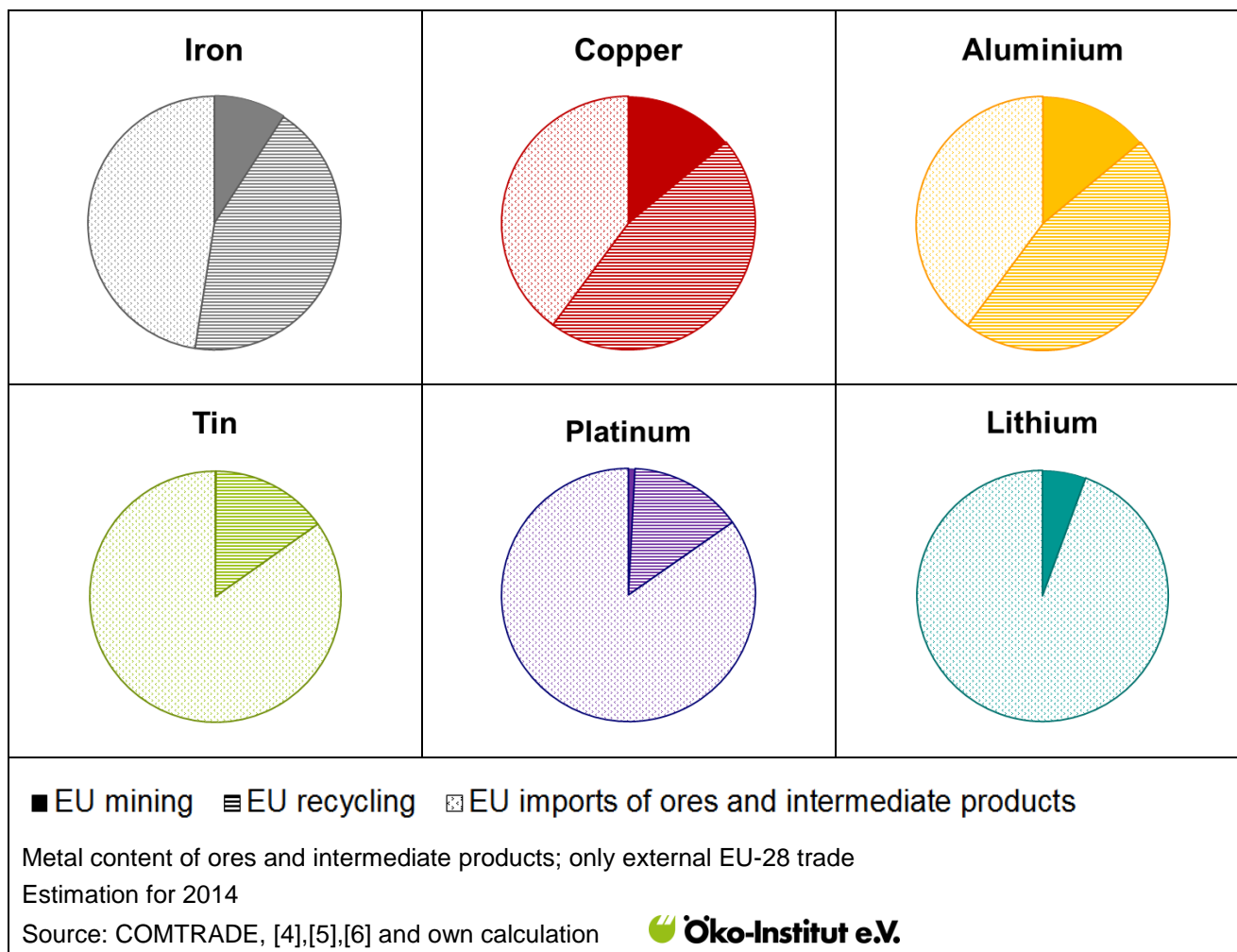
2. Europe's internal and external sourcing of ores and metals – an overview

This material flow analysis will focus on six selected metals – iron, aluminium, copper, tin, platinum, and lithium. The mass metals iron, aluminium and copper present the most relevant ores in terms of volume and have a high contribution to global mining waste volumes. The other three selected metals are highly relevant for innovative technologies and represent connections to other production countries and quite different socio-economic and environmental mining issues.

Europe's metal demand – for use within the EU or for the fabrication of export goods – is mainly met by imports of material in various processing stages and from recycling. In contrast, European mining only supplies a minor share of Europe's demand.

