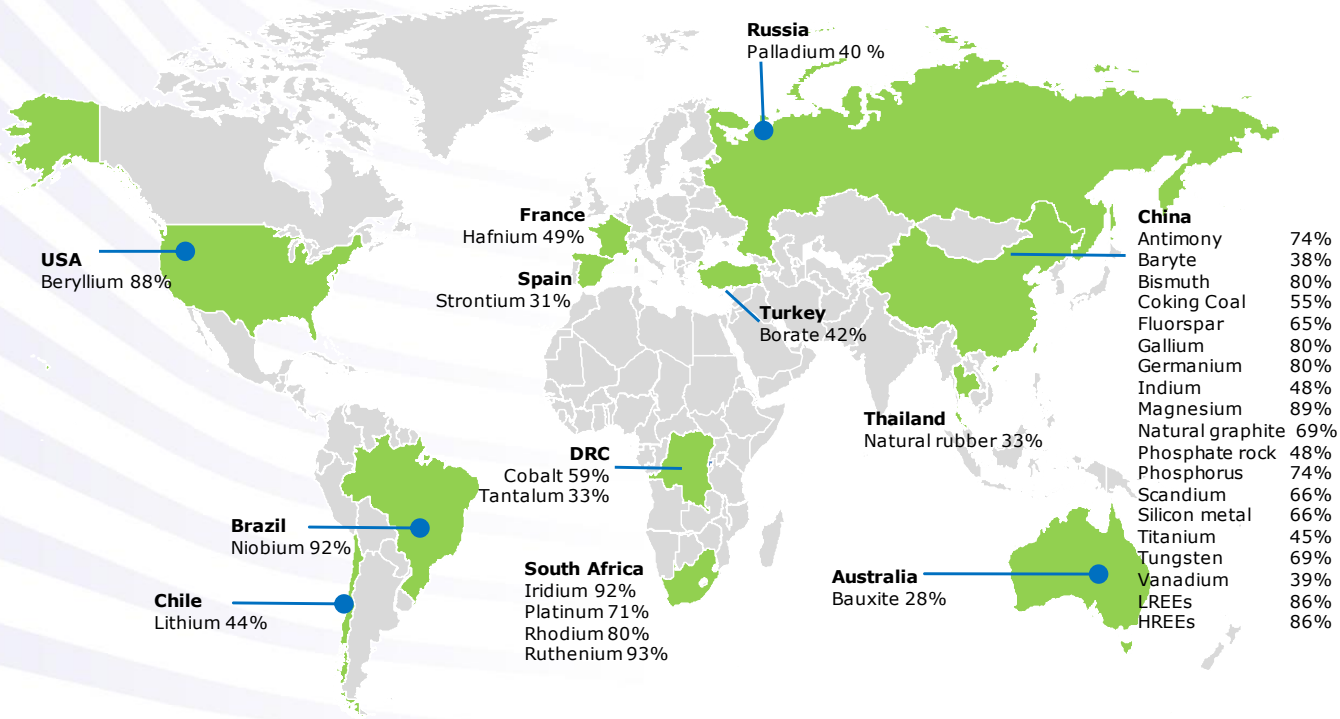
European Commission

Study on the EU's list of Critical Raw Materials (2020)

Final Report



Raw Materials

Authors: Gian Andrea Blengini, Cynthia EL Latunussa, Umberto Eynard, Cristina Torres de Matos, Dominic Wittmer, Konstantinos Georgitzikis, Claudiu Pavel, Samuel Carrara, Lucia Mancini, Manuela Unguru, Darina Blagoeva, Fabrice Mathieux, David Pennington.

LEGAL NOTICE

Luxembourg: Publications Office of the European Union, 2020

Print	ISBN 978-92-76-21050-4	doi: 10.2873/904613	ET-01-20-491-EN-C
PDF	ISBN 978-92-76-21049-8	doi: 10.2873/11619	ET-01-20-491-EN-N

How to cite this report: "European Commission, Study on the EU's list of Critical Raw Materials – Final Report (2020)"

EUROPEAN COMMISSION

Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs | Joint Research Centre
Directorate GROW.C | JRC.D
Unit GROW.C.2 – Energy-intensive Industries and Raw Materials | JRC.D.3 – Land Resources

Contact: GROW.C.2

E-mail: GROW-C2@ec.europa.eu

European Commission
B-1049 Brussels

Study on the EU's list of Critical Raw Materials (2020)

Final Report

EXECUTIVE SUMMARY

Context

Pressure on resources will increase - due to increasing global population, industrialisation, digitalisation, increasing demand from developing countries and the transition to climate neutrality with metals, minerals and biotic materials used in low-emission technologies and products. OECD forecasts that global materials demand will more than double from 79 billion tonnes today to 167 billion tonnes in 2060. Global competition for resources will become fierce in the coming decade. Dependence of critical raw materials may soon replace today's dependence on oil.

The EU Green Deal Communication[1] adopted on 11 December 2019 recognizes access to resources as a strategic security question to fulfil its ambition towards 2050 climate neutrality and increasing our climate ambition for 2030.

Secure and sustainable supply of both primary and secondary raw materials, in particular of critical raw materials, for key technologies and strategic sectors as renewable energy, e-mobility, digital, space and defence is one of the pre-requisites to achieve climate neutrality. The new Industrial Strategy for the EU[2] addresses the security and sustainability challenge and calls for an Action Plan on Critical Raw Materials and for industry-driven raw materials alliances.

This continues the work of the Commission to address the growing concern of securing valuable raw materials for the EU economy. Already in 2008, the European Commission launched the Raw Materials Initiative (RMI)[3]. This EU policy pursues a diversification strategy for securing non-energy raw materials for EU industrial value chains and societal well-being. Diversification of supply concerns reducing dependencies in all dimensions – by sourcing of primary raw materials from the EU and third countries, increasing secondary raw materials supply through resource efficiency and circularity, and finding alternatives to scarce raw materials.

One of the priority actions of the RMI was to establish a list of critical raw materials at EU level. The first list was published in 2011 and it is updated every three years to regularly assess the criticality of raw materials for the EU. Critical raw materials are considered to be those that have high economic importance for the EU and a high supply risk.

The present study is the fourth technical assessment of critical raw materials for the EU, based on the methodology[4] developed by the European Commission in cooperation with the Ad hoc Working Group on Defining Critical Raw Materials (AHWG)[5] in 2017.

The first assessment (2011) identified 14 critical raw materials (CRMs) out of the 41 non-energy, non-agricultural candidate raw materials. In the 2014 exercise, 20 raw materials were identified as critical out of 54 candidates. In 2017, 27 CRMs were identified among 78 candidates.

Novelties of the 2020 assessment

The 2020 assessment covers a larger number of materials: 83 individual materials or 66 candidate raw materials comprising 63 individual and 3 grouped materials (ten individual heavy rare earth elements (REEs), five light REEs, and five platinum-group metals (PGMs)). Five new materials (arsenic, cadmium, strontium, zirconium and hydrogen) have been assessed.

[1] COM(2019) 640 final
[2] COM(2020) 102 final
[3] https://ec.europa.eu/growth/sectors/raw-materials/policy-strategy_en
[4] Methodology for establishing the EU List of Critical Raw Materials, 2017, ISBN 978-92-79-68051-9
[5] The AHWG on Defining Critical Raw Materials is a sub-group of the Raw Materials Supply Group expert group.

Industrial and construction minerals	aggregates, baryte, bentonite, borates, diatomite, feldspar, fluorspar, gypsum, kaolin clay, limestone, magnesite, natural graphite, perlite, phosphate rock, phosphorus, potash, silica sand, sulphur, talc
Iron and ferro-alloy metals	chromium, cobalt, manganese, molybdenum, nickel, niobium, tantalum, titanium, tungsten, vanadium
Precious metals	gold, silver, and Platinum Group Metals (iridium, palladium, platinum, rhodium, ruthenium)
Rare earths	Heavy rare earths (dysprosium, erbium, europium, gadolinium, holmium, lutetium, terbium, thulium, ytterbium, yttrium); Light rare earths (cerium, lanthanum, neodymium, praseodymium and samarium); and scandium
Other non-ferrous metals	aluminium, antimony, arsenic, beryllium, bismuth, cadmium, copper, gallium, germanium, gold, hafnium, indium, lead, lithium, magnesium, rhenium, selenium, silicon metal, silver, strontium, tellurium, tin, zinc, zirconium
Bio and other materials	natural cork, natural rubber, natural teak wood, sapele wood, coking coal, hydrogen and helium

For comparison, 41 candidate materials have been screened in 2011, 54 in 2014 and 61 in 2017.

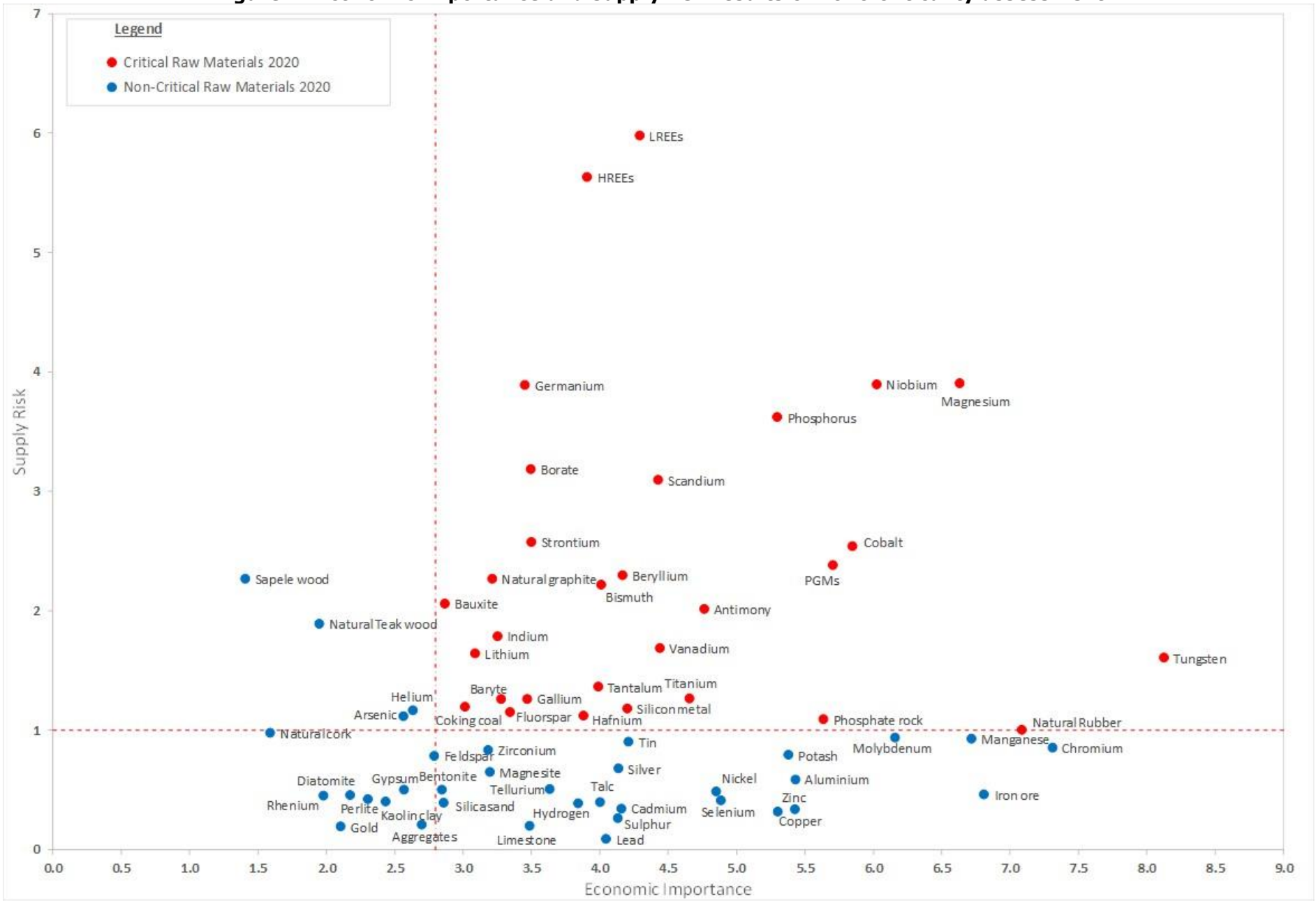
Results

Of the 83 individual (66 candidate) raw materials assessed, the following 30 were identified as critical in this assessment:

2020 Critical Raw Materials (30)			
Antimony	Fluorspar	Magnesium	Silicon Metal
Baryte	Gallium	Natural Graphite	Tantalum
Bauxite	Germanium	Natural Rubber	Titanium
Beryllium	Hafnium	Niobium	Vanadium
Bismuth	HREEs	PGMs	Tungsten
Borates	Indium	Phosphate rock	Strontium
Cobalt	Lithium	Phosphorus	
Coking Coal	LREEs	Scandium	

The overall results of the 2020 criticality assessment are presented in Figure A. Critical raw materials (CRMs) are highlighted by red dots and are located within the criticality zone (SR ≥ 1 and EI ≥ 2.8) of the graph. Blue dots represent the non-critical raw materials.

Figure A: Economic importance and supply risk results of 2020 criticality assessment



The 2020 list confirms 26 of the 2017 CRMs. Three CRMs in the 2020 list were not considered as critical in the 2017 list: Bauxite, Lithium and Titanium. Conversely, Helium, critical in the 2017 CRM list, is no longer in 2020. Strontium is the only new candidate material that is in the 2020 list of CRMs.

2020 CRMs vs. 2017 CRMs			
Antimony	Germanium	PGMs	Bauxite
Baryte	Hafnium	Phosphate rock	Lithium
Beryllium	HREEs	Phosphorus	Titanium
Bismuth	LREEs	Scandium	
Borate	Indium	Silicon metal	
Cobalt	Magnesium	Tantalum	Strontium
Coking Coal	Natural Graphite	Tungsten	
Fluorspar	Natural Rubber	Vanadium	
Gallium	Niobium	~~*Helium*~~	

Legend:

Black: CRMs in 2020 and 2017
Red: CRMs in 2020, non-CRMs in 2017
Green: CRMs assessed in 2020 that were not assessed in 2017
~~*Strike:*~~ Non-CRMs in 2020 that were critical in 2017

The table below summarises the key changes in the 2020 CRMs list compared to the 2014 CRMs list. The 2020 assessment confirmed 19 CRMs from the 2014 list, whereas 8 of the non-critical materials in 2014 shifted to being critical in 2020.

2020 CRMs vs. 2014 CRMs			
Antimony	Indium	Baryte	Bismuth
Beryllium	Lithium	Bauxite	Phosphorus
Borate	Magnesium	Hafnium	Strontium
Cobalt	Natural Graphite	Natural Rubber	
Coking Coal	Niobium	Scandium	
Fluorspar	PGMs	Tantalum	
Gallium	Phosphate Rock	Titanium	
Germanium	Silicon Metal	Vanadium	
HREEs	Tungsten		
LREEs			

Legend

Black: CRMs in 2020 and 2014

Red: CRMs in 2020 that were not CRMs in 2014

Green: CRMs in 2020 that were not included in the assessment in 2014

The following tables present the major global supplier of the 2020 critical raw materials. Table A presents the results for individual raw materials. Table B presents the averaged figures on global primary supply for the 3 material groups: HREEs, LREEs, and PGMs.

Table A: Major global supplier countries of CRMs – individual materials

Material		Stage[6]	Main global supplier	Share	Material		Stage	Main global supplier	Share
1	Antimony	E	China	74%	23	Magnesium	P	China	89%
2	Baryte	E	China	38%	24	Natural graphite	E	China	69%
3	Bauxite	E	Australia	28%	25	Natural rubber	E	Thailand	33%
4	Beryllium	E	USA	88%	26	Neodymium	E	China	86%
5	Bismuth	P	China	80%	27	Niobium	P	Brazil	92%
6	Borate	E	Turkey	42%	28	Palladium	P	Russia	40%
7	Cerium	E	China	86%	29	Phosphate rock	E	China	48%
8	Cobalt	E	Congo,DR	59%	30	Phosphorus	P	China	74%
9	Coking coal	E	China	55%	31	Platinum	P	S. Africa	71%
10	Dysprosium	E	China	86%	32	Praseodymium	E	China	86%
11	Erbium	E	China	86%	33	Rhodium	P	S. Africa	80%
12	Europium	E	China	86%	34	Ruthenium	P	S. Africa	93%
13	Fluorspar	E	China	65%	35	Samarium	E	China	86%
14	Gadolinium	E	China	86%	36	Scandium	P	China	66%
15	Gallium	P	China	80%	37	Silicon metal	P	China	66%
16	Germanium	P	China	80%	38	Tantalum	E	Congo,DR	33%
17	Hafnium	P	France	49%	39	Terbium	E	China	86%
18	Ho,Tm,Lu,Yb	E	China	86%	40	Titanium	P	China	45%
19	Indium	P	China	48%	41	Tungsten	P	China	69%
20	Iridium	P	S. Africa	92%	42	Vanadium	E	China	39%
21	Lanthanum	E	China	86%	43	Yttrium	E	China	86%
22	Lithium	P	Chile	44%	44	Strontium	E	Spain	31%

Legend	
Stage	E = Extraction stage P = Processing stage
HREEs	Dysprosium, erbium, europium, gadolinium, holmium, lutetium, terbium, thulium, ytterbium, yttrium
LREEs	Cerium, lanthanum, neodymium, praseodymium and samarium
PGMs	Iridium, palladium, platinum, rhodium, ruthenium

Table B: Major global supplier countries of CRMs – grouped materials (average)

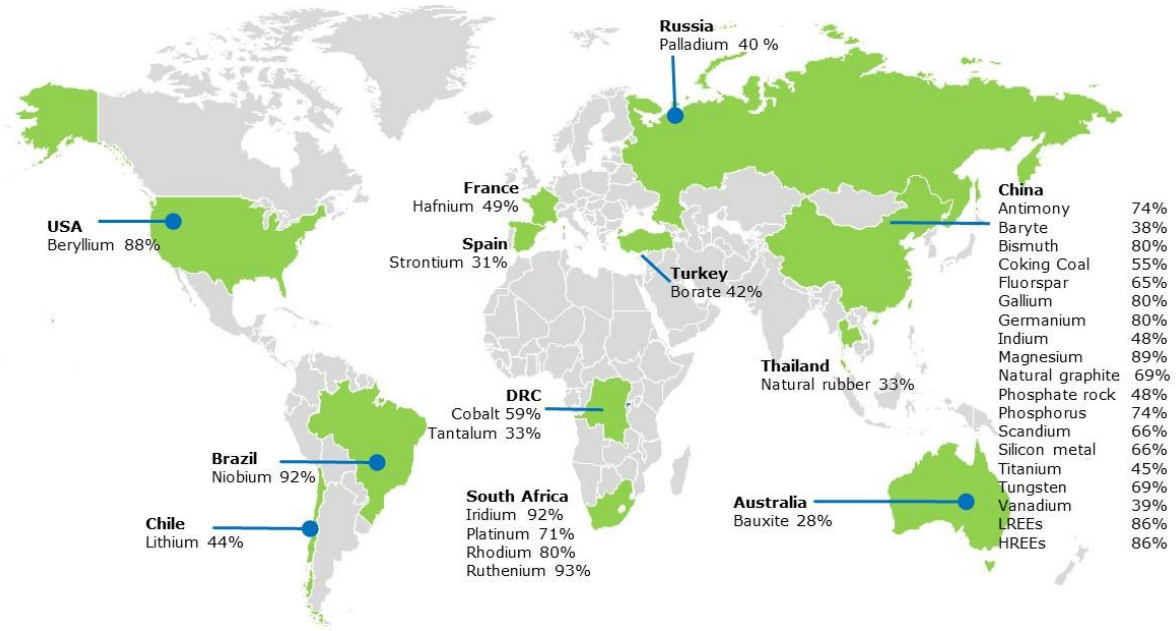
Material	Stage	Main global supplier	Share
HREEs	E	China	86%
LREEs	E	China	86%
PGMs[7] (iridium, platinum, rhodium, ruthenium)	P	South Africa	75%
PGMs (palladium)	P	Russian Federation	40%

Figure B is the world map of the main global producers of the raw materials listed as critical for the EU in 2020.