To illustrate this situation, Figure 1 shows the origin of European metal sourcing from imports for the processing industry (ores, concentrates, metals and other intermediate products), from recycling¹ and from mining within the EU. The figure presents rough estimations². The import data are derived from COMTRADE, metal associations³, a 2015 study on EU raw material flows [4] and Oeko-Institut calculations. The used COMTRADE data include those intermediate products and ores imports which are designated in own product categories in the statistical framework. Regrettably, Figure 1 does not include metals that are imported as part of end-user products or intermediate products with a mixed material composition. These products are classified in non-material-specific statistical categories within COMTRADE. The discussion on their relevance is part of chapter 6.

Figure 1: EU-28 processing industry’s sourcing of selected metals from EU mining, EU recycling and EU imports of ores and intermediate products (rough estimation of metal content in total volumes)



For the mass metals iron, copper and aluminium, Figure 1 impressively shows the large role recycling plays for the European processing industry. Recycling is as important for the EU metal sourcing as the imports of ores and intermediate products. For copper and aluminium, recycling provides even larger volumes than metal and ore imports. Platinum⁴ and tin recycling also produces sizable volumes. For lithium, which has still

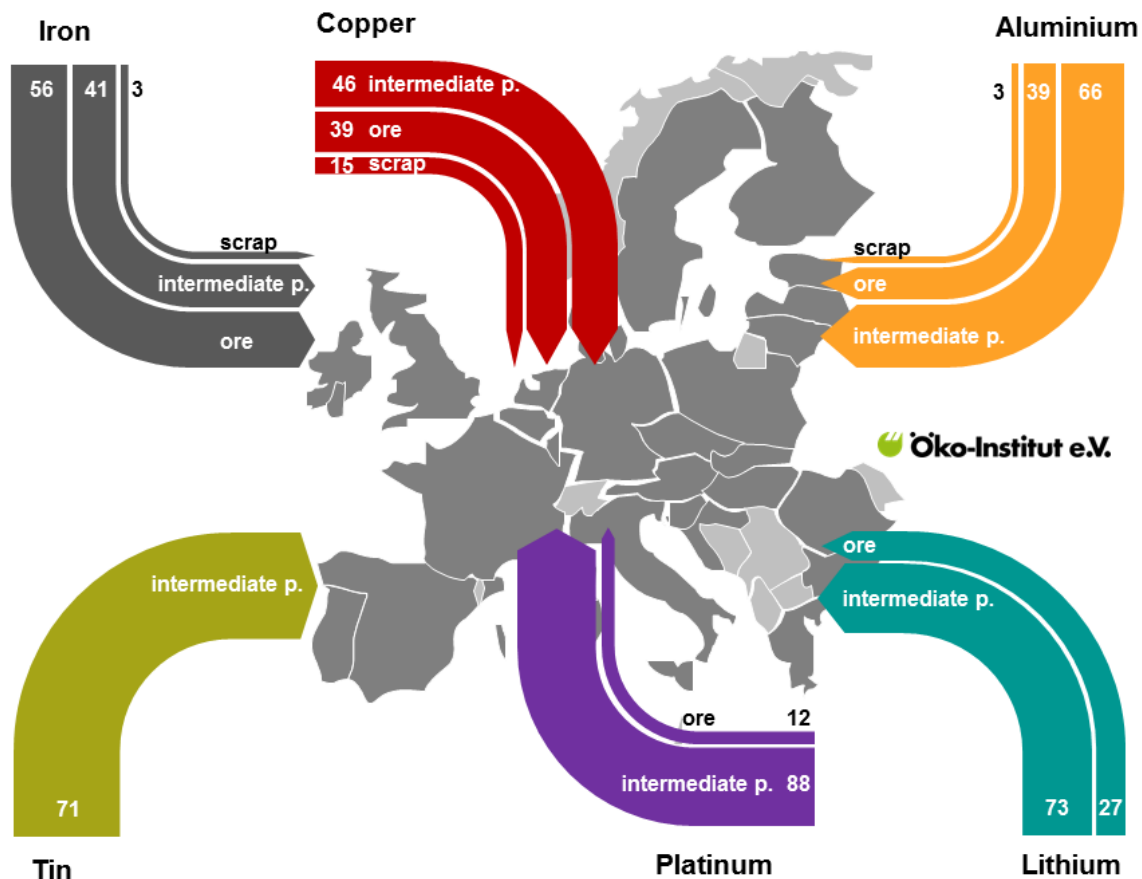
¹ EU recycling includes recycling from EU scrap imports.
² The available statistical data only allow rough estimations due to several shortages. The data do not cover all relevant material flows in sufficient degree of detail. In addition, the data from COMTRADE and metal and trade associations partly use different material categories according to their used methodological framework.
³ For aluminium: www.world-aluminium.org and for copper www.copperalliance.eu. Estimations for iron, tin, lithium and platinum are based on COMTRADE.
⁴ Available annual statistics for platinum do not provide data for recycling from industrial applications (e.g. process catalysts). Industrial applications for platinum usually have very efficient closed cycles [7]. Therefore the recycling share for platinum in the figure should be regarded as very conservative.

less recycling activities due to various technical, logistical and economic reasons, lithium compound imports are the leading source.

3. Analysis of EU imports for the processing industry along the value chain

Figure 2 illustrates the structure of EU metal imports for the processing industry for the six selected metals. The approach for data assessment is the same as described in the previous chapter. Therefore, Figure 2 does not include the materials embedded in imported products with a mixed material composition (i.e. no fabricated goods).

Figure 2: Specific EU gross imports: ores and intermediate products for EU processing industry; market shares (%) for six selected metals (rough estimation; intra-EU imports excluded; data refer to metal content)



Source: COMTRADE, [4],[5],[6] and own calculation; scrap share only indicated for iron, copper and aluminium

For iron, Figure 2 outlines that the gross import of ores and concentrates only accounts for around 60 % of all extra-EU iron imports for Europe’s processing industry. Around 40 % of iron for the processing industry is imported as intermediate iron and steel products. Iron scrap imports contribute a very small share of 3 % of total iron imports for the processing industry.

For the mass metals aluminium and copper, the Figure 2 shows that the downstream imports as intermediate products exceed ore imports. Therefore, the EU industry’s global aluminium and copper sourcing is largely linked to complex value chains across foreign refiners and manufacturers and their sourcing from global mining sites.

The import pattern of the other portrayed metals varies to a higher degree. Lithium is mainly imported as lithium hydroxide and carbonate for Europe’s industry⁵. Tin and platinum are mostly imported as intermediate goods⁶.

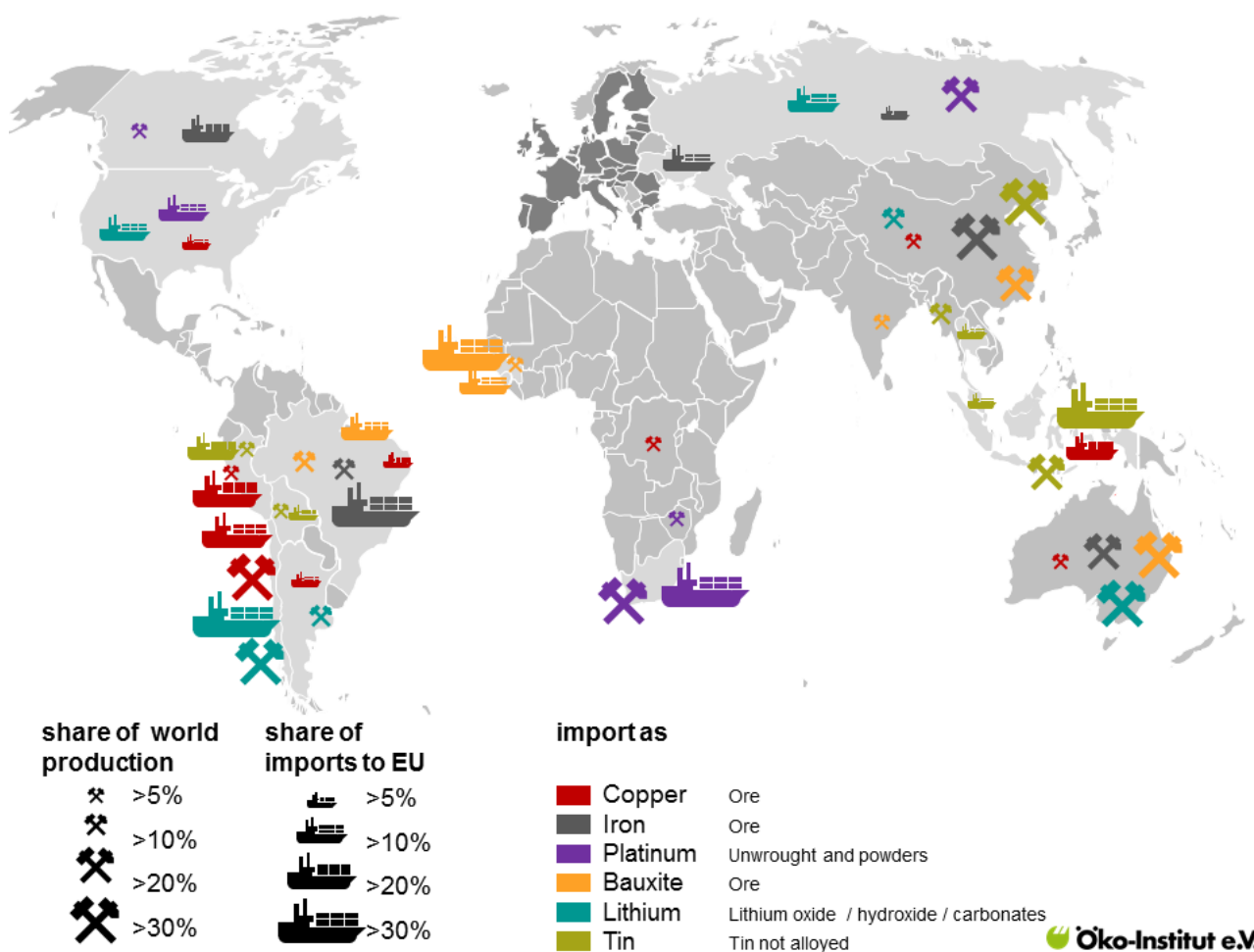
⁵ Currently, Lithium main applications are glass and ceramics and batteries.