[6] Stage refers to the life-cycle stage of the material that the criticality assessment was carried out on: extraction (E) or processing (P).

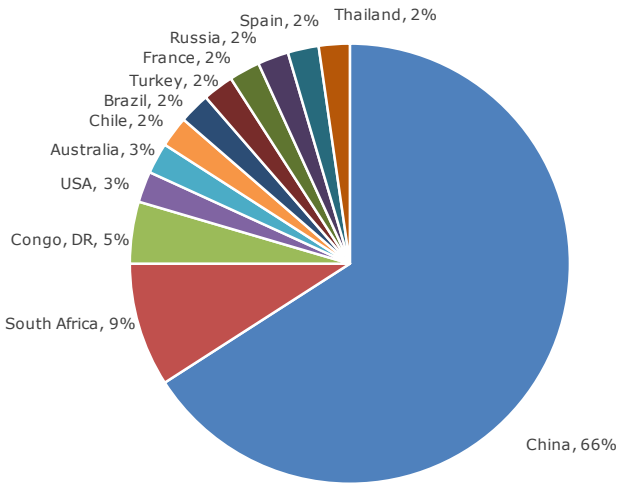
[7] Calculating the average for the largest global supplier for all the PGMs is not possible because the major producing country is not the same for each of the five PGMs.

Figure B: Countries accounting for largest share of global supply of CRMs



An analysis of global supply confirms that China is the largest supplier of several critical raw materials. Other countries are also important global suppliers of specific materials. For instance, Russia and South Africa are the largest global suppliers for platinum group metals, the USA for beryllium and Brazil for niobium.

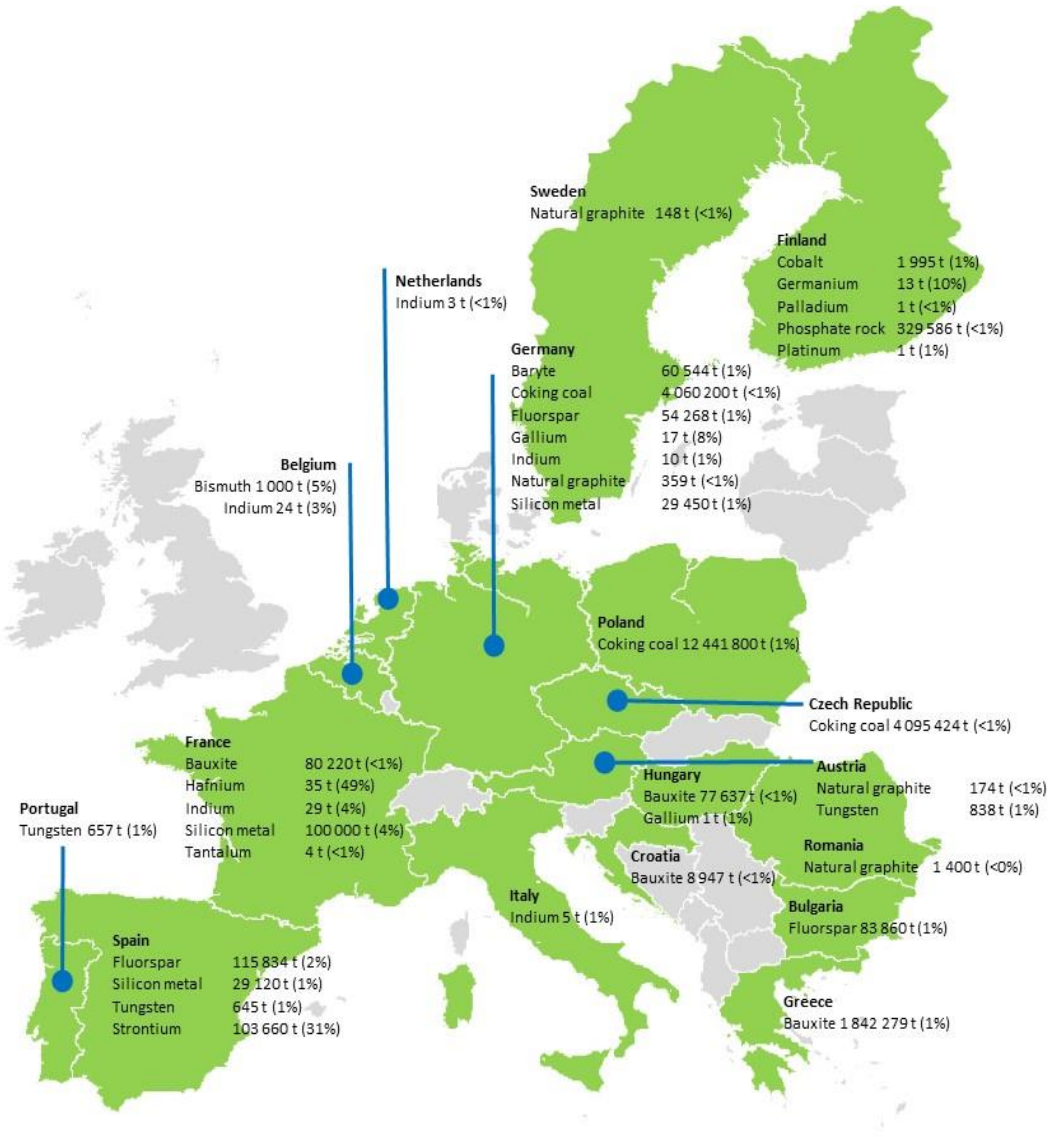
Figure C: Main Global supply countries of CRMs[8] (based on number of CRMs supplied, average 2012-2016)



In terms of the total number of CRMs, China is the major global supplier of 66% of the individual critical raw materials (Figure C). This includes all of the REEs and other critical raw materials such as magnesium, tungsten, antimony, gallium and germanium among others.

[8] The figure should not be interpreted in terms of tonnage of CRM that originate from these countries, but in terms of the number of CRMs, for which the country is the main global supplier or producer of the CRM.

Figure D: EU producers of CRMs, in brackets shares of global supply, 2012-2016[9]



[9] JRC elaboration on multiple sources

The following tables present the main countries from which the EU is sourcing critical raw materials (EU sourcing). Table C presents the results for individual raw materials. Table D presents the averaged figures for 3 material groups: HREEs, LREEs, and PGMs.

Table C: Major EU sourcing countries of CRMs – individual materials

	Material	Stage [10]	Main EU supplier	Share		Material	Stage	Main EU supplier	Share
1	Antimony	E	Turkey	62%	23	Magnesium	P	China	93%
2	Baryte	E	China	38%	24	Natural graphite	E	China	47%
3	Bauxite	E	Guinea	64%	25	Natural Rubber	E	Indonesia	31%
4	Beryllium	E	n/a	n/a	26	*Neodymium*	P	China	99%
5	Bismuth	P	China	49%	27	Niobium	P	Brazil	85%
6	Borate	E	Turkey	98%	28	*Palladium*	P	n/a	n/a
7	*Cerium*	P	China	99%	29	Phosphate rock	E	Morocco	24%
8	Cobalt	E	Congo,DR	68%	30	Phosphorus	P	Kazakhstan	71%
9	Coking coal	E	Australia	24%	31	*Platinum*	P	n/a	n/a
10	*Dysprosium*	P	China	98%	32	*Praseodymium*	P	China	99%
11	*Erbium*	P	China	98%	33	*Rhodium*	P	n/a	n/a
12	*Europium*	P	China	98%	34	*Ruthenium*	P	n/a	n/a
13	Fluorspar	E	Mexico	25%	35	*Samarium*	P	China	99%
14	*Gadolinium*	P	China	98%	36	Scandium	P	n/a	n/a
15	Gallium	P	Germany	35%	37	Silicon metal	P	Norway	30%
16	Germanium	P	Finland	51%	38	Tantalum	E	Congo,DR	36%
17	Hafnium	P	France	84%	39	*Terbium*	P	China	98%
18	Ho,Tm,Lu,Yb	P	China	98%	40	Titanium	P	n/a	n/a
19	Indium	P	France	28%	41	Tungsten	P	China	26%
20	*Iridium*	P	n/a	n/a	42	Vanadium	E	n/a	n/a
21	*Lanthanum*	P	China	99%	43	*Yttrium*	P	China	98%
22	Lithium	P	Chile	78%	44	Strontium	E	Spain	100 %

Legend

Stage	E = Extraction stage P = Processing stage
HREEs	Dysprosium, erbium, europium, gadolinium, holmium, lutetium, terbium, thulium, ytterbium, yttrium
LREEs	Cerium, lanthanum, neodymium, praseodymium and samarium
PGMs	Iridium, palladium, platinum, rhodium, ruthenium

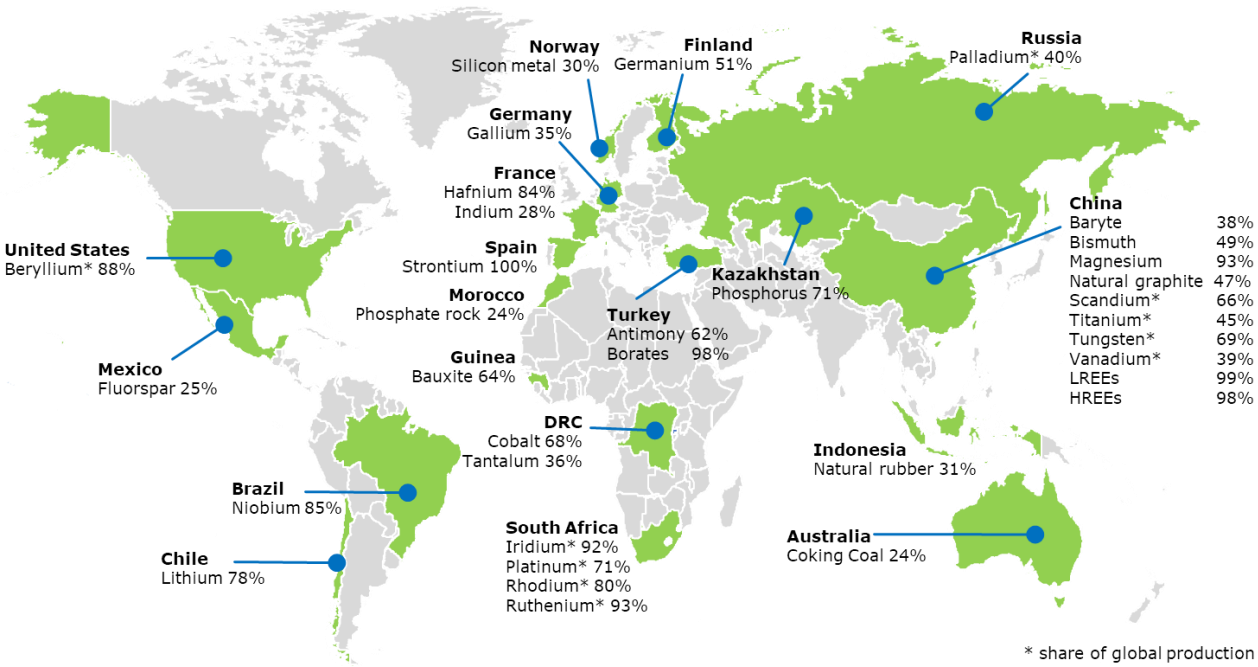
Table D: Major EU sourcing countries of CRMs – grouped materials (average)

Material	Stage	Main global supplier	Share
HREEs	P	China	98%
LREEs	P	China	99%
PGMs	P	n/a	n/a

Figure E is the world map of the main countries from which the EU is sourcing critical raw materials (EU sourcing).

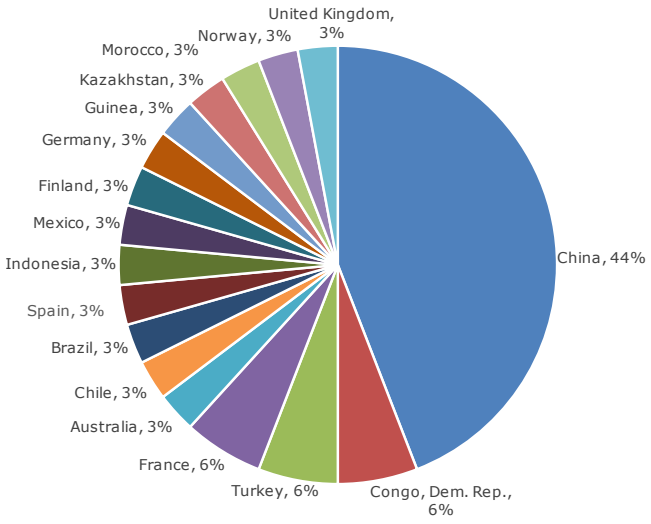
[10] Stage refers to the life-cycle stage of the material that the criticality assessment was carried out on: extraction (E) or processing (P).

Figure E: Countries accounting for largest share of EU sourcing of CRMs



Despite China being the largest global supplier for the majority of the critical raw materials, the EU sourcing (i.e. domestic production plus imports) paints sometimes a different picture (Figure E). The picture of EU sourcing lacks specific data for the five PGMs, titanium and beryllium. Although China is certainly a major EU supplier (44% of materials, in number, as shown in Figure F), several other countries represent main shares of the EU supply for specific critical raw materials, such as Brazil (niobium), Chile (lithium) and Mexico (fluorspar).

Figure F: Main EU suppliers of CRMs[11] (based on number of CRMs supplied, average 2012-2016)



All raw materials, even if not considered critical, are important for the EU economy. The fact that a given material is classed as non-critical does not imply that availability and importance to the EU economy can be neglected. Moreover, the availability of new data and possible evolutions in EU and international markets may affect the list in the future.

[11] The figure should not be interpreted in terms of tonnage of CRM that originate from the countries, but in terms of the number of CRMs, for which the country is the main supplier for the EU.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

1.1. CONTENT AND PURPOSE OF THIS REPORT

This joint GROW and JRC report 'Study on the review of the list of Critical Raw Materials' serves as the background document in support of the 2020 list of CRMs for the EU.

The present report is the result of intense cooperation with the Ad hoc Working Group on Defining Critical Raw Materials (AHWG[12]), consultants and key industry and scientific experts identified through the H2020 SCRREEN[13] project.

This report includes information on the criticality assessments carried out on the materials covered for this 2020 exercise. Further information is presented in the materials factsheets[14], for both critical and non-critical materials. These factsheets are provided as separate documents and are available in the EC's Raw Materials Information System (RMIS)[15].

The present report is divided into the following chapters and annexes:

- Chapter 1 – Introduction to the report: objectives and context of critical raw materials in Europe;
- Chapter 2 – Criticality assessment approach: scope of the criticality assessments, application of the EC criticality methodology, data sources used and stakeholder consultation;
- Chapter 3 – Criticality assessment outcome: results and key findings, comparison with previous assessments and limitations of the assessment results, conclusions and recommendations; and
- Annexes – Additional supporting information on the methodology, international developments, quantitative assessment and related data, stakeholder consultations

1.2. OBJECTIVES OF THIS REPORT

This report presents the results of the assessment of the criticality of 83 raw materials for the EU based on the revised methodology developed by the European Commission (DG GROW and DG JRC)[16]. The report builds upon the work carried out in the previous assessments (2011[17], 2014[18] and 2017[19]). The report takes into account feedback gathered from the previous and 2020 exercises, and in doing so, establishes the basis for the updated list of critical raw materials for the EU.

---

[12] The AHWG on Defining Critical Raw Materials is a sub-group of the Raw Materials Supply Group expert group. The list of its members and observers is available here: http://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupDetail&groupID=1353

[13] http://scrreen.eu/the-project/

[14] The factsheets for critical and non-critical materials are provided as separate documents and are available through the RMIS. A total of 68 factsheets, corresponding to the 83 candidates (including both individual materials and groups) are included. The breakdown of the 68 factsheets are as follows:
- 64 individual material factsheets
- 1 individual factsheet for Aluminium (metal and bauxite)
- 1 individual factsheet for Phosphorus (phosphorus and phosphate rock)
- 1 grouped factsheet for the REEs (with sections dedicated to single elements)
- 1 grouped factsheet for the PGMs

[15] https://rmis.jrc.ec.europa.eu/

[16] Methodology for establishing the EU List of Critical Raw Materials, 2017, ISBN 978-92-79-68051-9

[17] 2011 assessment refers to the study on Critical Raw Materials for the EU published in 2010 and the Commission's Communication COM(2011)25 adopted in 2011.

[18] 2014 assessment refers to the study on Critical Raw Materials at EU level published in 2013 and the Commission's Communication COM(2014)297 adopted in 2014.

[19] 2017 assessment refers to the study on Critical Raw Materials at EU level published in 2016 and the Commission's Communication COM(2017)0490 final adopted in 2017.

The operational objectives of this study were to:

- Assess the criticality of a selection of raw materials based on the EC criticality methodology.
- Analyse the production, key trends, trade flows and barriers of the raw materials with the aim to identify potential bottlenecks[20] and supply risks throughout the value chain. To the extent possible, data and projections are based on the reference period of the last 5 years in terms of data availability.
- Produce qualitative factsheets for all the raw materials assessed.
- Produce full datasets, calculation sheets and comprehensive list of data sources in an excel-compatible format.
- Continue to improve the quality and availability of data.
- Cooperate with both EU and non-EU experts (where relevant) to improve the findings of the study.
- Collaborate with the expert group 'Ad hoc Working Group on Defining Critical Raw Materials'[21] and with the SCRREEN[22] expert group.

In particular, the 2020 assessment incorporates the following aspects:

- Analysis of a wider range of raw materials (5 new candidates);
- Introduces a systematic two-stage supply chain assessment of the supply risk (mining/extracting and processing/refining stages);
- Updated factsheets for each of the materials assessed to include information on the supply chain, the criticality assessment and future trends;
- Optimise data quality and transparency, in respect to the hierarchy of data sources identified in the EC methodology, both in the assessments and factsheets; and
- Better coordination with parallel efforts to develop further Material System Analyses[23], as the priority data source for e.g. recycling data (EOL-RIR).