In terms of EU responsibilities, the examples show prominently that EU metal sourcing is not only connected to ore supplying countries but also has a strong connection to non-EU refining and manufacturing countries and their sourcing from global markets.

4. Origin of EU ore imports

EU imports of ores and concentrates can be traced to their countries of origin, as seen in Figure 3. The figure specifically indicates origins for the six selected metals based on the COMTRADE database and shows the global major mining countries regardless of their export destination. For iron, aluminium and copper, the figure also shows the main origin countries of EU ore imports. For lithium, platinum and tin, which are mostly exported after a first processing stage, the figure shows the EU imports of the corresponding intermediate products at an early processing stage.

Figure 3: Major ore-producing countries and origin of EU imports of the six selected metals in their least processed form



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The overview depicted in Figure 3 shows the outstanding role of just a few global mining regions for EU raw material supply of the six metals:

- South America – namely Chile and Peru – has a very high level of importance for global copper ore production and EU copper ore imports.
- South America is also the main region of origin for the EU’s iron ore (Brazil) and lithium compounds (Chile) imports.
- Other globally important iron and lithium mining countries, namely Australia and China, are of negligible relevance for EU imports of these metals. China - with its high domestic demand - is the world largest iron

⁶ EU-28 merely imports 146 t tin ores. The European tin smelter production, mainly in Belgium, uses almost exclusively secondary materials [8]. Due to lack of data, tin included in scrap imports is not considered in figure 2.

ore importer; and Australia mainly supplies the Chinese market. The same is true for bauxite, with large mining activities in Australia and China.

- South Africa is a major supplier of platinum ores, globally and for the EU.
- The EU bauxite imports mainly come from West Africa, namely Guinea and Sierra Leone, though neither country is a major producer in global terms. Guinea merely contributes to 7 % of global bauxite production and Sierra Leone only around 0.4 %. Nevertheless, Guinea is the world's fifth largest bauxite producer and second largest exporter (after Australia).
- Besides iron, copper and lithium, South America also exports tin and bauxite to the EU.
- Indonesia is the main EU tin supplier (as unwrought tin).

In summary, the analysis shows the high relevance for South-America for the ore supply of the two mass metals iron and copper. South American countries further supply the EU with large amounts of lithium, which is becoming increasingly relevant with the higher demand for electric vehicles. South American's mining sector is related to a number of challenges, such as tailing dam bursts, water scarcity and local conflicts due to environmental pressure and socio-economic problems. In Africa, Guinea exports most of its bauxite to Europe and is thus the EU's main bauxite supplier. For other metals, other regions play a prominent role for EU imports, e.g. South-Africa (platinum) and Indonesia (tin). Related challenges are issues of violent social conflicts (platinum from South-Africa), maritime ecosystem degradation from offshore mining (tin from Indonesia) and missing links to local socio-economic development (bauxite from Guinea).