1.3. THE PURPOSE OF THE LIST OF CRITICAL RAW MATERIALS FOR THE EU

The assessment and the list of critical raw materials are intended to flag the supply risks of important materials for the EU economy. They contribute to securing the competitiveness of the EU industrial value chains starting with raw materials in line with the EU industrial policy. This should increase the overall competitiveness of the EU economy, in line with the Commission´s priorities. It should also help incentivise the European production of critical raw materials and facilitate the launching of new mining and recycling activities. The list is also being used to help prioritise needs and actions. For example, it serves as a supporting element when negotiating trade agreements, challenging trade distortion measures or promoting research and innovation actions.

It is also worth emphasising that all raw materials, even if not classed as critical, are important for the European economy and that a given raw material and its availability to the European economy should therefore not be neglected just because it is not classed as critical.

[20] A bottleneck is considered to be the point in the value chain for a specific material where the supply risk is highest, i.e. the stage (either extraction/harvesting or processing/refining), that has the highest numerical criticality score for the Supply Risk.

[21] The consultants have provided scientific and technical support to the Commission throughout the course of the study, incorporated relevant comments and feedback, provided updates on the advancement of the work, and presented the findings of the assessment in the final report of the study on "Critical Raw Materials for the EU" and the publication of the new list of Critical Raw Materials.

[22] http://scrreen.eu/the-project/

[23] As part of a broader project, JRC and GROW are current delevoping or updating the MSA of 14 raw materials

1.4. THE IMPORTANCE OF RAW MATERIALS IN EUROPE

In the last decade the growing challenge of securing access to metals and minerals needed for economic production has received increased attention from the public, economic actors and from politicians. Raw materials are not only essential for the production of a broad range of goods and services used in everyday life, but also for the development of emerging innovations, which are notably necessary for more eco-efficient technologies and globally competitive products.

The importance of metals and minerals to sustain businesses and the economy is particularly true for the EU, where about 30 million jobs[24] are directly reliant on access to raw materials.

The importance of critical raw materials for the EU:

- ***Industrial value chains*** *- non-energy raw materials are linked to all industries across all supply chain stages.*
- ***Strategic technologies*** *- technological progress and quality of life rely on access to a growing number of raw materials. For example, a smartphone might contain up to 50 different kinds of metals, all of which contribute to its small size, light weight and functionality.*
- ***Climate, energy and environment*** *– raw materials are closely linked to clean technologies essential to reach carbon neutrality targets by 2050. They are irreplaceable in solar panels, wind turbines, electric vehicles, and energy efficient lighting.*[25]

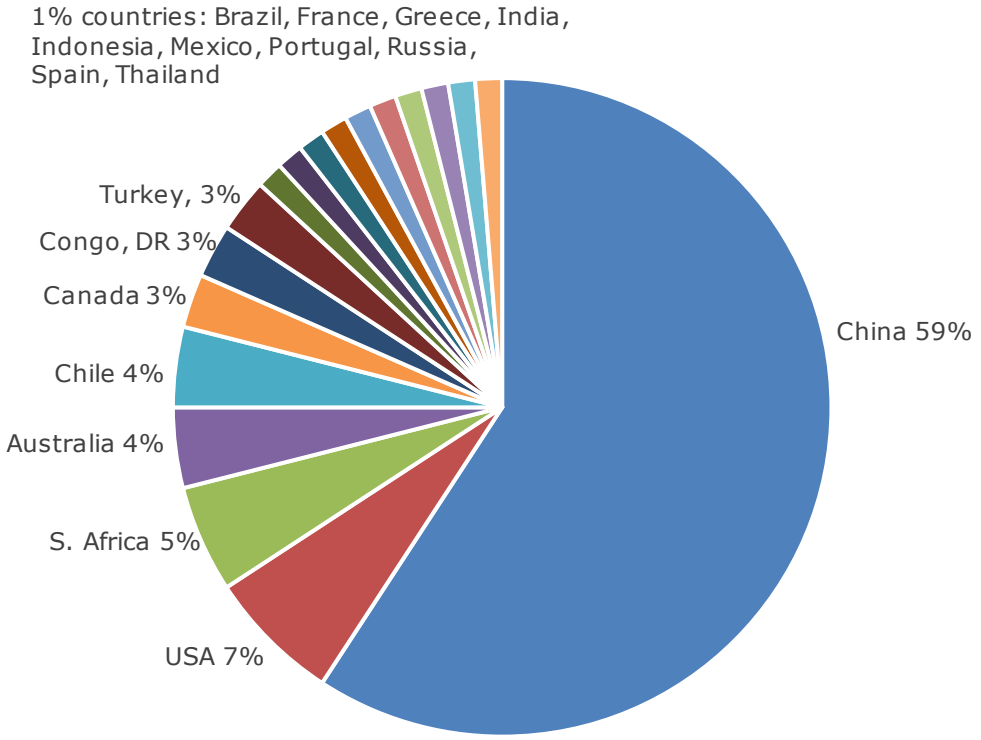
In Europe, the manufacturing industry (i.e. the production of end products and applications) and the refining industry (metallurgy, etc.) are often regarded as more important than the extractive industry (e.g. mining activities). Moreover, the value chain of raw materials is not fully and homogeneously covered by the European industry, with a pronounced imbalance between the upstream steps (extraction / harvesting) and the downstream steps (manufacturing and use). Nevertheless, the need for primary materials, such as ores and concentrates, and also for processed and refined materials is crucial for the wealth - even the survival - of the European industries and their associated jobs and economy.

Actually, very little extraction of non-energy raw materials occurs within European Member States, with e.g. the majority of ore and concentrates or refined materials or metals being sourced from non-European countries.

The following figure represents the main global producers of all candidate critical raw materials (in terms of number of raw materials, not in terms of tonnage). China clearly dominates, with 59% of the raw materials assessed[26] being mainly extracted in China. South Africa and USA are also the principal producer of the raw materials assessed.

[24] https://ec.europa.eu/growth/sectors/raw-materials/specific-interest/critical_pl
[25] https://ec.europa.eu/growth/sectors/raw-materials/specific-interest/critical_pl
[26] Figures are based on the assessment results of individual candidate materials, with the exclusion of sapele wood. Sapele wood was excluded from the analysis of primary global supply because it was not clear from available public EU trade data, which country(s) is the major global supplier. Several producing countries of sapele wood were identified such as Cameroon, Democratic Republic of Congo (Kinshasa), the Republic of Congo (Brazzaville), the Central African Republic, Ivory coast and Gabon, however without a clear indication of the overall shares coming from these producing countries.

Figure 1: Main global suppliers of all candidate critical raw materials assessed, (based on number of raw materials supplied, average from 2012-2016)[27]



Global suppliers of all candidate critical raw materials (% based on number of raw materials supplied)

For many raw materials, the EU is absent from the upstream steps of the value chain, with no extraction of e.g. antimony, beryllium, bismuth, borates, molybdenum, niobium, PGMs, rare earths, tantalum, titanium, vanadium and zirconium. This may be due either to the absence of mineral deposits in the EU, or more often the limited knowledge of the availability of those materials in the EU, or to economic and societal factors that negatively affect exploration (for deposit discovery and characterisation, estimation of resources and reserves) or extraction, (closure of existing mines, reluctance to open new mines, etc.). The biotic materials natural rubber, sapele and natural teak wood come from tropical plants. Their production therefore also lies entirely outside the EU. To access these raw materials, the European Member States have no other choice than to import them, either unprocessed or refined, from other countries to feed their industries and markets.

The only few raw materials for which an EU Member State is the main global producer are hafnium (France), strontium (Spain), natural cork (Portugal) and perlite (Greece). For some raw materials such as e.g. aggregates, feldspar, gypsum, hafnium, indium, kaolin clay, limestone (high purity), magnesite, natural cork, perlite, silica sand, sulphur, the Member States produce enough primary materials to avoid significant extra-European

[27] Figures are based on the assessment results of 78 individual materials, rather than 80 due to the exclusion of sapele wood and limestone. Sapele wood was excluded from the analysis of primary global supply because it was not clear from available public EU trade data, which country(s) is the major global supplier. Several producing countries of sapele wood were identified such as Cameroon, Democratic Republic of Congo (Kinshasa), the Republic of Congo (Brazzaville), the Central African Republic, Ivory Coast and Gabon, however without a clear indication of the overall shares coming from these producing countries. Also Aggregates and Hydrogen are excluded because global production is not available.

imports. However, this situation is fairly uncommon, with the EU being dependent on foreign imports for more than 80% of the raw materials needed for its industry and economy.

1.5. THE CHALLENGE OF CRITICAL RAW MATERIALS IN EUROPE

The dynamic technological changes and the rapid growth of emerging economies have led to an increasing, though sometimes volatile, demand for several metals and minerals. Securing access to a stable supply of such critical raw materials has become a major challenge for national and regional economies with limited indigenous natural resources, such as the EU economy, which is heavily dependent on imported supplies of many minerals and metals needed by industry.

Many of these materials are currently only extracted in a few countries, with China being the leading supplier as well as consumer of several important raw materials e.g. antimony, bismuth, magnesium, REEs, etc. This increases the risk of supply shortages and supply vulnerability along the value chain.

The likelihood of supply disruption is further increased by the fact that processing, smelting and refining of many metals are also concentrated in a small number of countries. On top of high concentration, some producing countries strictly control and limit the export of raw materials, intermediates and/or metals in order to safeguard them for their national industries, by imposing a number of export restriction measures that are often considered as distortive to free markets.

Supply restrictions can bring negative consequences to all the actors of the supply chain, as they have an influence on the supply conditions and price volatility. Mine production of minerals and metals often relies on large scale investment projects, which can take many years to implement, and, therefore, cannot react quickly to short term changes in demand, or are vulnerable to market manipulations by established suppliers trying to hamper emerging mining operations.

These factors together lead to a risk of supply shortages for various metals and minerals in the EU. The resources known to exist in the EU are not used well to provide adequate and timely supplies of these materials to meet domestic demand. The impact of raw materials supply disruption could therefore be loss of competitive economic activity in the EU and in some specific cases reduced availability of certain (strategic) final products.

1.6. ADDRESSING CRITICAL RAW MATERIAL CHALLENGES

The Raw Materials Initiative and the Identification of Critical Raw Materials

To address the growing concern of securing valuable raw materials for the EU economy, the European Commission launched the European Raw Materials Initiative[28] in 2008. It is an integrated strategy that establishes targeted measures to secure and improve access to raw materials for the EU:

- Fair and sustainable supply of raw materials from international markets;
- Fostering sustainable supply within the EU; and
- Boosting resource efficiency and promoting recycling.

For the successful implementation of EU policies in the field of raw materials, there is a need to know the key raw materials for the European economy, understand their stocks and flows and the market and to identify the supply bottlenecks.

One of the priority actions of the European Raw Materials Initiative was to establish a list of critical non-energy raw materials (CRMs) at EU level.

CRMs combine **a high economic importance** to the EU with **a high risk of supply disruptions**. In this context, the European Commission established an Ad Hoc Working

[28] https://ec.europa.eu/growth/sectors/raw-materials/policy-strategy_en

Group on Defining Critical Raw Materials (AHWG) in 2009 as support and advisory group in identifying the non-energy raw materials considered as critical for the EU. The first report of this group, published in 2010, 'Critical raw materials for the EU', among its many valuable conclusions, suggested that the list of critical raw materials should be updated every three years. Accordingly, in its Communication 'Tackling the challenges in commodity markets and on raw materials' (COM(2011)25), the Commission committed to undertake a regular update of the list at least every three years. Regular revisions of the first assessment were carried out and resulted in the 2014 and 2017 list. The 2020 assessment addresses the fourth list of critical raw materials for the EU.

The methodology to identify CRMs

The identification of critical raw materials for the EU is based on the methodology developed and updated by the European Commission, in cooperation with the Ad hoc Working Group on Defining Critical Raw Materials (AHWG). Based on the methodology used in the assessments carried out in 2011 and 2014, the EC's Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (DG GROW) established an internal Administrative Arrangement with the EC's DG Joint Research Centre (DG JRC) in 2015 to undertake a study on improving the assessment methodology used to define critical raw materials for the EU. This study resulted in a refined methodology for assessing the criticality of raw materials, which was applied in the 2017 and this 2020 assessment. The revised EC methodology introduced some targeted methodological improvements while keeping maximum possible comparability of the results with the previous assessments. The two main high-level components of criticality were retained:

- **Economic Importance (EI)** - calculated based on the importance of a given material in the EU for end-use applications and on the performance of its substitutes in these applications.
- **Supply Risk (SR)** - calculated based on factors that measure the risk of disruptions in supply of a given material (e.g. supply concentration, import reliance, governance performance measured by the World Governance Indicators, trade restrictions and agreements, existence and criticality of substitutes)

2. CRITICALITY ASSESSMENT APPROACH

2.1 SCOPE & MATERIALS COVERED

The scope of this criticality assessment includes assessment of the 83 individual materials listed in Table 1. To facilitate coherence, all materials from previous assessments are included (with the exception of osmium[29]). This allows for the identification of any key materials that may move from the non-critical to critical status or vice versa.

Table 1: List of materials/groupings covered in the 2020 assessment

Legend:	
Green boxes =	Materials covered in 2014 but not in the 2011 assessments
Orange boxes =	Materials covered in 2017 but not in the 2014 assessments
Light blue boxes =	New materials covered in the 2020 assessment

Individual materials		
Aggregates	Germanium	Phosphate rock
Aluminium	Hafnium	Rhenium
Antimony	Helium	Scandium
Arsenic	Hydrogen	Selenium
Baryte	Indium	Sulphur
Bauxite	Iron Ore	Potash
Bentonite	Lead	Silica Sand
Beryllium	Limestone	Silicon Metal
Bismuth	Gold	Silver
Boron (Borates)	Gypsum	Strontium
Cadmium	Lithium	Talc
Chromium	Magnesite	Tantalum
Kaolin clay	Magnesium	Tellurium
Cobalt	Manganese	Tin
Coking coal	Molybdenum	Titanium
Copper	Natural Graphite	Tungsten
Diatomite	Nickel	Vanadium
Feldspar	Niobium	Zinc
Fluorspar	Perlite	Zirconium
Gallium	Phosphorus	
Platinum group metals (PGMs)		
Iridium	Platinum	Ruthenium
Palladium	Rhodium	
Rare earth elements (REEs)		
LREEs	HREEs	
Cerium	Dysprosium	Lutetium
Lanthanum	Erbium	Terbium
Neodymium	Europium	Thulium
Praseodymium	Gadolinium	Ytterbium
Samarium	Holmium	Yttrium
Biotic materials		
Natural Rubber	Natural cork	
Sapele wood	Natural Teak wood	

[29] Osmium was nominally assessed in 2011 and 2014 as part of the PGM group; however it cannot be assessed in its own right because of the lack of data specific to osmium. It was, therefore, excluded from the 2017 and 2020 exercises. Complementary information on osmium is provided in the PGMs factsheet.

In addition to covering the same materials as previous assessments, the candidate materials assessed in the 2020 exercise also include five new materials[30] with the aim of widening the scope of the materials covered.

2.1.1 Bottleneck screening vs Double stage (changes 2017→ 2020)

The bottleneck screening in the 2017 exercise generated some discussion with stakeholders on which was the true bottleneck. In some cases (e.g. cobalt) some experts indicated the processing stage as the one with higher supplier concentration, whereas the numerical assessment pointed to the extraction stage as the one with the higher risk. For the 2020 exercise it was decided to systematically include a double-stage supply risk assessment for those materials where two clear stages could be identified and where an initial analysis revealed the likely existence of the necessary data; see Table 2. The bottleneck could then be more readily identified.

Table 2: List of materials covered by a double-stage supply risk assessment

2020 Raw materials assessed with double stage			
Antimony	Erbium	Lithium	Tin
Beryllium	Europium	Manganese	Titanium
Borate	Fluorspar	Molybdenum	Tungsten
Cerium	Gadolinium	Neodymium	Vanadium
Chromium	Ho, Tm, Lu, Yb	Nickel	Yttrium
Cobalt	Hydrogen	Praseodymium	Zinc
Coking Coal	Iron ore	Samarium	
Copper	Lanthanum	Silver	
Dysprosium	Lead	Terbium	

In accordance to the EC methodology, the stage with higher Supply Risk (SR) score has been used. For the remaining candidate materials, the assessment of the calculation risk was performed with the same approach and in the same stage in the supply chain as in 2017.

Annex 2 provides further information on the stage assessed and the rationale.

2.1.2 Time coverage

The reference period for data used in the assessments is the 5-year average for 2012-2016, where possible. Exceptions to this are clearly stated and justified in the individual factsheets.

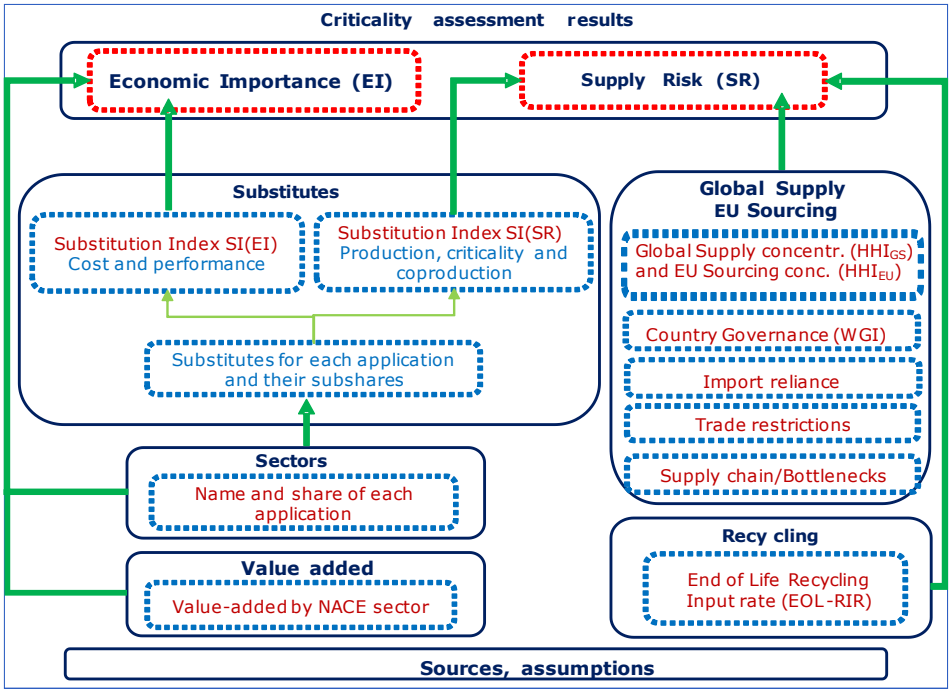
[30] Arsenic, Cadmium, Hydrogen, Strontium, Zirconium

2.2 THE EC CRITICALITY METHODOLOGY

An overview of the EC's criticality methodology[31] is reported in Figure 2.

Two main parameters form the basis of the updated methodology: Economic Importance (EI) and Supply Risk (SR).

Figure 2: Overall structure of the criticality methodology[32]



The 2020 assessment applies consistently the EC criticality methodology, while ensuring comparability with the previous methodology used in 2011, 2014 and 2017.

There are several updates compared to the 2017 implementation of the revised methodology[33]:

- Identification of the bottlenecks for these two stages: systematic calculation of the supply risk for 36 candidate CRMs for both mining/extracting and processing/refining stages;
- More consistent application of the data source hierarchy in all calculations;
- Substantial improvement of End-of-Life Recycling Input Rate (EOL-RIR) results using higher quality EU based data (14 new Material System Analyses - MSA);

2.3 DATA COLLECTION AND SOURCES

The availability and quality of the data required to complete the criticality assessment are essential to ensure the robustness and comparability of the results and to maximise the quality of the outputs of the study. A detailed list of the sources used in the criticality assessments are provided in each of the material factsheets.

[31] Methodology for establishing the EU List of Critical Raw Materials, 2017, ISBN 978-92-79-68051-9
[32] Study on the review of the list of critical raw materials, 2017, ISBN 978-92-79-47937-3
[33] Further details in Methodology for establishing the EU List of Critical Raw Materials, 2017, ISBN 978-92-79-68051-9.

The revised criticality methodology includes a data hierarchy that prioritises, first, official EU and Member States data over those from trade/industry associations and other special interest groups. Where possible, it also prioritises the use of data for Europe over datasets that relate to the whole world e.g. global data. In other words, European data shall receive priority over non-EU data. Data from organisations such as the United States Geological Survey (USGS) are used in the cases where no other comparable sources exist or where the alternatives are not of acceptable quality. Data from private sources (industry, trade associations, private data providers etc.) may also be considered in the absence of other data, under the condition that such data can be shared and published.

Regarding the overall availability and quality of the data sources, in general, there is good public data availability for global supply (e.g. from the World Mining Database and British Geological Survey). However, there are some materials that are more difficult to deal with because of material inconsistencies between world production and EU sourcing data. In addition, there is a general difficulty obtaining public data on the shares of applications of materials, as well as their substitutes. Stakeholders were therefore consulted to validate or provide additional inputs regarding the data used for the assessments.

Table 3 presents the scoring matrix used based on the recommendations of the Commission to assess the quality of EU data on EU Supply Risk. The scoring matrix defines three main criteria using a scoring scale of 1 to 3 (from lowest to highest in terms of data quality). The overall score of the data quality used for the calculation of Supply Risk was characterised as: limited, satisfactory or very strong coverage based on the individual scores of the three main criteria. Sources used in the factsheets are provided at the end of each material or group factsheet. Additional details on the quality of the data sources are provided in the individual material factsheets and in the EC's Background Report on the Assessment of the Methodology on the list of Critical Raw Materials[34].

Table 3: Scoring matrix to evaluate quality of EU supply data

Criteria	Limited coverage	Satisfactory coverage	Very strong coverage
	1	2	3
Geographic coverage	Data is not available at EU level	Data is partly available at EU level	Data is available at EU level
Time coverage	Data available only for a few years	Data with no meaningful time series due to poor regularity of updates	Data available for time series and updated at regular intervals
Source type	Private/corporate data	Public source of data (except from several justified sources)	Public source

2.4 STAKEHOLDER CONSULTATION

In addition to the use of data sources described in the previous section, the involvement of stakeholders was of utmost importance in order to maximise the quality of the outputs of the study and to ensure transparency. By involving all relevant industry stakeholders and members of the AHWG, the assessment results reflect the body of knowledge available throughout the EU on the topic of raw materials.

[34] JRC technical report (2017): Assessment of the methodology for establishing the EU list of Critical Raw Materials: «Background Report», ISBN 978-92-79-69612-1, available at the JRC Science Hub: https://ec.europa.eu/jrc

The aim of the stakeholder consultation was to ensure that industrial and scientific stakeholders are given the opportunity to provide their expert feedback on specific materials and eventually improve the results. Consultation with stakeholders ensures that the outcomes of this study, especially the conclusions, are optimally validated and subsequently disseminated and applied, where relevant.

In addition to bilateral exchanges during the data collection for the criticality assessment, a key aspect of the overall stakeholder consultation approach includes the stakeholder data collection and validation workshops co-organised with the Horizon 2020 project SCRREEN. These workshops were aimed to collect and review the data used for the purpose of criticality calculations and information used in the factsheets. The stakeholder workshops also provided the opportunity to present the data sources used and contributions delivered by stakeholders as well as to discuss any recommendations to improve results.

The stakeholder data collection and validation workshops took place on 10, 11 and 12 September 2019. The aim of these stakeholder workshops was to discuss in detail the criticality calculations for each of the materials covered and to review and validate the data used in criticality assessments. Experts were also asked to contribute to relevant sections of the factsheets.

Several follow-up actions were carried out after the workshops, which included a summary of key stakeholder feedback received from the validation workshops and follow-up with individual stakeholders who indicated willingness and capability to contribute relevant data and input for the criticality assessments. Based on this feedback, some of the criticality assessments were improved while others were consolidated with more accurate data. A summary report of the stakeholder validation workshops is provided in Annex 8 and includes details of the preparation and organisation of the workshops as well as the list of participants.

3. CRITICALITY ASSESSMENT OUTCOME

3.1 CRITICALITY ASSESSMENT RESULTS

Table 4 summarises the criticality assessment results for the 83 individual candidate materials covered by the assessment.

Table 4 provides the scaled results of the Supply Risk (SR), Economic Importance (EI), Import Reliance (IR) and End-of-life Recycling Input Rate (EOL-RIR) for each of the candidate materials as well as the life cycle stage assessed. Results are rounded to one decimal point to enhance clarity. The table also indicates the supply data that was used (e.g. global supply and / or EU sourcing) in the calculations for Supply Risk. Annexes provide additional details of the assessment results, including substitution indexes and all other parameters.

Regarding the materials with negative import reliance, i.e. in case of net export, or IR=0, it should be noted that the SR is calculated based on EU sourcing only (except cases with inadequate quality data). Further details on negative import reliance results are provided (see section 3.4.2).

Table 4: Criticality assessment results (individual[35] materials, grouped materials)

Legend:

PGMs	Iridium, palladium, platinum, rhodium, ruthenium
LREEs	Cerium, lanthanum, neodymium, praseodymium and samarium
HREEs	Dysprosium, erbium, europium, gadolinium, holmium, lutetium, terbium, thulium, ytterbium, yttrium
EOL-RIR	End-of-life Recycling Input Rate
Supply data used	Indicates whether the Supply Risk calculation uses EU sourcing (EU only), global supply only (GS) or both (GS + EU)[36]

Material	Stage	Supply Risk	EI	IR (%)	EoL-RIR (%)	SI_{SR}	SI_{EI}	Supply used in SR calc.
Aggregates	Extraction	0.2	2.7	1	8	0.93	0.97	EUS only
Aluminium	Processing	0.6	5.4	59	12	0.80	0.88	GS + EUS
Antimony	Extraction	2.0	4.8	100	28	0.92	0.94	GS + EUS
Arsenic	Processing	1.2	2.6	32	0	0.85	0.94	GS + EUS
Baryte	Extraction	1.3	3.3	70	1	0.95	0.96	GS + EUS
Bauxite	Extraction	2.1	2.9	87	0	0.99	1.00	GS + EUS
Bentonite	Extraction	0.5	2.8	15	19	0.99	0.99	GS + EUS
Beryllium	Extraction	2.3	4.2	0	0	0.99	0.99	GS only
Bismuth	Processing	2.2	4.0	50	0	0.96	0.94	GS + EUS
Borate	Extraction	3.2	3.5	100	1	1.00	1.00	GS + EUS
Cadmium	Processing	0.3	4.2	0	30	0.92	0.91	EUS only
Cerium	Processing	6.2	3.5	100	1	0.95	0.99	EUS only
Chromium	Processing	0.9	7.3	66	21	1.00	1.00	GS + EUS
Cobalt	Extraction	2.5	5.9	86	22	0.92	0.92	GS + EUS
Coking coal	Extraction	1.2	3.0	62	0	0.99	0.99	GS + EUS
Copper	Extraction	0.3	5.3	44	17	0.93	0.93	GS + EUS

[35] 80 rows, because *Ho, Tm, Lu, Yb are grouped*

[36] By default, both EU and global sources are used in the calculation. In case only either EU or global supply was used, data availability prevented to use both sourcing types.

Material	Stage	Supply Risk	EI	IR (%)	EoL-RIR (%)	SI_{SR}	SI_{EI}	Supply used in SR calc.
Diatomite	Extraction	0.5	2.2	0	4	0.96	0.96	GS + EUS
Dysprosium	Processing	6.2	7.2	100	0	0.95	1.00	EUS only
Erbium	Processing	6.1	3.1	100	1	0.96	0.99	EUS only
Europium	Processing	3.7	3.3	100	38	0.79	0.95	EUS only
Feldspar	Extraction	0.8	2.8	34	8	0.99	0.99	GS + EUS
Fluorspar	Extraction	1.2	3.3	66	1	0.89	0.88	GS + EUS
Gadolinium	Processing	6.1	4.6	100	1	0.92	0.99	EUS only
Gallium	Processing	1.3	3.5	31	0	0.98	0.98	GS + EUS
Germanium	Processing	3.9	3.5	31	2	0.95	0.95	GS only
Gold	Extraction	0.2	2.1	n/a	29	0.98	0.99	GS only
Gypsum	Extraction	0.5	2.6	0	1	0.88	0.96	EUS only
Hafnium	Processing	1.1	3.9	0	0	0.91	0.96	GS only
Helium	Processing	1.2	2.6	89	1	0.94	0.96	GS + EUS
Ho, Tm, Lu, Yb	Processing	6.1	3.4	100	1	1.00	1.00	EUS only
Hydrogen	Extraction	0.4	3.8	0	0	1.00	1.00	GS + EUS
Indium	Processing	1.8	3.3	0	0	0.97	0.98	GS only
Iridium	Processing	3.2	4.2	100	14	0.91	0.95	GS only
Iron ore	Extraction	0.5	6.8	72	31	0.93	0.95	GS + EUS
Kaolin clay	Extraction	0.4	2.4	20	1	0.96	0.97	GS + EUS
Lanthanum	Processing	6.0	1.5	100	1	0.89	0.97	EUS only
Lead	Extraction	0.1	4.0	15	75	0.96	0.96	GS + EUS
Limestone	Extraction	0.2	3.5	5	19	0.90	0.98	GS + EUS
Lithium	Processing	1.6	3.1	100	0	0.93	0.93	GS + EUS
Magnesite	Extraction	0.6	3.2	0	2	0.98	0.99	GS + EUS
Magnesium	Processing	3.9	6.6	100	13	0.93	0.94	GS + EUS
Manganese	Extraction	0.9	6.7	90	8	1.00	1.00	GS + EUS
Molybdenum	Extraction	0.9	6.2	100	30	1.00	1.00	GS + EUS
Natural cork	Extraction	1.0	1.6	0	8	0.91	0.91	GS + EUS
Natural graphite	Extraction	2.3	3.2	98	3	0.99	0.99	GS + EUS
Natural Rubber	Extraction	1.0	7.1	100	1	0.99	0.99	GS + EUS
Natural Teak wood	Extraction	1.9	2.0	100	0	0.90	0.90	GS + EUS
Neodymium	Processing	6.1	4.8	100	1	0.93	0.98	EUS only
Nickel	Extraction	0.5	4.9	28	17	0.83	0.90	GS + EUS
Niobium	Processing	3.9	6.0	100	0	0.97	0.98	GS + EUS
Palladium	Processing	1.3	7.0	93	28	0.92	0.98	GS only
Perlite	Extraction	0.4	2.3	0	42	0.88	0.92	GS only
Phosphate rock	Extraction	1.1	5.6	84	17	1.00	1.00	GS + EUS
Phosphorus	Processing	3.5	5.3	100	0	1.00	1.00	GS + EUS
Platinum	Processing	1.8	5.9	98	25	0.85	0.98	GS only
Potash	Extraction	0.8	5.4	27	0	1.00	1.00	GS + EUS
Praseodymium	Processing	5.5	4.3	100	10	0.93	0.97	EUS only
Rhenium	Processing	0.5	2.0	22	50	0.98	1.00	GS only
Rhodium	Processing	2.1	7.4	100	28	0.99	0.99	GS only
Ruthenium	Processing	3.4	4.1	100	11	0.92	0.96	GS only
Samarium	Processing	6.1	7.3	100	1	0.98	0.98	EUS only
Sapele wood	Extraction	2.3	1.4	100	0	0.94	0.94	EUS only
Scandium	Processing	3.1	4.4	100	0	1.00	0.95	GS only
Selenium	Processing	0.4	4.9	9	1	0.90	0.95	GS + EUS
Silica sand	Extraction	0.4	2.9	0	18	0.97	0.97	GS + EUS
Silicon metal	Processing	1.2	4.2	63	0	0.99	0.99	GS + EUS
Silver	Extraction	0.7	4.1	40	19	0.95	0.97	GS + EUS

Material	Stage	Supply Risk	EI	IR (%)	EoL-RIR (%)	SI_{SR}	SI_{EI}	Supply used in SR calc.
Strontium	Extraction	2.6	3.5	0	0	0.93	0.90	EUS only
Sulphur	Processing	0.3	4.1	0	5	0.99	0.99	EUS only
Talc	Extraction	0.4	4.0	13	16	0.98	0.99	GS + EUS
Tantalum	Extraction	1.4	4.0	99	0	0.95	0.96	GS only
Tellurium	Processing	0.5	3.6	0	1	0.86	0.93	EUS only
Terbium	Processing	5.5	4.1	100	6	0.79	0.95	EUS only
Tin	Extraction	0.9	4.2	0	31	0.90	0.91	GS only
Titanium	Processing	1.3	4.7	100	19	0.92	0.96	GS only
Tungsten	Processing	1.6	8.1	n/a	42	0.95	0.98	GS only
Vanadium	Extraction	1.7	4.4	n/a	2	0.98	0.99	GS only
Yttrium	Processing	4.2	3.5	100	31	0.98	0.99	EUS only
Zinc	Extraction	0.3	5.4	60	31	0.93	0.96	GS + EUS
Zirconium	Extraction	0.8	3.2	100	12	0.96	0.97	GS + EUS

Group averages	Stage	Supply Risk	EI	IR (%)	EOL-RIR (%)	SI_{SR}	SI_{EI}	Supply used in SR calc.
LREEs	Processing	6.0	4.3	100	3	0.94	0.98	EUS only
HREEs	Processing	5.6	3.9	100	8	0.94	0.99	
PGMs	Processing	2.4	5.7	98	21	0.92	0.97	GS only

Figure 3 presents the individual results for the grouped materials. The grey dots in Figure 3 represents the average scores for the platinum group metals (PGMs), the light green dot indicates the average result for the light rare earth metals (LREEs) and the dark green dot presents the heavy rare earth metals (HREEs).

Figure 3: SR and EI for individual materials grouped as PGMs, LREEs and HREEs

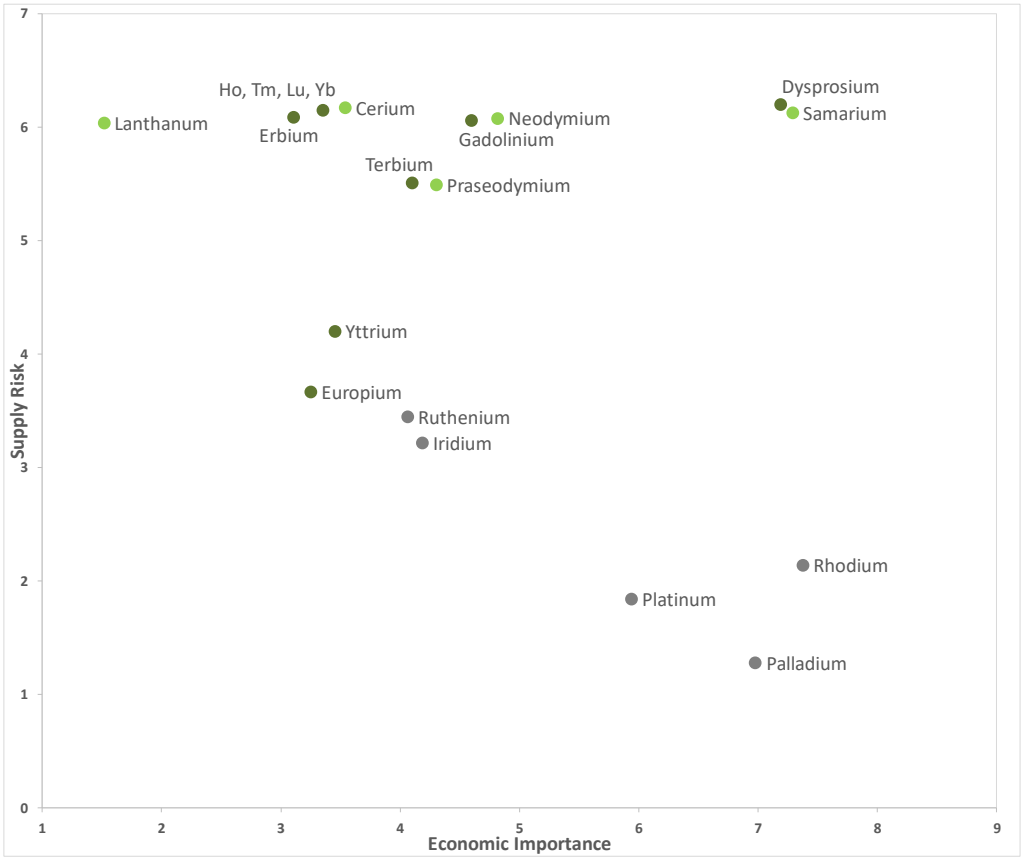


Figure 4 presents the Supply Risk and Economic Importance results for all the individual raw materials. Figure 5 presents the individual results for all non-grouped materials, as well as the average SR and EI scores for the PGMs, LREEs and HREEs groups.