Besides the outlined countries, further countries are relevant for EU's ore and unwrought metal supply, e.g. Philippines (nickel); USA (zinc, molybdenum), Australia (zinc, titanium), Bolivia (zinc), Turkey (magnesium) and DRC (cobalt, tantalum, tin, gold), Gabon (manganese), Canada (titanium), India (titanium), Norway (titanium), China (rare earths).

5. Origin of EU imports of metals and products

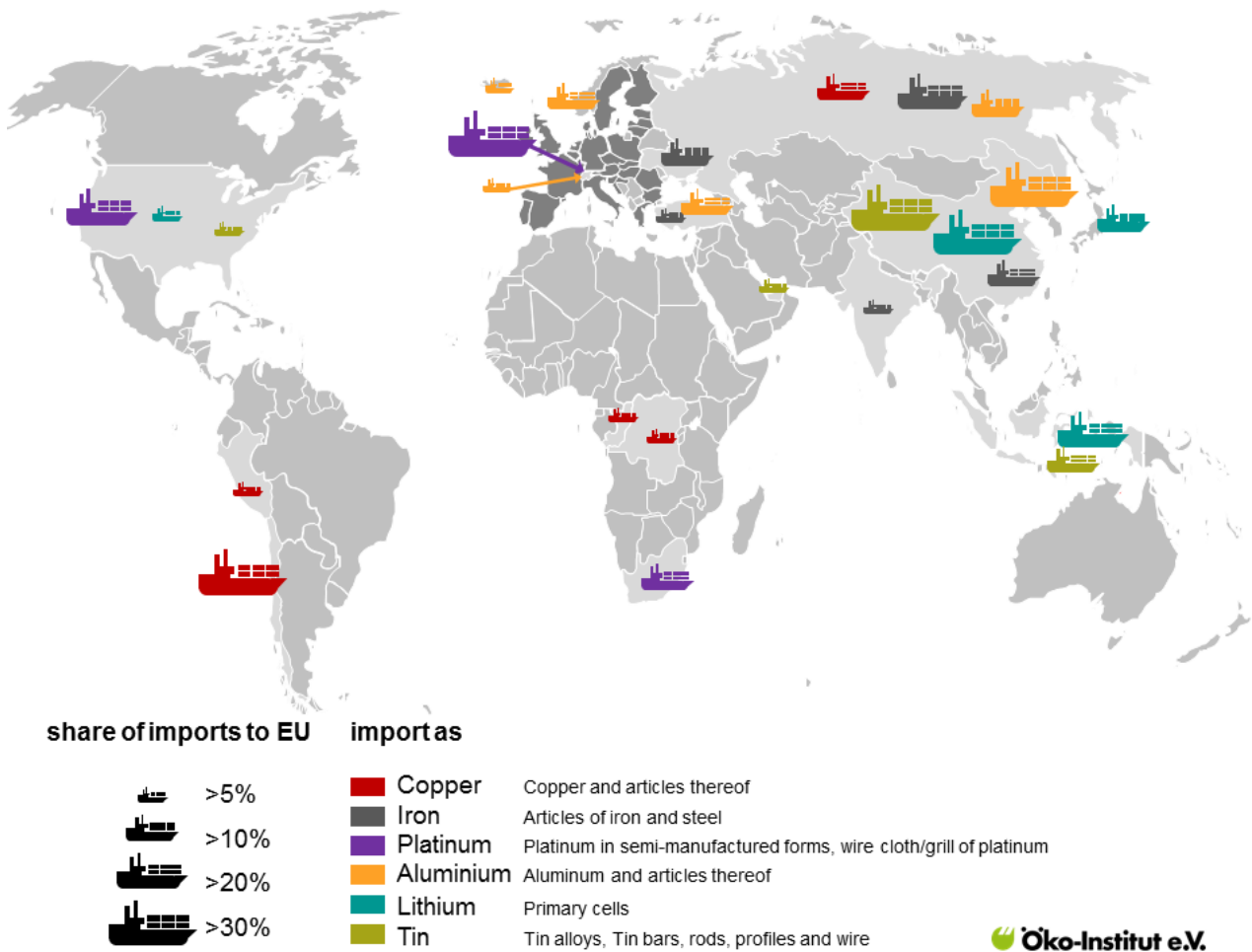
The origin of EU imports of the six selected metals as refined metal or other intermediate products can be seen in Figure 4. Not surprisingly, a much higher number of countries are involved in the processing and manufacturing of metals than just in the mining business. Thus, the supply chain becomes much more complex when moving from mining to refining and manufacturing. Likewise, there is a drastic shift in the involved regions.