Figure 4: SR and EI results, individual materials and grouped materials

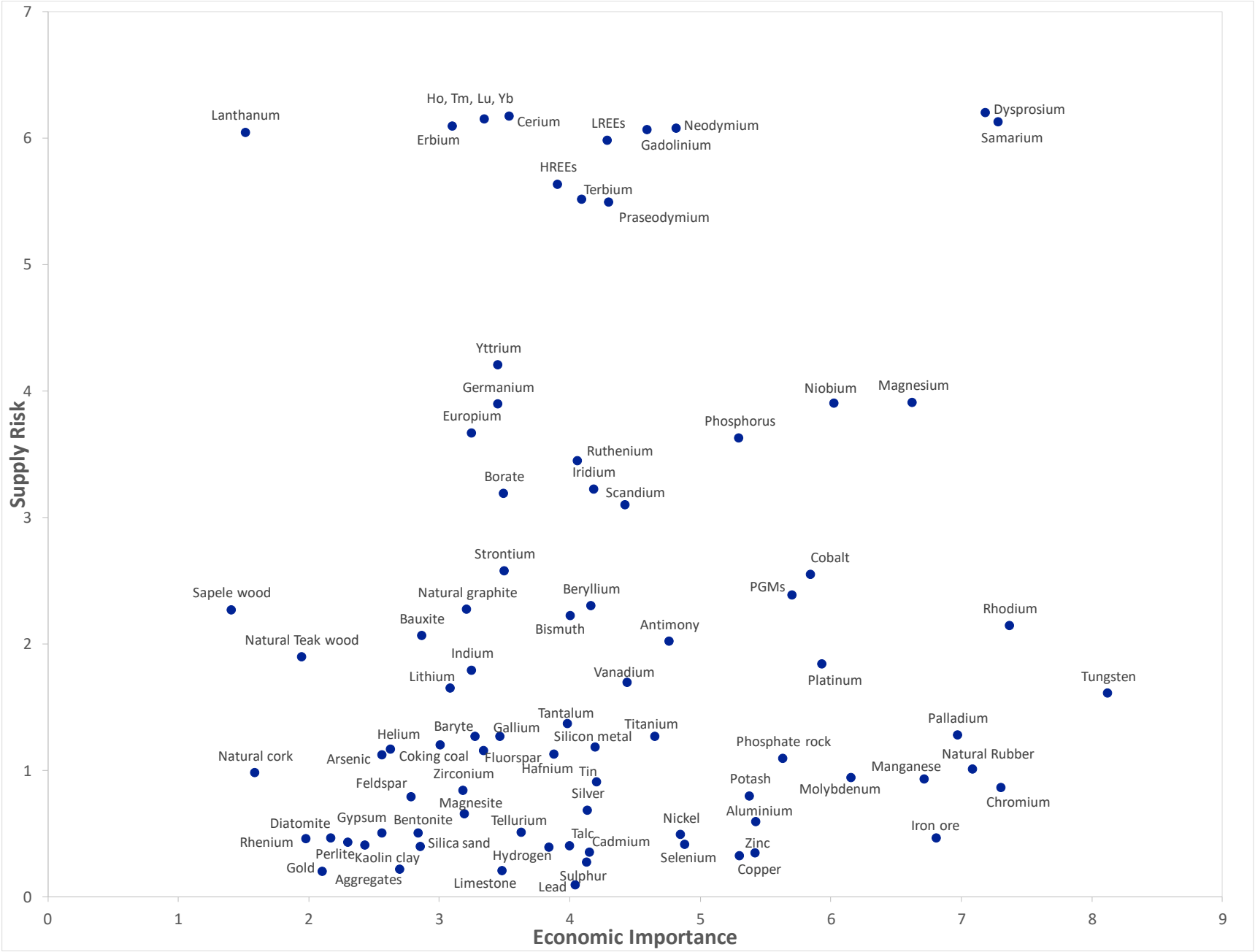
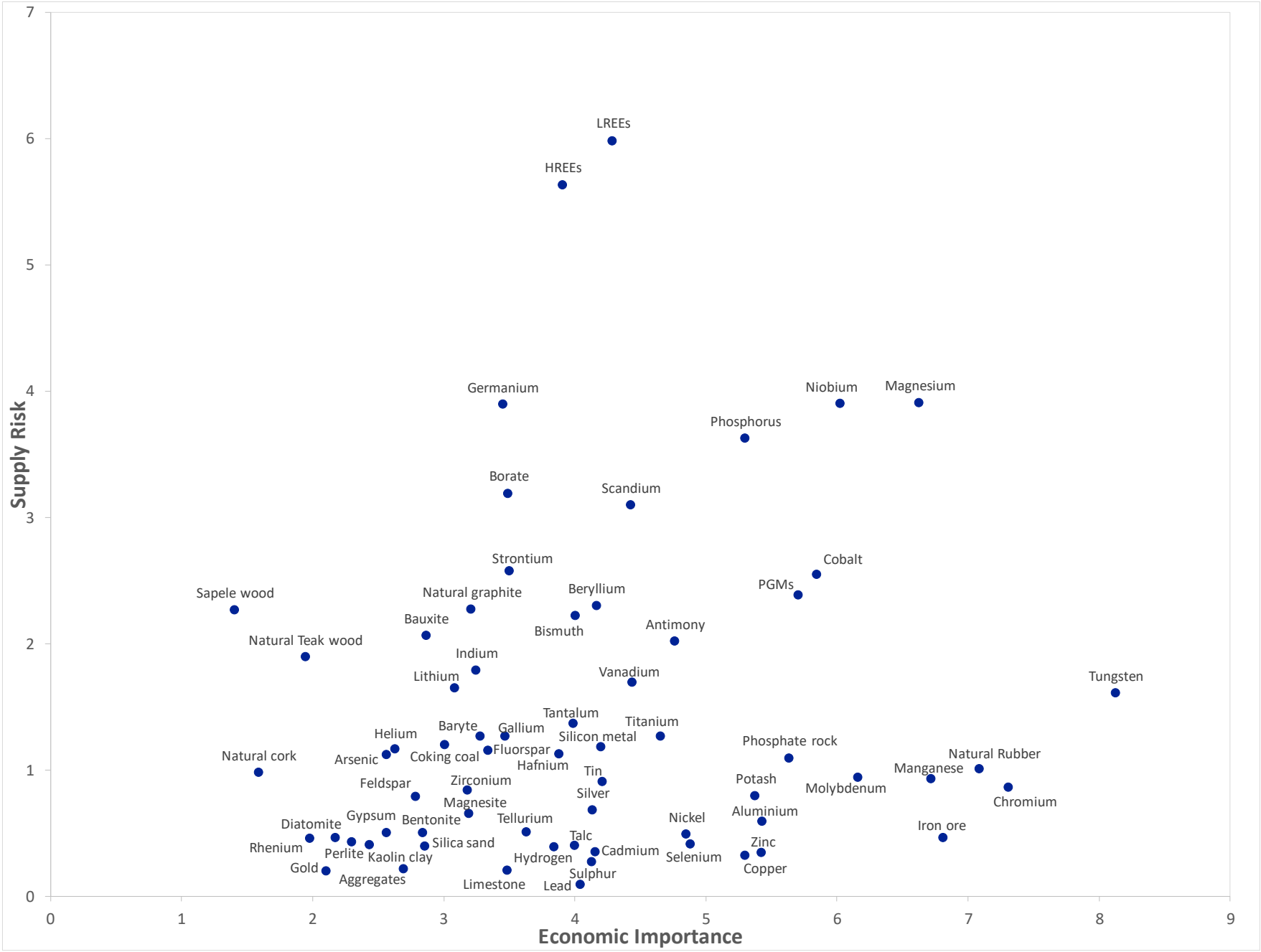


Figure 5: SR and EI results for individual non-grouped and grouped materials (HREEs, LREEs and PGMs)



3.2 2020 LIST OF CRITICAL RAW MATERIALS FOR THE EU (CRMs)

Of the 83 candidate raw materials assessed, the following 30 raw materials or groups of raw materials are identified as critical.

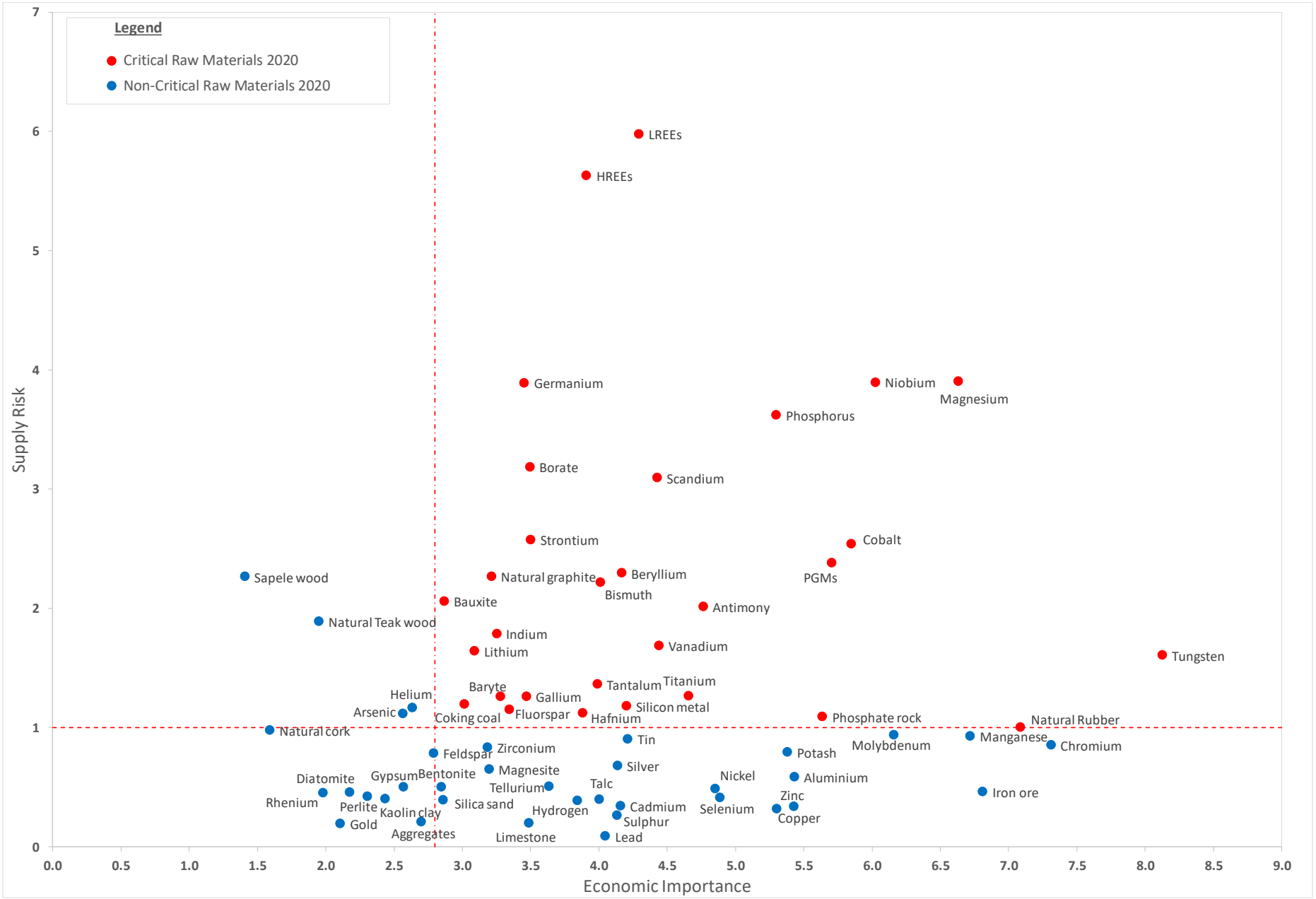
Table 5: 2020 Critical raw materials for the EU

2020 Critical Raw Materials (30)			
Antimony	Fluorspar	Magnesium	Silicon Metal
Baryte	Gallium	Natural Graphite	Tantalum
Bauxite	Germanium	Natural Rubber	Titanium
Beryllium	Hafnium	Niobium	Tungsten
Bismuth	HREEs	PGMs	Vanadium
Borates	Indium	Phosphate rock	Strontium
Cobalt	Lithium	Phosphorus	
Coking Coal	LREEs	Scandium	

The list of critical raw materials (CRM) is established on the basis of the raw materials which reach or exceed the thresholds for both parameters. There is no ranking order of the raw materials in terms of criticality.

Figure 6 presents the overall results of the criticality assessments mapped against the criticality thresholds. Critical raw materials are highlighted by red dots and are located within the criticality zone (SR ≥ 1 and EI ≥ 2.8). Blue dots represent the non-critical raw materials.

Figure 6: Criticality assessment results (individual materials and groups)



3.3 COMPARISON WITH THE RESULTS OF PREVIOUS ASSESSMENTS

A good level of backwards compatibility and consistency with the previous criticality assessments remains a high priority for the EC. Table 6 highlights the key changes of the 2020 list in comparison to 2017. The changes in SR and EI are illustrated in Figure 7.

The 2020 CRMs list includes 26 of the CRMs identified in 2017. Only one CRM from 2017 shifted out of the list: helium. Compared to the 2017 CRM list, 3 additional raw materials are identified as critical and enter the 2020 CRMs list: bauxite, lithium, titanium. One of the 5 new candidates is in the 2020 list: strontium.

Table 6: Key changes to the 2020 list of CRMs compared to the 2017 CRMs list

2020 CRMs vs. 2017 CRMs		
Antimony	LREEs	Tungsten
Baryte	Indium	Vanadium
Beryllium	Magnesium	
Bismuth	Natural Graphite	Bauxite
Borate	Natural Rubber	Lithium
Cobalt	Niobium	Titanium
Coking Coal	PGMs	
Fluorspar	Phosphate rock	Strontium
Gallium	Phosphorus	
Germanium	Scandium	~~Helium~~
Hafnium	Silicon metal	
HREEs	Tantalum	

Legend:

Black: CRMs in 2020 and 2017

Red: CRMs in 2020, non-CRMs in 2017

Green: CRMs assessed in 2020, not assessed in 2017

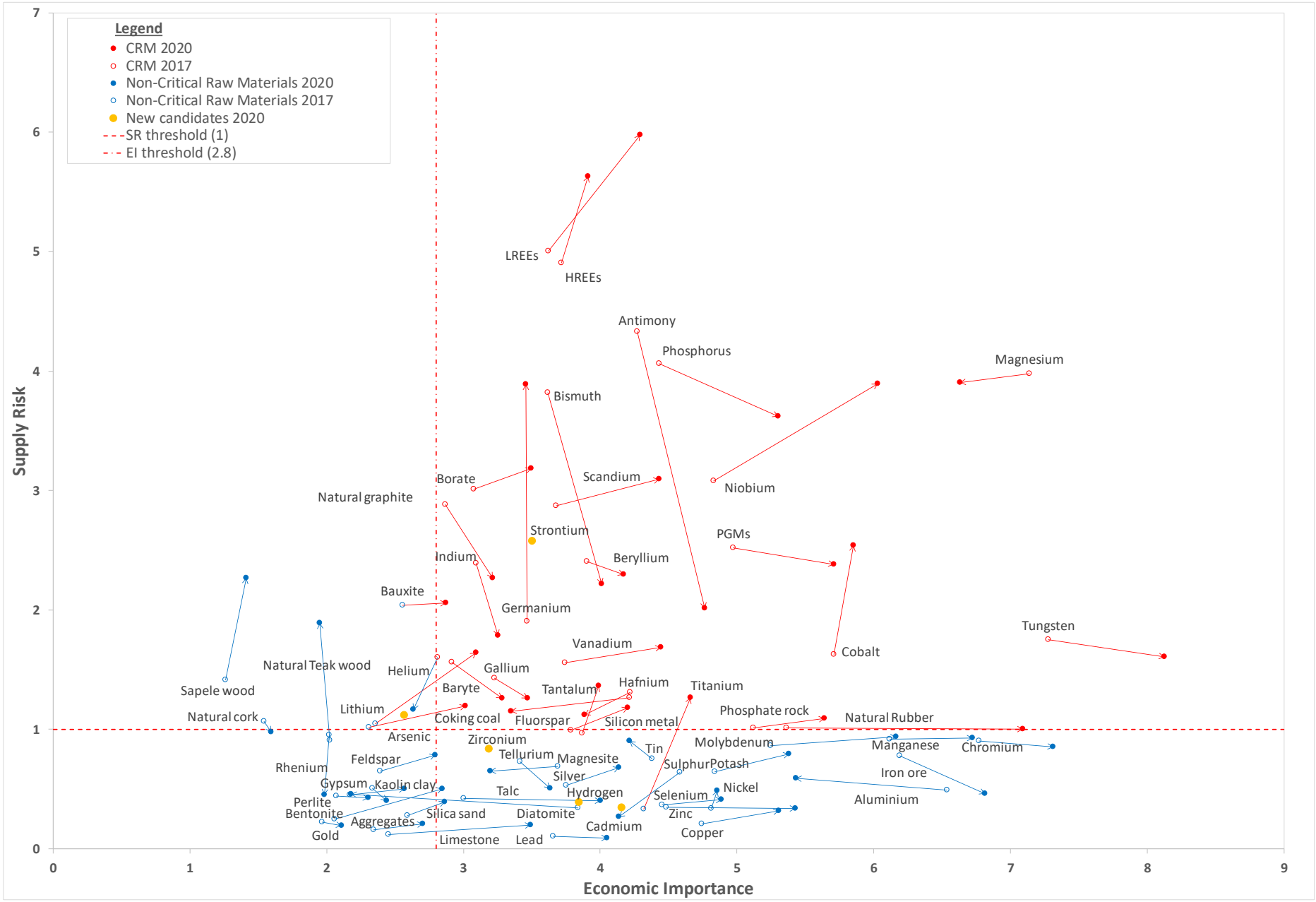
~~Strike out:~~ Non-CRMs in 2020, critical in 2017

The materials that have remained critical in all assessments are listed in Table 7. Other key differences in the assessments across the exercises are further discussed in the following section.

Table 7: Materials identified as critical in 2011, 2014, 2017 and 2020 assessments

Critical raw materials in 2011, 2014, 2017 and 2020		
Antimony	Germanium	Natural graphite
Beryllium	Heavy rare earth elements	Niobium
Cobalt	Indium	PGMs
Fluorspar	Light rare earth elements	Tungsten
Gallium	Magnesium	

Figure 7: 2020 Criticality assessment results compared to the 2017 assessment



3.4 KEY FINDINGS OF THE CRITICALITY ASSESSMENTS

This section highlights the key findings of the criticality assessment results, with emphasis on changes since 2017, newly assessed candidate CRMs and battery raw materials. Additional details are provided in the Annexes and in the individual material factsheets.

3.4.1 Summary of main results

A general decrease of supply risk and general increase of the economic importance have been observed, though with exceptions. Regarding the economic importance increase, this is mainly due to two reasons: i) there were sectors that grew in comparison with the previous assessment and had a higher value-added; ii) the final result is influenced by a scaling step, as the value-added of the largest manufacturing sector is now lower, corresponding to 27 Member States.

For some of the assessed materials, the criticality assessment highlights changes in the criticality in respect to 2017:

Raw material	Changes in SR and EI from 2017 to 2020	Reason for the change
Antimony	SR: 4.3 to 2.0	In the 2020 assessment the refining stage included also antimony oxides. This resulted in a lower supply risk at the refining stage, since global production was less concentrated and there is also production in the EU. Therefore, in 2020 the mine stage presented higher SR, because the EU has no production; hence is 100% reliant on import.
	EI: 4.3 to 4.7	Difference is due to changes in the value-added of NACE Rev. 2 sectors.
Bauxite	SR: 2.0 to 2.1	No significant change
	EI: 2.6 to 2.9	Difference is due to changes in the value-added of NACE Rev. 2 sectors.
Coking coal	SR: 1.0 to 1.2	Different consideration of the available substitutes in 2020. In particular, the use of Pulverized coal for injection (PCI) as a substitute has been removed from the calculation formula, as it is a widely applied technique by the EU steel industry, which has already reached its technical limits. In addition, an error in the calculation formulas of the EU supply risk component resulted in lower supply risk in the previous assessment by a value of 0.1.
	EI: 2.3 to 3.0	Introduction in the 2020 calculation of the NACE 2 sector C20 and a lower share allocated to the C24 sector.
Germanium	SR:1.9 to 3.9	Compared to 2017 in 2020 assessment only global supply of germanium was used in the calculations, since there was a lack of up-to-

		date and reliable data for EU sourcing of other Ge products. The global supply of germanium is highly concentrated in China.
	EI: no change	No change
Helium	SR: 1.6 to 1.2	Both global supply and EU sourcing became less concentrated.
	EI: 2.8 to 2.6	Sectors distribution changed to better represent EU applications.
Titanium	SR: 0.3 to 1.2	The critical stage in 2020 assessment is the metal stage, which was not studied in 2017 (titanium sponge, essential in high-tech applications).
	EI: 4.3 to 4.7	Changes in the value-added of NACE Rev. 2 sectors.
Tungsten	SR: 1.8 to 1.6	In 2020 the refining stage was considered to be the most critical. Supply risk was calculated taking into account the distribution of smelters worldwide.
	EI: 7.3 to 8.1	Changes in the value-added of NACE Rev. 2 sectors.

For the main raw materials used in batteries:

Raw material	**Changes in SR and EI from 2017 to 2020**	**Reason for the change**
Cobalt	SR: 1.6 to 2.5	A different approach was applied in the 2020 assessment in order to reflect more accurately the market in the extraction and processing stages. In particular, the trade of intermediate cobalt products requiring further refining was allocated to the extraction stage, whereas in the 2017 assessment they were considered as part of the processing (refining) stage.
	EI: 5.7 to 5.8	No significant changes are observed for the EI. Even with a change in the sectors distribution which better represents the EU applications.
Lithium	SR: 1.0 to 1.6	In 2020 the stage with the higher SR is the processing stage, which was not evaluated in the 2017 exercise.
	EI: 2.4 to 3.1	Changes in the value-added of NACE Rev. 2 sectors.
Manganese	SR: 0.9 to 0.9	Results are similar to the previous assessment

	EI: 6.1 to 6.7	Results are similar to the previous assessment
Natural graphite	SR:2.9 to 2.3	The difference is due to a lower value of the EU supply risk in 2020. The EU sourcing became less concentrated.
	EI: 2.9 to 3.2	Changes in the value-added of NACE Rev. 2 sectors.

For the 5 new candidates:

Table 8: Criticality assessment results for new materials

Material	Stage assessed	Supply Risk	Economic Importance	Import Reliance (%)	EOL-RIR (%)
Arsenic	P	1.2	2.6	32	0
Cadmium	P	0.3	4.2	0	30
Hydrogen	E	0.4	3.8	0	0
Strontium	E	2.6	3.5	0	0
Zirconium	E	0.8	3.2	100	12

Raw material	Comment
Strontium	It is the only new candidate classified as critical, due to high supply concentration in Spain (only 1 company).
Arsenic	The supply risk is based on the global supply risk of arsenic in the form of diarsenic trioxide. Trade figures in Eurostat-Comext were not available in disaggregated form for diarsenic trioxide, thus the calculation for EU supply risk was not possible.
Cadmium	There is a very high recycling rate for cadmium.
Zirconium	Despite the very high import dependency, global supply and EU sourcing show relatively low concentration.
Hydrogen	There is a low supply risk as it is mostly produced from diversified sources of natural gas and synthetic gases.

3.4.2 Summary of other criticality assessment results

Stages assessed

Table 9 lists the stage with higher SR for each of the critical raw materials The CRMs were assessed at the extraction stage (14) and at the processing stage (16).

Table 9: Stages assessed as critical for the 2020 critical raw materials

Mining/extraction (14)	Processing/refining (16)
Antimony	Bismuth
Baryte	Gallium
Bauxite	Germanium
Beryllium	Hafnium
Borate	HREEs
Cobalt	Indium
Coking Coal	Lithium
Fluorspar	LREEs
Natural Graphite	Magnesium
Natural Rubber	Niobium
Phosphate Rock	PGMs
Tantalum	Phosphorus
Strontium	Scandium
Vanadium	Silicon Metal
	Titanium
	Tungsten

Analysis of individual materials, Global suppliers and EU sourcing

Table 10 presents the results for the 2020 CRMs as individual materials, i.e. not including the groups HREEs (10 materials), LREEs (5 materials) and PGMs (5 materials).

Table 11 presents the averaged figures on global primary supply for the 3 material groups: HREEs, LREEs, and PGMs. It should be noted, however, that in Table 11 it is not possible to calculate the average for the largest global supplier of all the PGMs because the major producing country is not the same for the five PGMs. For iridium, platinum, rhodium and ruthenium, the major global supplier is South Africa, whereas for palladium the major global supplier is Russia.

Table 10: Global supply of the CRMs, individual materials

Material		Stage [37]	Main global supplier	Share	Material		Stage	Main global supplier	Share
1	Antimony	E	China	74%	23	Magnesium	P	China	89%
2	Baryte	E	China	38%	24	Natural graphite	E	China	69%
3	Bauxite	E	Australia	28%	25	Natural rubber	E	Thailand	33%
4	Beryllium	E	USA	88%	26	Neodymium	E	China	86%
5	Bismuth	P	China	80%	27	Niobium	P	Brazil	92%
6	Borate	E	Turkey	42%	28	Palladium	P	Russia	40%
7	Cerium	E	China	86%	29	Phosphate rock	E	China	48%
8	Cobalt	E	Congo,DR	59%	30	Phosphorus	P	China	74%

[37] Stage refers to the life-cycle stage of the material that the criticality assessment was carried out on: extraction (E) or processing (P).

Material		Stage [37]	Main global supplier	Share	Material		Stage	Main global supplier	Share
9	Coking coal	E	China	55%	31	Platinum	P	S. Africa	71%
10	Dysprosium	E	China	86%	32	Praseodymium	E	China	86%
11	Erbium	E	China	86%	33	Rhodium	P	S. Africa	80%
12	Europium	E	China	86%	34	Ruthenium	P	S. Africa	93%
13	Fluorspar	E	China	65%	35	Samarium	E	China	86%
14	Gadolinium	E	China	86%	36	Scandium	P	China	66%
15	Gallium	P	China	80%	37	Silicon metal	P	China	66%
16	Germanium	P	China	80%	38	Tantalum	E	Congo,DR	33%
17	Hafnium	P	France	49%	39	Terbium	E	China	86%
18	Ho,Tm,Lu,Yb	E	China	86%	40	Titanium	P	China	45%
19	Indium	P	China	48%	41	Tungsten	P	China	69%
20	Iridium	P	S. Africa	92%	42	Vanadium	E	China	39%
21	Lanthanum	E	China	86%	43	Yttrium	E	China	86%
22	Lithium	P	Chile	44%	44	Strontium	E	Spain	31%

Legend	
Stage	E = Extraction stage P = Processing stage
HREEs	Dysprosium, erbium, europium, gadolinium, holmium, lutetium, terbium, thulium, ytterbium, yttrium
LREEs	Cerium, lanthanum, neodymium, praseodymium and samarium
PGMs	Iridium, palladium, platinum, rhodium, ruthenium

*Global supply calculation based on production capacity.

Table 11: Global supply of grouped CRMs, arithmetic average

Global supply or production capacity of the CRMs – grouped materials (average)			
Material	Stage	Main global supplier	Share
HREEs	E	China	86%
LREEs	E	China	86%
PGMs[38] (iridium, platinum, rhodium, ruthenium)	P	South Africa	75%
PGMs (palladium)	P	Russian Federation	40%

The analysis of the global supply results indicates that China is the largest global supplier of the critical raw materials. In terms of the total number of CRMs, China is the major supplier (Figure 8[39]). This includes all of the REEs and other critical raw materials including magnesium, tungsten, antimony, gallium and germanium, among others. In addition to China, several other countries are also important global suppliers of specific materials. For instance, Russia and South Africa are the largest global suppliers of platinum group metals, the USA of beryllium and Brazil for niobium.

Furthermore, despite China being the largest global supplier for the majority of the critical raw materials, the analysis of the primary EU sourcing (i.e. domestic production plus imports) paints a different picture (Figure 9[40]). The analysis of the EU sourcing excludes the five PGMs, titanium and beryllium due to little or no EU sourcing activity. Although China is the major EU supplier, several other countries represent main shares of the EU supply for specific critical raw materials, such as the Brazil (niobium), Chile (lithium) and Mexico (fluorspar).

[38] Calculating the average for the largest global supplier for all the PGMs is not possible because the major producing country is not the same for each of the five PGMs.
[39] The figure should not be interpreted in terms of tonnage of CRM that originate from these countries, but in terms of the number of CRMs, for which the country is the main global supplier or producer of the CRM.
[40] The figure should not be interpreted in terms of tonnage of CRM that originate from the countries, but in terms of the number of CRMs, for which the country is the main supplier for the EU.

Figure 8: Main global suppliers of CRMs (based on number of CRMs supplied), average from 2012-2016

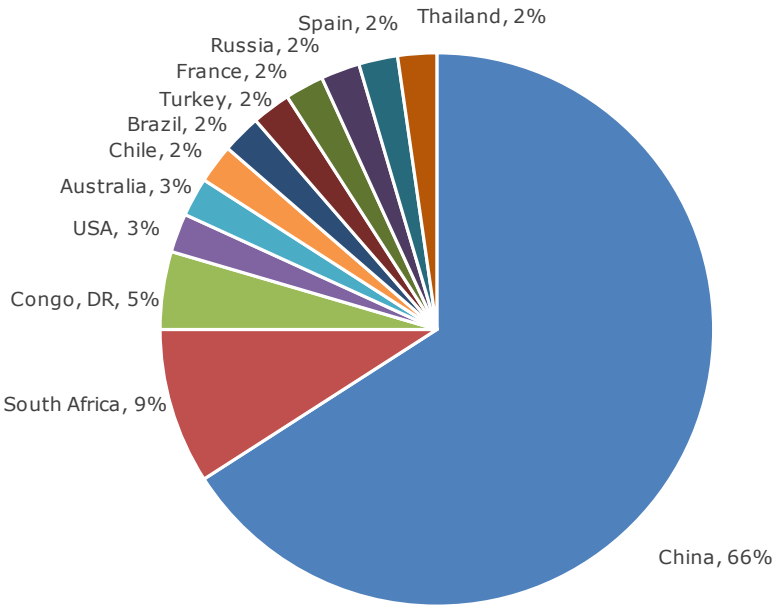
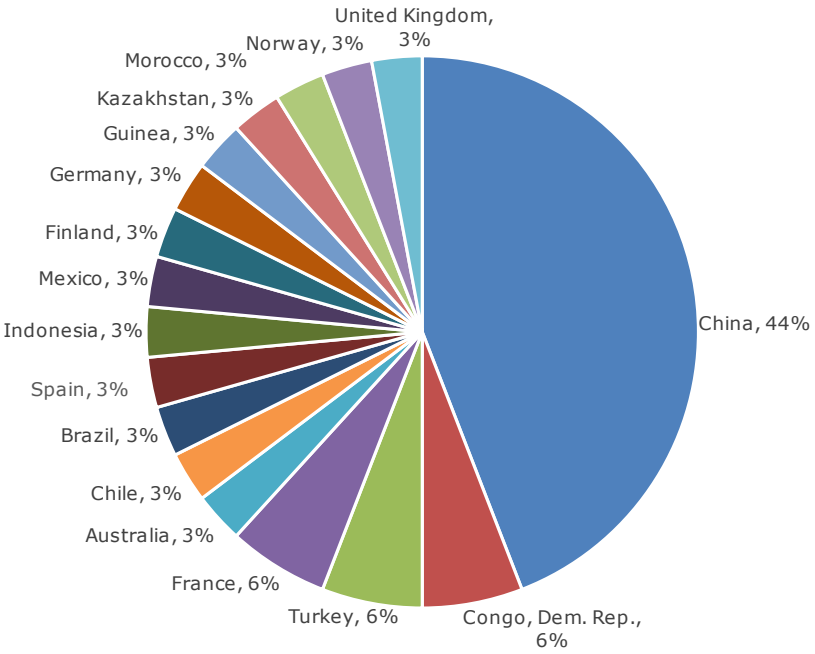


Figure 9: Main EU sourcing countries of CRMs (based on number of CRMs supplied), average from 2012- 2016 (REEs 2016-2018).



Another significant confirmation is that for certain CRMs, despite China being the largest global supplier, other countries represent the main source for the EU; see Table 12.

Table 12: CRMs with China as the largest global supplier but not as largest EU supplier

CRM	Main EU supplier	Share of EU sourcing
Antimony	Turkey	62%
Coking coal	Australia	24%
Fluorspar	Mexico	25%
Gallium	Germany	35%
Germanium	Finland	51%
Indium	France	28%
Phosphate rock	Morocco	24%
Phosphorus	Kazakhstan	72%
Silicon metal	Norway	30%

Analysis of Supply risk results (global SR vs EU sourcing)

The revised methodology made available two measures of the SR, which are certainly useful for a more comprehensive evaluation of the current situation.

In the initial criticality methodology, the SR was estimated based on the mix of global supplier countries only. The revised methodology used an updated Supply Risk formula, which incorporates both global supply and EU sourcing. EU sourcing refers to the actual sources of the supply to the EU Member States.

In the revised methodology, the actual supply to the EU (EU sourcing) is used in combination with the global supply in order to calculate a more representative measure of the risk. The revised methodology uses the Import Reliance (IR) indicator to combine the two measures of Supply Risk, i.e. the one based on global supply and the one based on actual EU sourcing:

Due to concerns over sufficiently available high-quality data, the revised methodology recommends that in the case of data unavailability and/or low quality, the SR should be estimated based on global supply only. This is based on the rationale that although it is not a true measure of the risk specific to the EU, the risk calculated using global supply is probably a more stable calculation and more reliable in terms of data quality. Moreover, the mix of global suppliers is generally more stable in time, whereas the exporters to the EU might change more rapidly.

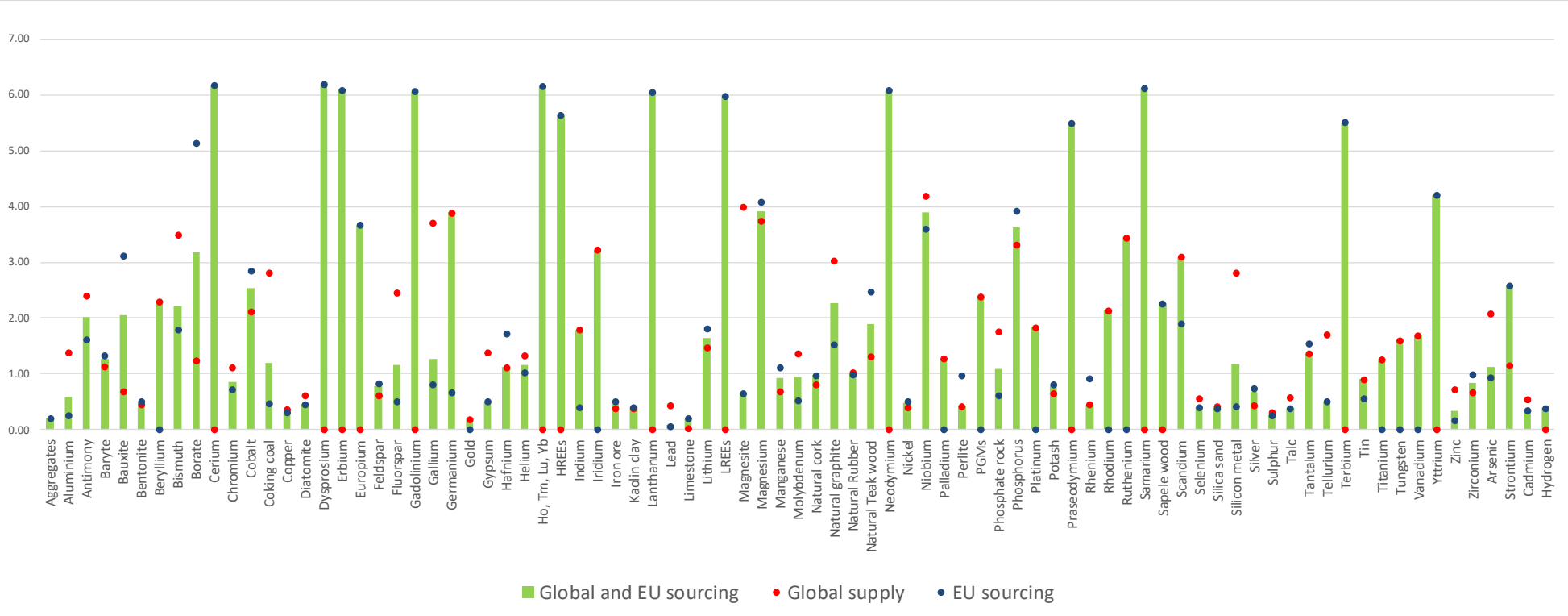
The guidelines for applying the revised SR formula based on both global supply and EU sourcing are summarised as follows:

- Use of both global supply and EU sourcing data, which is the preferred method when the data quality is of sufficient high quality for both indicators;
- Use of global supply data only when the data on EU sourcing is of inadequate quality or not available;
- Use of EU sourcing data only, which is to be used only in specific cases when it is correct to assume that import dependency is negative or at zero percent.

Figure 10 presents a graphical comparison of the difference in SR scores based on the supply data used in the SR calculation. Table 15 in Annex 3 provides the detailed SR figures for each of the materials assessed. Analysis of the different possible SR results indicates that the SR score, when based on global supply only is in general higher compared to EU sourcing data only. It is noted that is not always possible to calculate both global supply and EU sourcing.

The systematic double-stage assessment made available 4 measures of the supply risk, for a limited number of candidate CRMs, as reported in Figure 11.