Figure 4 particularly illustrates the following issues on the six selected metals:

- Though China does not export relevant amounts of ores or concentrates of the mass metals to Europe, it is a relevant exporter of iron products and a major exporter of aluminium and tin products as well as the main supplier of lithium primary cells to the EU. China sources its related ore demand mainly from domestic extraction and from imports from Australia (iron and aluminium), Brazil (iron) and Chile and Peru (copper).
- Russia is also a relevant exporter of iron, copper and aluminium products to the EU. It sources its iron and copper ores mainly from domestic extraction and imports from Kazakhstan.
- Some mining countries, e.g. Chile (copper), South-Africa (platinum) and Indonesia (tin) refine and process a large portion of their mined ores before exporting the unwrought metal or other intermediate products to the EU.
- Resource-rich industrialized countries Australia and Canada do not export relevant amounts of the six selected metals as products to Europe. The USA merely exports some platinum products and small amounts of lithium and tin products to the EU.
- Switzerland exports high amounts of platinum products to the EU-28.

As can be seen, the EU's metal consumption is closely linked to global mining and production activities. Besides the short connections via direct ore and concentrate imports, a considerable amount of imports stem from processing countries which themselves source at least some of the ores globally. China and Russia contribute significantly to this supply chain as well as various industrialized, emerging and developing countries.

Figure 4: Major countries exporting intermediate products to the EU



6. Indirect metal imports

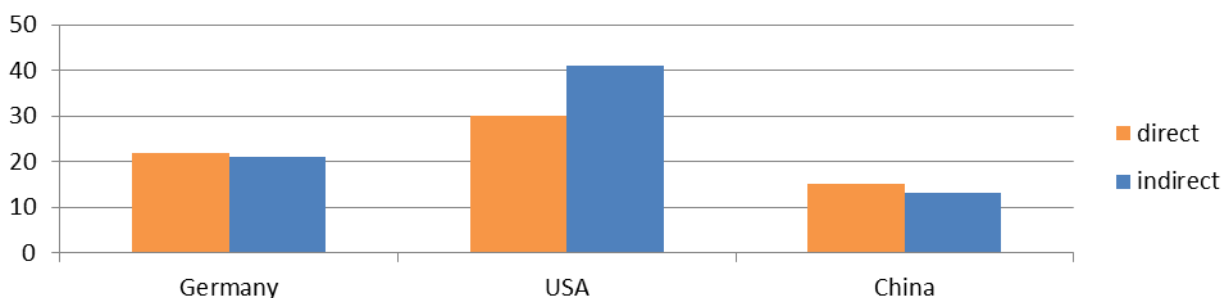
The imports of intermediate steel products are called ‘direct imports’ [9] in a study by the World Steel association. In contrast, the imports of metals as part of finished products or end-user products are called ‘indirect imports’. For example, an imported car is related to high *indirect steel imports*. Further upstream, car manufacturers’ imports of metal sheets are classified as *direct imports*. Due to intense European trade activities, indirect imports of metals play an important role. However, because different metals are widely used in a huge variety of different products, it is extremely complicated to adequately quantify the metal content found in indirect imports. Nevertheless, the following data activities address and attempt to quantify the complex raw material flows:

- The 2015 “Study on data for a raw material system analysis” [4] estimates the imports of critical metals in final products based on 2012 data. However, this analysis does not cover the mass metals and tin which are in the focus of this policy brief.
- Eurostat estimates all metal flows in the EU economy and in the external trade by material flow accounting [10]. Hereby, it does not track the net metal content, but instead indicates the related gross ore contents. Statements to the volume of indirect metal imports could only be derived if assumptions on average ore contents in indirect flows would be available.
- The World Steel Association published data on global indirect steel flows [9]. However, the data for the EU contains intra-European trade and allow no aggregated view on the EU-28.

As an alternative to EU-28 data, Figure 5 illustrates the role of indirect imports for the example of indirect steel imports (in cars, ships, machines, white goods etc.) in relation to direct steel imports (bars, sections, coils, tubes etc.; no iron ores) for Germany, the USA and China⁷.

⁷ The data on direct and indirect imports refer to gross imports.