Figure 10: Comparison of SR results based on scope of supply data used[41]



[41] Global supply data and/'or EU sourcing supply data i.e. refers to actual sourcing (imports) of the material into the EU

Figure 11: Comparison of SR results based on scope of supply data used (double stage)

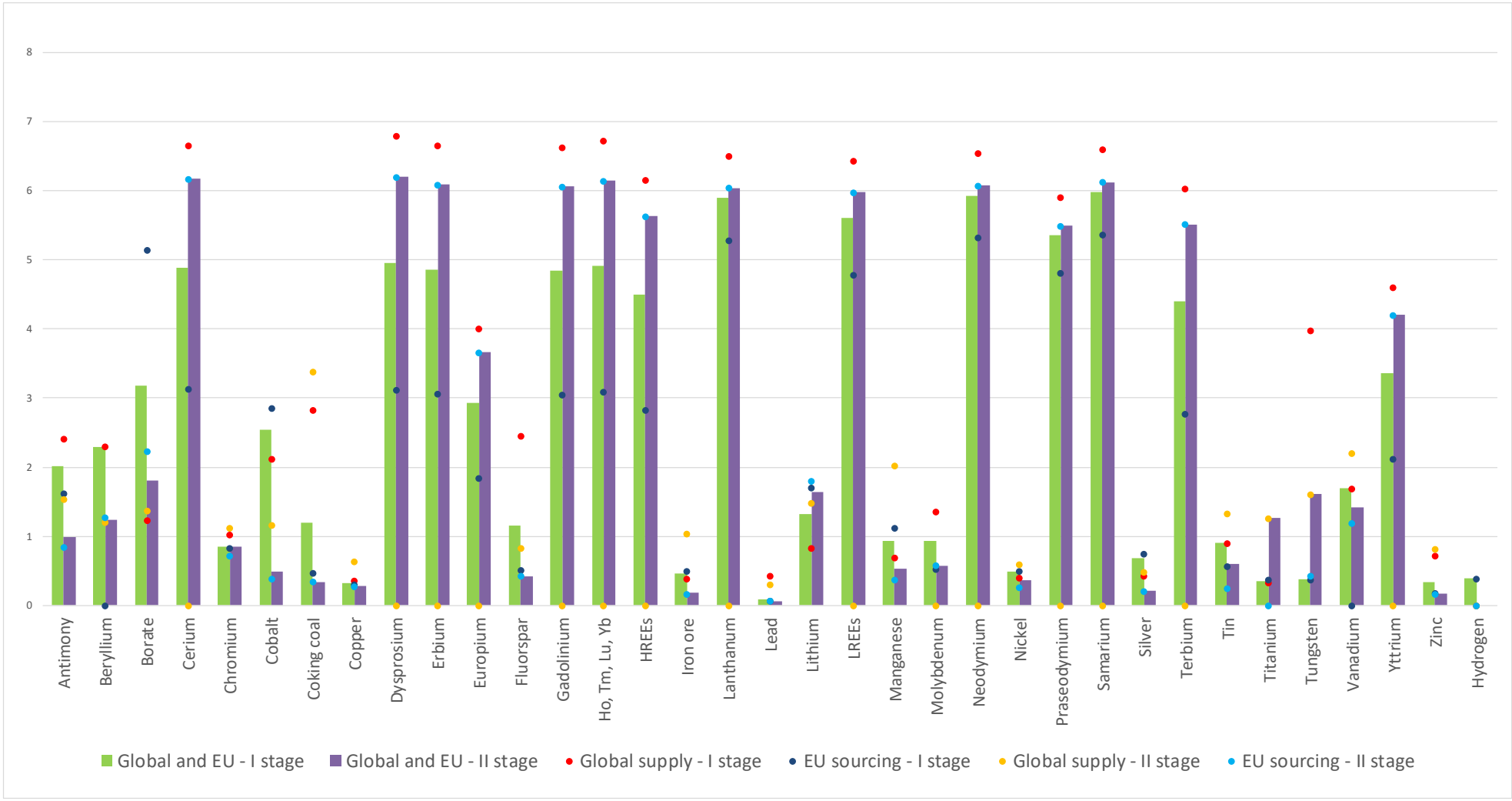


Figure 12: End of life recycling input rate (EOL-RIR)

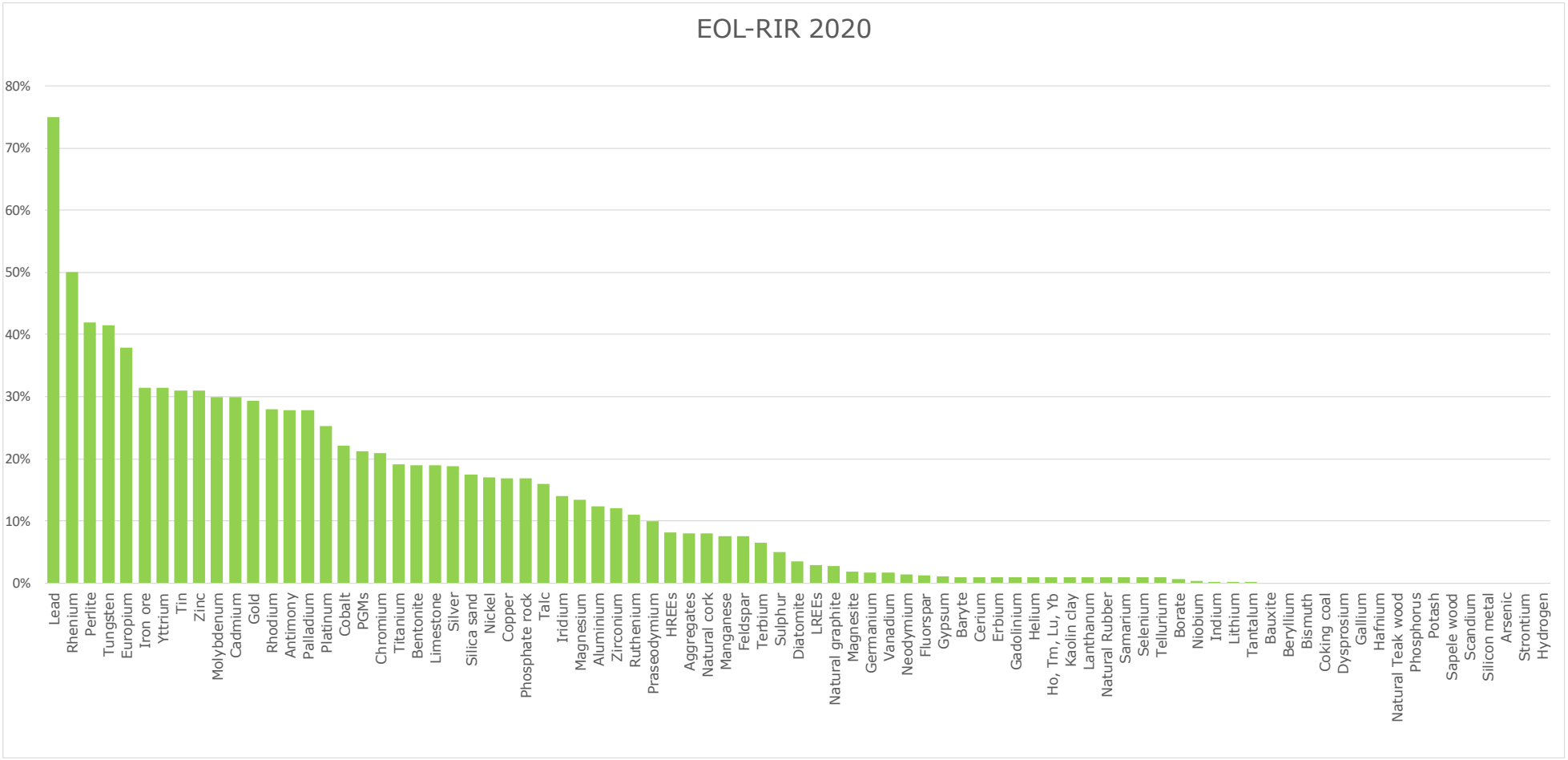
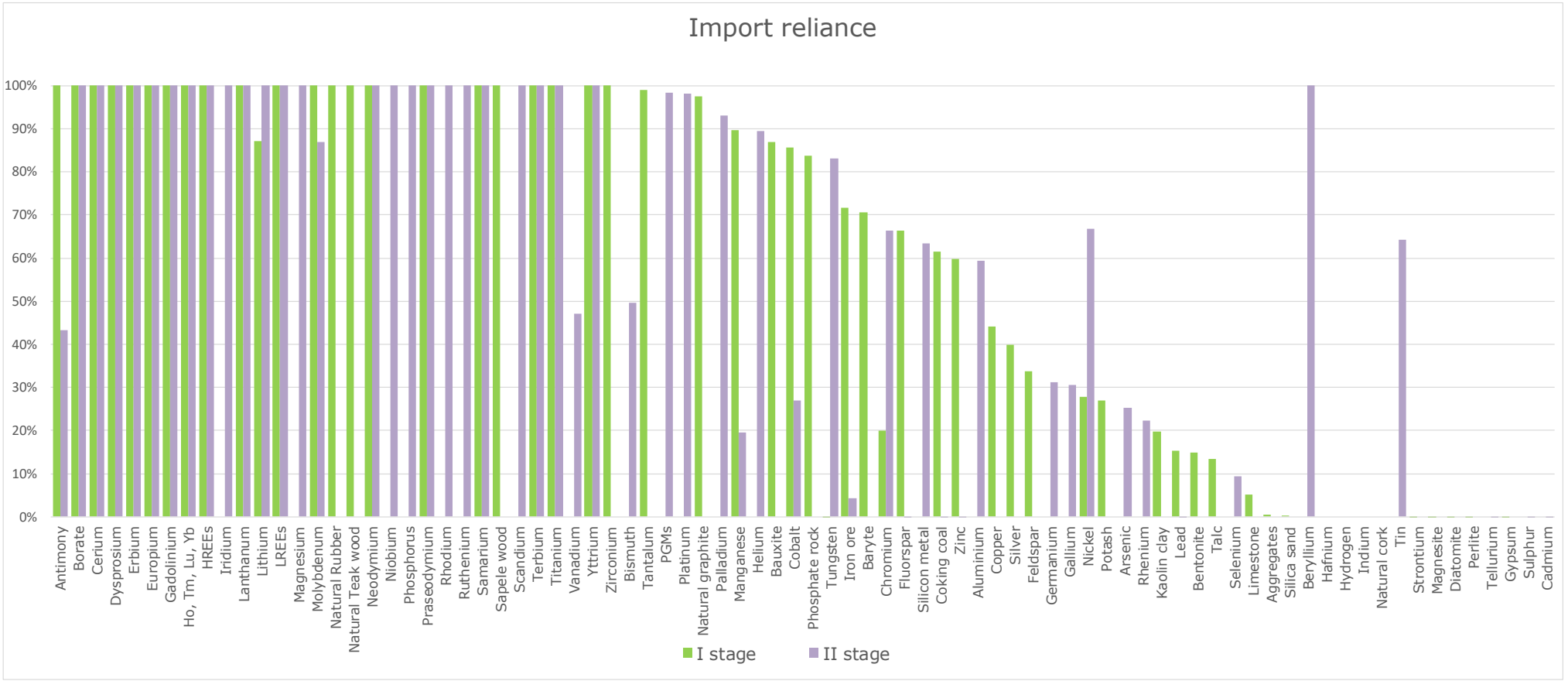


Figure 13: Import reliance



End-of-Life (EOL)-recycling input rate results

Figure 12 presents the full set of EOL-RIR. EOL-RIR is the selected recycling indicator used as a risk reducing filter in the EC criticality methodology. A remarkable effort was paid to search for or to develop better data for such a key parameter, for which low availability or inadequate quality / representativeness is a well known problem. Synergies were identified and substantial improvements of End-of-Life Recycling Input Rate (EOL-RIR) results, using higher quality EU based data, were made possible thanks to 14 new Material System Analyses (MSAs) that were run in parallel to the criticality assessment.

Import reliance results for specific materials

Figure 13 presents the full set of Import Reliance values for all candidate CRMs, in several cases made available at two stages.

For some materials, the import reliance is negative or zero. This means that exports from the EU are higher than imports to the EU (see Table 13). As stipulated in the revised methodology, when IR is 100%, the Supply Risk calculation should take the average of the two indicators, i.e. 50% based on global supply and 50% based on actual EU sourcing. In the few cases where the EU is independent, or almost independent, of imports, the global supply mix is disregarded and the risk is entirely calculated based on the actual sourcing of the material to the EU.

A 0% or <0% IR means that the SR result is calculated based on EU sourcing data only.

Table 13: Materials with negative or zero Import reliance

Material	Stage	Actual import reliance result
Cadmium	P	-178
Diatomite	E	-1
Gypsum	E	-25
Hydrogen	E	0
Magnesite	E	0
Natural cork	E	0
Silica sand	E	0
Strontium	E	0
Sulphur	P	-35
Tellurium	P	-14
Tin	E	0
Coking coal	P*	-3
Copper	P*	0
Fluorspar	P*	-19
Lead	P*	-1
Silver	P*	0
Tungsten	E*	-397
Zinc	P*	-2

* Second stage not used to define the criticality

3.5 LIMITATIONS OF THE CRITICALITY ASSESSMENTS

Even though it is based on the most robust and comprehensive data available, a criticality assessment remains a screening exercise. This is more a call for attention than an in-depth analysis that would allow for stronger conclusions. Thus, limitations of the criticality assessment are important to take into account when interpreting the results. Key limitations can help to understand the robustness of the 2020 assessment results and the comparability of the results across the four assessments.

3.5.1 Robustness of the results

Regarding the robustness of the analysis and corresponding results, despite the use of data of optimal quality, the following **limitations on data** are noted:

- **Data on EU market shares**: For several materials EU market shares were not available, therefore hypotheses and assumptions were used based on available global shares instead. Moreover, there were some issues with the use of NACE 2-digit codes, since a single code had to be selected per application; however, in some cases more than one code was applicable to a specific application.
- **Cases with issues on data to assess the EU supply**: Similar to the 2017 exercise, also, the 2020 assessment integrates data on EU sourcing (when available and of high quality) to calculate the Supply Risk. Taking into account actual sourcing to the EU provides a more realistic picture of the situation for each material. Previous assessments considered the global supplier mix only to calculate SR. In general, there was good public data availability for global supply for the majority of the materials assessed, however, data on EU sourcing were not always available or were of poor quality for some materials. Further, for some materials, there were also challenges related to inconsistencies in the type of data reported (for the REEs and PGMs for example) e.g. units, % of the material contained, time period covered, life-cycle stage covered, etc. between world production and EU sourcing data. In these cases, only reliable global supply data was used or stakeholders were consulted to validate or provide additional inputs to develop possible justified assumptions and hypothesis, where relevant.
- **Data on substitution and shares of material applications**: In general, it was difficult to identify or obtain public data on the shares of material applications, as well as their substitutes. The reason for the lack of available and reliable data on the sub-share of substitutes for a given application is that there are very few cases where substitutes are actually already being used in practice. As a consequence, in many cases, feedback was sought from industry experts to further develop acceptable assumptions and hypotheses for potential substitutes and sub-shares.
- **Data on End-of-life Recycling Input Rates (EOL-RIR):** The role of recycling as a risk-reducing filter of Supply Risk remains unchanged compared to the previous EC criticality exercises. Efforts were thus focused on expanding Material System Analysis (MSA) data availability and integrating available high-quality EU based data. Priority remained on EU sources of data such as the MSAs, but also to use data published in the report 'Recycling Rates of Metals' by the International Resource Panel of the United Nations Environment Programme (UNEP) to maintain the highest possible comparability with previous EC criticality reports. In the cases where MSA and UNEP data were not available, data or assumptions were used based on information provided in other sources e.g. sectorial reports, expert judgement and stakeholder inputs. Therefore, the SR result of the materials which use an EOL-RIR figure that does not stem from the preferred reference studies should be considered carefully.
- **Bottleneck screening:** uncertainty related to which stage is more critical has been reduced using a systematic two-stage supply risk assessment as far as possible.

3.6 RECOMMENDATIONS FOR FUTURE ASSESSMENTS

In the Communication on raw materials of 2011[42], the EC committed to regularly update the CRM list; every three years. A second and third criticality assessment were therefore published in 2014 and 2017. This study supports the fourth, 2020 list of CRMs for the EU, which is part of the process to maintain and update important information and findings on a regular basis. With this in mind, the following recommendations should be considered in order to facilitate further updates and the robustness of the exercises on criticality in the future.

The recommendations provided address both recommendations for improving the quality of the data used and recommendations for improving the reliability of future exercises.

Regarding recommendations to improve the quality of the data, although the revised methodology advises the use of high-quality EU based data, certain limitations and uncertainties with data sources were identified that could be further improved in future exercises. This underlines the importance of continuing to work closely with industry experts, members of the AHWG, important data providers such as Eurostat and other EC services, as well as Member State authorities to further improve the quality and reporting of European data. The following points could also be considered to increase the quality of the required data:

- Maintaining the importance of the transparency, objectivity and quality of the data used – as is recommended in the revised methodology, priority should be given to official and publicly available data over other sources such as private data that cannot be publicly accessed or unofficial / unpublished data. In addition, future exercises should continue to strive to maximise the contributions from all stakeholders and experts to ensure transparency as well as robustness of the data used and results derived. Continuous consultation with industry stakeholders is of crucial importance as they can provide important insights and feedback that are not necessarily available through existing data sources. With this in mind, adequate time should be allowed for the stakeholder consultations and for addressing inputs. This entails not only a period dedicated for the review of the criticality assessment calculations and the material factsheets but also to allow for exchanges with stakeholders and experts regarding contributions and other feedback.

- Working more closely with organisations that publish or provide publicly available EU-based data e.g. Eurostat, OECD, National statistics departments, geological surveys, ministries, trade organisations and others – this is important to further improve the quality and availability of EU production and trade statistics used in the criticality assessments. Regular discussions with these official data providers, for example, would be helpful to identify specific areas e.g. certain Member States, sectors, topics, specific data reporting challenges where greater efforts may be needed to improve and interpret the data reported.

- Finally, it is also essential to maintain the availability of detailed and coherent metadata information from EC public databases as well as the development of explanatory notes related to nomenclatures, which can provide important information in order to accurately interpret the data reported.

In view of future assessments, some recommendations for potential methodological improvements are summarised in Table 14.