Figure 5: Direct and indirect steel imports for Germany, USA and China in 2013 (million tonnes) [9]



Source: Data from World Steel Association [9]

For Germany, the USA and China, Figure 5 outlines that the indirect imports have approximately the same level of importance as direct imports. Consequently, indirect imports are highly relevant for the overall cross-boundary material flows. Considering this issue, it is not only the European processing sector, which imports large volumes of goods with complex supply chains but also the trading sector.

7. Steps to developing a profound knowledge base of EU's import materials' social and environmental footprint

The interrelationship between EU material imports and the social and ecological impacts along the supply chain can be titled with the term “social and environmental footprint of EU import materials”. This footprint comprises mining’s positive contribution to local income, jobs, revenues, education etc. as well as the negative socio-economic and environmental impacts as analysed in the previous policy briefs No. [04/2016](#) [1] and [05/2016](#) [2]). The chapters above illustrate the high complexity in tracking imports to the EU, due to the global value chain along different countries and companies at various processing stages. In addition, it is closely related to the mining region’s governance performance and comprises many positive and negative facets of socio-economic and environmental impacts including the opportunities from the extractive sector.

The EU and EU’s companies both have a responsibility to address the challenges in their supply chain and to support an adequate net-benefit of mining countries (see policy brief [01/2017](#) [3]). Meaningful strategies to assume this responsibility need a good understanding of the social and environmental footprint of the raw material imports to take charge of the most urgent issues, conduct dialogues on opportunities for progress and develop appropriate measures. This is particularly true for the due diligence of conflict minerals - in view of the coming EU directive on conflict minerals - and the extended due diligence of EU companies which increasingly seek to identify and mitigate socio-economic and environmental risk along their supply chain. However, due diligence is only one approach amongst others within the broad range of measures for responsible mining and not undisputed. It will be discussed in more detail in a coming STRADE policy brief and a STRADE report. In addition to this topic, other political fields of action also require a sound understanding of EU’s import flows and their related footprint.

The following Table 1 shows some relevant data sources on EU raw material flows and responsible mining issues and offers information about relevant activities:

Table 1: Selected data sources related to imported raw material flows and responsible mining issues

Institution	Type of activity	Name
Eurostat	International trade and production statistics	COMEXT, PRODCOM, [11] [12]
Eurostat	Raw material indicators related to EU raw material consumption and material flows along the supply chain based on environmental-economic accounting	Indicators DMC, RMC, DMI, RME [13]

Institution	Type of activity	Name
European Innovation Partnership on Raw Materials (EIP)	24 indicators on EU raw materials (5 related to imports)	Raw materials score board [14]
European Commission	Criticality analysis of raw materials	Critical material list and background reports [15–17]
Joint Research Centre	Raw material information systems (under development)	RMIS [18]
UN	Database on global trade	COMTRADE [19]
OECD	Information on human rights issues for companies' due diligence activities (under development)	Minerals Risk Handbook
UNEP	Platform and information for stakeholders in the extractives sector (under development)	MAP-X [20]
Responsible Mining Foundation	Independent ranking of large mining companies in responsible mining practice (under development)	Responsible Mining Index (RMI) [21]
Mining companies	Sustainability reporting	Sustainability reports
World Bank	Evaluation of countries' governance (cross-sectoral)	World Governance Indicators (WGI) [22]
Natural Resource Governance Institute	Evaluation of countries' resource governance	Resource Governance Index (RGI) [23] [24]
Civil Society and Research (e.g. Environmental Justice Atlas)	Mapping of mining conflicts	Web based information on environmental and social conflicts, e.g. [25]
International Council on Mining & Metals (ICMM)	Evaluation of mining countries' contribution to national economies	Mining Contribution Index (MCI)
Ilostat (ILO labour statistics)	Country specific data on labour issues	Data on mining employment and working conditions

Table 1 illustrates that several institutions in the EU and the Member States are already working on specific aspects of data compilation. However, the knowledge on the social and environmental footprint of EU import materials is still fragmented and scattered. Understanding the whole picture of the social and environmental footprint from the EU's import material is still a challenge. An indicator or a set of indicators which fairly well represent the social and environmental footprint of European's import materials and allows the monitoring of its progress will likely not be available in the short term. Instead, the challenge to first be tackled is the development of a broad, public knowledge base which provides information for downstream companies, policy makers, associations, researchers and civil society. The key questions for such a knowledge base are:

- What are the major socio-economic and environmental hotspots with direct connections to the European supply chain?

- What are further socio-economic and environmental hotspots in global raw materials production which are indirectly linked to the EU's imports by complex value chains?
- How does European raw material demand affect global markets, global players and the global mining sector beyond the EU's supply chains?
- Where is support and action for improvement in responsible mining practice and an increasing net-benefit in the mining countries needed: along Europe's value chain or also beyond the EU's direct and indirect connections?
- Are there ongoing initiatives with which Europe's companies or institutions can connect?

The target of the knowledge base of the social and environmental footprint is not to completely track Europe's material flows along the non-EU supply chain. Firstly, complete transparency is not feasible for most of the material flows. Secondly, the EU, with its share of around 20 % of global raw material consumption, is an important global demander and thus influences not only its own supply chain but also the global market.

STRADE suggests creating the support tool 'Profiles on raw material import footprints' in cooperation with other raw-material data-related activities (e.g. the further development of the Raw Material Scoreboard) – eventually with an attached data base – which would present basic information on: European and global raw material flows, mining country origin, global major suppliers, specific environmental and social hot-spots of mining sites, governance performance in mining regions, socio-economic progress in mining regions, and ongoing cooperation (e.g. technical cooperation, partnerships, certification and due diligence schemes), opportunities and net-benefit from mining. STRADE will develop a draft concept for the support tool 'profiles on raw material import footprints' in the first half of 2017 and discuss it at a European stakeholder workshop in Brussels in June 2017.

8. Summary

This policy brief analyses the import structure of six selected metals – iron, aluminium, copper, tin, platinum and lithium – and the connections between specific resource rich countries and the EU. While raw materials mined in the EU only supply a minor share of European demand, European recycling plays an important role in the European material supply structure. Despite strong recycling efforts, imports still meet a high share of European demand. Highly relevant imports are not only ores and concentrates, but also imports further downstream in the value chain: metals, alloys, intermediate and finished products. Consequently, Europe's metal sourcing is also largely linked to complex value chains across foreign refiners, manufacturers and global mining sites. This complexity imposes strong challenges to meaningful EU engagement.

The analysis of the six selected metals revealed South America's prominent role for European imports of lithium and the two mass metals iron and copper. These imports are related to a number of opportunities and challenges – e.g. job generation, socio-economic development from mining – but also face challenges, such as tailing dam bursts, water scarcity and local conflicts due to environmental pressure and socio-economic problems. The other selected metals indicate, for mining, issues of violent social conflicts (platinum from South-Africa), maritime ecosystem degradation from offshore mining (tin from Indonesia) and missing links to local socio-economic development (bauxite from Guinea). The imports of processed goods frequently originate from other regions. Particularly, China and Russia play an important role in the supply chain of the EU's manufacturing industry.

Companies and policy makers need a better knowledge base on the relationship between raw material imports and responsible mining issues that will support their measures to mitigate negative impacts and to support socio-economic development in non-EU mining areas. Available data is fragmented and scattered though some European and international institutions in the EU globally generate data and provide information. The current major challenge is consolidating the available data and filling in missing information in this data set. With this objective, STRADE suggests generating 'profiles on raw material import footprints', which document the socio-economic and environmental footprint of the EU's material imports including opportunities and challenges, hereby using synergies with other EU raw material data provision activities and integrating the available information on supply security issues. STRADE will discuss a draft concept for the raw material profiles at a stakeholder workshop in Brussel in June 2017.

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Project Background

The Strategic Dialogue on Sustainable Raw Materials for Europe (STRADE) addresses the long-term security and sustainability of the European raw material supply from European and non-European countries.









Using a dialogue-based approach in a seven-member consortium, the project brings together governments, industry and civil society to deliver policy recommendations for an innovative European strategy on future EU mineral raw-material supplies.

The project holds environmental and social sustainability as its foundation in its approach to augmenting the security of the European Union mineral raw-material supply and enhancing competitiveness of the EU mining industry.

Over a three year period (2016-2018), STRADE shall bring together research, practical experience, legislation, best practice technologies and know-how in the following areas:

1. A European cooperation strategy with resource-rich countries
2. Internationally sustainable raw-material production & supply
3. Strengthening the European raw-materials sector

Project Identity

Project Name	Strategic Dialogue on Sustainable Raw Materials for Europe (STRADE)	
Coordinator	Oeko-Institut; Doris Schueler, Project Coordinator, d.schueler@oeko.de	
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Funding Scheme	This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 689364	 Funded by the Horizon 2020 Programme of the European Union
Duration	1.12.2015 – 30.11.2018	
Budget	EU funding: €1 977 508.75	
Website	www.STRADEproject.eu	

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