[42] Communication *'Tackling the challenges in commodity markets and on raw materials'* (COM(2011)25)

Table 14: Summary of conclusions and recommendations to further strengthen future criticality exercises

Topics	Conclusions and recommendations
Materials and scope definitions	**Conclusions:** Additional efforts can be made to further develop harmonised definitions and to more clearly define the scope of some of the assessments. **Recommendations:** Further harmonise nomenclature and terms used to define materials and concepts related to the material life cycles would help in to define the scopes of the assessments. It is important for instance to define a priori the scope of each life cycle stage.
Life-cycle stages accessed	**Conclusions:** A key issue with all criticality assessments is the scope of each assessment made. As with most other analyses of this type, the revised EU methodology focuses on risk related to the first steps in the raw material's life cycle, such as extraction/harvesting, or related to a bottleneck further down the value chain, e.g. influencing potentially the refining steps. These studies generally do not consider the steps in which the refined material is used in a multitude of applications (except in the links in the economic importance). In the 2020 assessment, the first two life cycle stages were more systematic assessed. This reduced the risk of missing the stage with more supply risk in the material's life cycle. But, some raw materials may include an intermediate stage between mining and refining stages that may also be important for the assessment. **Recommendations:** Systematic assessment of both extraction and refining stages should continue in the next assessments. The factsheets should contain a more in-depth investigation of the materials across their life cycle and their supply chains, including for aspects such as future outlook, pricing and other key trends.
End-of-life Recycling Input Rates (EOL-RIR)	**Conclusions:** While the 2017 revised methodology provides guidelines and data sources than can be used for the EOL-RIR, the available data for all of the materials assessed is of varying quality. Material System Analyses (MSA) serve as a good basis for data gathering for EOL-RIR, however certain elements could be further improved. For example, these studies do not cover all materials in the 2020 criticality assessment and certain data are not reliable and/or up-to-date. In addition, the EOL-RIR used in EC methodology only considers the recycling of primary supply of the raw materials and does not take into account potential Supply Risk associated with secondary raw materials. Imports of "wastes and scraps" are not considered as part of the Supply Risk parameter. **Recommendations:** Further expansion of MSA studies and updates are needed. The factsheets may provide further information not captured in the EOL-RIR, nor in the CRM assessment, which may include: different recycling indicators reported in the literature and information on imports of wastes and scraps.
Allocation of end-use per sector	**Conclusions:** It was not always straightforward to determine to what extent a specific material is used directly in a manufacturing sector or used in downstream" sectors" towards the final product. An example would be the use of a certain metal in a turbine, which could be a

Topics	Conclusions and recommendations
	metal product or a piece of machinery. Evidence could also indicate that the material's end-use is in the production and distribution of energy. **Recommendations:** The selection of applications and associated sectors has a significant influence on the Economic Importance values. Therefore, future methodological improvements could offer additional guidance on the approach to be used. Clear guidance on how to deal with the evolution of volumes and values across the value chain would be helpful. Further modelling of selected key value chains and MSAs would also help, with stronger links being made between such studies and the CRM assessments.
Data Gaps	**Conclusions:** Official European statistics are prioritised over other sources of data, however on several occasions these databases have gaps that didn´t allow proper use of these data sources. **Recommendations:** In future assessments it could be useful to involve e.g. Eurostat directly in these assessments and/or provide feedback from such assessments. This may help to resolve some data gaps and to highlight data needs for the future.

ABBREVIATIONS AND GLOSSARY

General abbreviations

AHWG	Ad-Hoc Working Group on Defining Critical Raw Materials
BGS	British Geological Survey
CRM	Critical Raw Material
DG GROW	European Commission's Directorate General Internal market, Industry, Entrepreneurship, SMEs
EC	European Commission
EI	Economic Importance
EOL-RIR	End-of-life Recycling Input Rate
FAO	Food and Agriculture Organization of the United Nations
FTA	Free Trade Agreements
GDP	Gross Domestic Product
GVA	Gross Value Added
HHI	Herfindahl-Hirschman-Index
HREE	Heavy rare earth element
IR	Import Reliance
JRC	European Commission's Joint Research Centre
LREE	Light rare earth element
NACE	Nomenclature statistique des activités économiques dans la Communauté européenne
OECD	Organisation for Economic Co-operation and Development
PGM	Platinum group metal
REE	Rare earth element
RMSG	Raw Materials Supply Group
SI	Substitution Index
SI(EI)	Substitution Index for Economic Importance
SI(SR)	Substitution Index for Supply Risk
SR	Supply Risk
USGS	US Geological Survey
VAT	Value added tax
WGI	World Governance Index
WMD	World Mining Data
WTO	World Trade Organisation

SPECIFIC ABBREVIATIONS FOR THE MATERIALS COVERED

Agr	Aggregates	Mn	Manganese
Al	Aluminium	Mo	Molybdenum
Sb	Antimony	NC	Natural cork
Brt	Baryte	Gr	Natural graphite
Bx	Bauxite	Nr	Natural Rubber
Bn	Bentonite	Nt	Natural Teak wood
Be	Beryllium	Nd	Neodymium
Bi	Bismuth	Ni	Nickel
Bo	Borate	Nb	Niobium
Ce	Cerium	Pd	Palladium
Cr	Chromium	Pe	Perlite
Co	Cobalt	P	Phosphorus
Cc	Coking coal	Phs	Phosphate rock
Cu	Copper	Pl	Platinum
Di	Diatomite	Po	Potash
Dy	Dysprosium	Pr	Praseodymium
Er	Erbium	Re	Rhenium
Eu	Europium	Rh	Rhodium
Fsp	Feldspar	Ru	Ruthenium
Fl	Fluorspar	Sm	Samarium
Gd	Gadolinium	Sw	Sapele wood
Ga	Gallium	Sc	Scandium
Ge	Germanium	Se	Selenium
Au	Gold	Sl	Silica sand
Gp	Gypsum	Si	Silicon metal
Hf	Hafnium	Ag	Silver
He	Helium	S	Sulphur
Ho	Holmium	Tc	Talc
In	Indium	Ta	Tantalum
Ir	Iridium	Te	Tellurium
Fe	Iron ore	Tb	Terbium
Kc	Kaolin clay	Tm	Thulium
La	Lanthanum	Sn	Tin
Pb	Lead	Ti	Titanium
Ls	Limestone	W	Tungsten
Li	Lithium	V	Vanadium
Lu	Lutetium	Yb	Ytterbium
Mgs	Magnesite	Y	Yttrium
Mg	Magnesium	Zn	Zinc

GLOSSARY

Term	Definition in the context of this report
Bottleneck	A bottleneck is considered to be the point in value chain for a specific material where the supply risk is highest, i.e. the stage (either extraction/harvesting or processing/refining), that has the highest numerical criticality score for the Supply Risk.
Critical Raw Materials (CRMs)	Critical raw materials (CRMs) are raw materials of a high importance to the economy of the EU and whose supply is associated with a high risk. The main two parameters: Economic Importance (EI) and Supply Risk (SR) are used to determine the criticality of the material for the EU. The list of CRMs is established on the basis of the raw materials which reach or exceed the thresholds for both parameters.
Economic Importance (EI)	One of the two main assessment parameters (in addition to Supply Risk) of the revised EC methodology to measure the criticality of a raw material. In the EC methodology[43], the Economic Importance is calculated based on the importance of a given material in the EU for end-use applications and on the performance of available substitutes in these applications.
End-of-life Recycling Input Rate	The end-of-life recycling input rate (EOL-RIR) since the 2017 assessment refers to the ratio of recycling of old scrap in the EU to the EU supply of raw material. In other words, EOL-RIR is production of secondary material from post-consumer functional recycling (old scrap) sent to processing and manufacturing and replacing primary material input. In the previous EC criticality assessments (EC 2011, 2014), recycling rates and EOL-RIR refer only to functional recycling i.e. the portion of EOL recycling in which the material in a discarded product is separated and sorted to obtain recyclates.
Extraction stage	Refers to the process of obtaining (extracting) raw materials from our environment and is also referred to as the mining or harvesting stage. This may involve discovering where these raw materials are located (often achieved with knowledge of geology) and developing processes to extract them from these locations (e.g. mining the ores).
Heavy rare earth elements (HREEs)	Heavy rare earth elements (HREEs) are one of the two sub-categories of the rare earth elements (REEs) group. HREEs are part of the lanthanide elements and have higher atomic weights (hence "heavier") compared to the light rare earth elements (LREEs). HREEs are currently used in a few niche applications, which are mostly related to their optical properties (Laser dopants, radiography, etc.). The HREEs (10) covered by the study include dysprosium, erbium, europium, gadolinium, holmium, lutetium, terbium, thulium, ytterbium and yttrium.
Herfindahl-Hirschman-Index (HHI)	The Herfindahl-Hirschman-Index is a commonly accepted measure of market concentration. In the context of the 2020 exercise, the Herfindahl-Hirschmann-Index (HHI_{WGI}), based on the world governance index (WGI), is used to calculate the Supply Risk as a parameter quantifying the stability of and level of concentration in producing countries.
Import Reliance (IR)	Import reliance (or import dependency) is part of the Supply Risk calculation in the revised EC methodology for updating the list of critical raw materials for the EU[43]. It takes into account actual EU sourcing (net imports divided by a sum of domestic production with net imports) and the level of import dependency in the calculation of Supply Risk.
Light rare earth elements (LREEs)	Light rare earth elements (LREEs) are one of the two sub-categories of the REEs group. LREEs are part of the lanthanide elements and are characterised by lower atomic weights (hence "lighter") compared to HREEs. Generally, LREEs are more abundant in the earth's crust compared to HREEs. LREEs can be used in a wide variety of applications according to the individual REEs and regional specificities, but they are in general used in sectors such as catalysts, metallurgy, glass/polishing and magnets. The LREEs (5) covered by the study include cerium, lanthanum, neodymium, praseodymium and samarium.
Mineral deposit	A natural concentration of material of possible economic interest in the earth's crust.
New scrap / Old scrap	New scrap refers to the scrap generated from processing and manufacturing processes and it is also sometimes regarded as pre-consumer scrap. It has a

[43] Methodology for establishing the EU List of Critical Raw Materials, 2017, ISBN 978-92-79-68051-9

Term	Definition in the context of this report
	known composition, normally high purity, and origin, and can be often recycled within the processing facility. Old scrap, also regarded as post-consumer scrap, is the amount of material contained in products that have reached their end of life (EOL). It is often mixed with other materials such as plastics or alloys, therefore its recycling requires further detailed processing for proper recovery.
Platinum group metals (PGMs)	Five platinum group metals are covered by the assessment: ruthenium, rhodium, palladium, iridium and platinum. They have similar physical and chemical properties, tend to be found together, and are commonly associated with ores of nickel and copper. The PGMs are generally derived from the same types of ore deposit in which they occur together, commonly in the same mineral phases. For this reason, they are classed as co-products, because they have to be mined together. They rarely occur in native form. The PGMs are highly resistant to wear, tarnish, chemical attack and high temperature. The PGMs are regarded as precious metals, like gold and silver. All PGMs, commonly alloyed with one another or with other metals, can act as catalysts which are exploited in a wide range of applications. Platinum and palladium are of major commercial significance, with rhodium the next most important. The main use of PGMs is in autocatalysis, but other major applications include jewellery, chemical manufacture, petroleum refining and electrical products.
Primary raw material / Secondary raw material	Primary raw materials are virgin materials, natural inorganic or organic substance, such as metallic ores, industrial minerals, construction materials or energy fuels, used for the first time. Secondary raw materials are defined as materials produced from other sources other than primary. Secondary raw materials can also be obtained from the recycling of raw (i.e. primary) materials. Examples: steel or aluminium scrap.
Processing / refining stage	Refers to a series of operations and treatments that transform raw materials from a raw-material state into substances which are then used to make semi-finished and finished products. Also referred to as the post-mining or post-harvesting stage.
PRODCOM / NACE 2	EUROSTAT Prodcom survey provides statistics on the production of manufactured goods. The term comes from the French "PRODuction COMmunautaire" (Community Production) for mining, quarrying and manufacturing: sections B and C of the Statistical Classification of Economy Activity in the European Union (NACE 2). The first four digits refer to the equivalent class within the Statistical classification of NACE, and the next two digits refer to subcategories within the Statistical classification of products by activity (CPA). Most PRODCOM headings correspond to one or more Combined nomenclature (CN) codes related to EU trade.
Rare earth elements (REEs)	Refers to a set of 15 elements in the Lanthanide series and two other elements: scandium and yttrium (see definitions for HREEs and LREEs). In the context of this study, yttrium is considered a rare earth element since it tends to occur in the same ore deposits as the lanthanides and exhibits similar chemical properties. However, scandium is not considered as part of the REEs in the study because its properties are not similar enough to classify it as either a heavy rare earth element or light rare earth element. The REEs are typically sub-divided into two groups, the light rare earth elements (LREEs) and heavy rare earth elements (HREEs), both for commercial reasons and their physical-chemical properties. The main uses of REEs are in automotive, telecom and electronics sectors, as well as in the aerospace, defence and renewable energy sectors. REEs find uses in a large variety of applications linked with their magnetic, catalytic and optical properties.
Raw material	Natural or processed resources which are used as an input to a production operation for subsequent transformation into semi-finished and finished good. Primary raw materials are, as opposed to semi-finished products, extracted directly from the planet and can be traded with no, or very little, further processing.
Reserves	The term is synonymously used for “mineral reserve”, “probable mineral reserve” and “proven mineral reserve”. In this case, confidence in the reserve is measured by the geological knowledge and data, while at the same time the extraction would be legally, economically and technically feasible and a licensing permit is certainly available.

Term	Definition in the context of this report
Resources	The term is synonymously used for "mineral resource", "inferred mineral resource", "indicated mineral resource" and "measured mineral resource". In this case, confidence in the existence of a resource is indicated by the geological knowledge and preliminary data, while at the same time the extraction would be legally, economically and technically feasible and a licensing permit is probable.
Substitution	In the revised EC methodology for updating the list of CRMs for the EU, substitution is considered to reduce the potential consequences in the case of a supply disturbance based on the rationale that the availability of substitute materials could mitigate the risk of supply disruptions. It is therefore incorporated in both the Economic Importance (EI) and Supply Risk (SR) dimension as a substitution index. Since the 2017 assessment, only proven substitutes that are readily-available today (snapshot in time) and that would subsequently alter the consequences of a disruption are considered. As a result, only substitution, and not substitutability or potential future substitution is considered in the revised EC methodology.
Supply Risk (SR)	One of the two main assessment parameters (along with Economic Importance) of the revised EC methodology to measure the criticality of a raw material. In the EC methodology, the Supply Risk is calculated based on factors that measure the risk of a disruption in supply of a specific material (e.g. global supply and EU sourcing countries mixes, import reliance, supplier countries' governance performance measured by the World Governance Indicator, trade restrictions and agreements, availability and criticality of substitutes).
Value chain	The value chain describes the full range of activities required to bring a raw material through the different phases of production, transformation, delivery to final consumers and final disposal or recovery after use.

ANNEXES

Annex 1. Overview of international criticality methodologies and assessments

Criticality is not an absolute concept and the methodologies for the assessment of Critical Raw Materials have to implicitly answer the question "**critical to whom?**". There is no generic and standardized approach to conduct a criticality assessment. Moreover, criticality is usually considered to be a relative concept in the sense that one material is more or less critical than another.

Criticality assessments are conducted at different levels: for a specific product[44], technology[45], company[46], country or region[47], or even at a global level[48]. The criticality of a raw material can be considered in the short term (e.g. a few years) or in the long term (a few decades).

Given the different scopes and objectives, a variety of indicators can be used for the assessment. Therefore, comparability is usually not possible between results from different methodologies.

The **International Round Table on Materials Criticality (IRTC)[49]** was partly established to discuss criticality in the context of industry, including the relationship/harmonization of criticality methods. The Round Table consists of international experts, including some criticality method developers, with a focus on relevant stakeholders such as industry representatives.

The **IRTC** published a **review of methodologies[50]** for criticality assessment. A first step of the review was the identification of differences in the goal and scope of the methods, their spatial boundary and time horizons. Secondly, the review analysed the other features of the methodologies: criticality dimensions, factors, indicators, data sources, methodological choices (for instance, use of thresholds, aggregation methods), foreseen application and intended audience.

Goal and scope of criticality assessment

Concerning the goal and scope phase, methodologies stemmed from different perceptions of "**what is at risk**". For instance, the first criticality assessments were governmental reports (in the US and UK) referring to raw materials used for national security and defence, and thus considered as "strategic"[51]. Lately, countries with high level of industrialisation and high import dependency for materials started to identify potential supply risk of materials that are important to **sustain contemporary lifestyles**, and for the development of national and regional economies. Some studies address **specific industrial sectors**, and identify potential bottlenecks for their deployment. This is the case of low-carbon energy

[44] E.g.: Bach et al. (2016) Integrated method to assess resource efficiency – ESSENZ. J. Clean. Prod. 137, 118–130.; Gemechu et al. (2017) Geopolitical-related supply risk assessment as a complement to environmental impact assessment: the case of electric vehicles. Int. J. Life Cycle Assess.; Graedel and Nuss, (2014) Employing Considerations of Criticality in Product Design. Jom 66, 2360–2366.

[45] E.g.: Bauer et al. (2010) US Department of Energy: Critical Materials Strategy; Helbig et al. (2018) Supply risks associated with lithium-ion battery materials. J. Clean. Prod. 172, 274–286 ; Moss et al. (2013). Critical Metals in the Path towards the Decarbonisation of the EU Energy Sector.

[46] Duclos et al. (2010) Design in an era of constrained resources. Mech. Eng. 36–40.

[47] E.g. European Commission, 2017a. Methodology for establishing the EU list of Critical Raw Materials ; Graedel et al. (2015). Criticality of metals and metalloids. Proc. Natl. Acad. Sci. 112, 4257–4262. Etc.

[48] E.g.: Graedel et al. (2015) Criticality of metals and metalloids. Proc. Natl. Acad. Sci. 112, 4257–4262. Morley & Eatherley (2008). Material Security - Ensuring Resource Availability for the UK Economy.

[49] https://irtc.info/about-irtc/

[50] Schrijvers et al. (2019) A review of methods and data to determine raw material criticality. Resources, Conservation & Recycling.

[51] NRC, 2008. Minerals, Critical Minerals, and the U.S. Economy. ; Morley, N., Eatherley, D., 2008. Material Security - Ensuring Resource Availability for the UK Economy.

technologies. Geographical scope can be national or regional, but sometimes this is not clearly specified.

Time horizon is usually limited to the present status quo, but few studies make future projections[52].

Three **main objectives** of the criticality studies can be distinguished:

i) **raise the attention** of decision makers in industry and governments regarding raw materials supply and demand dynamics;

ii) provide information on **mitigation measures** (diversifying supply, increase recycling, launching new mining projects, etc.)

iii) perform a **pre-screening** to support prioritization of in-depth analysis.

The **set of materials** under investigation in the criticality studies also varies among different methodologies. Figure 14 provides an overview of the frequency with which materials are included in a selection of criticality assessment studies reviewed in Schrijvers et al. 2019.

Selection of indicators and data sources

Criticality assessments usually combine two main **dimensions** to evaluate materials: supply risk/disruption and vulnerability. These dimensions are characterized through various **indicators**. Diversity of supply, political stability, depletion and recyclability are the most frequently aspects included in the assessment of supply risk. Vulnerability can be assessed with a variety of indicators, which most frequently include substitutability, demand growth and price volatility.

Data availability is crucial for any assessment and strongly influences the study outcomes. A wide range of data sources can be used, but geological surveys are the major data providers, together with World Bank, which produces the Worldwide Governance Indicators, that is used by most of the studies. Scientific literature and industry reports are also relevant sources of information, as well as other international organizations report (e.g. UNEP). Data quality can vary from one material to another, as more information is usually available for bulk materials while minor metals, for instance, are more difficult to obtain. Moreover, important data gaps are usually affecting by-products and intermediate products.

The review highlights the importance of a clear **definition of goal and scope** of the study and the understanding of cause-effect mechanisms that link risk factors to indicators. Communication of CRM should also be more transparent regarding the methodological choices and the underlying uncertainty.

[52] E.g. KIRAM, KITECH (2014). The current activity of Korea for the rare metals future. ; Coulomb et al. (2015). Critical Minerals Today and in 2030: AN ANALYSIS FOR OECD COUNTRIES. OECD Environ. Work. Pap. 0_1,3-5,8-49.

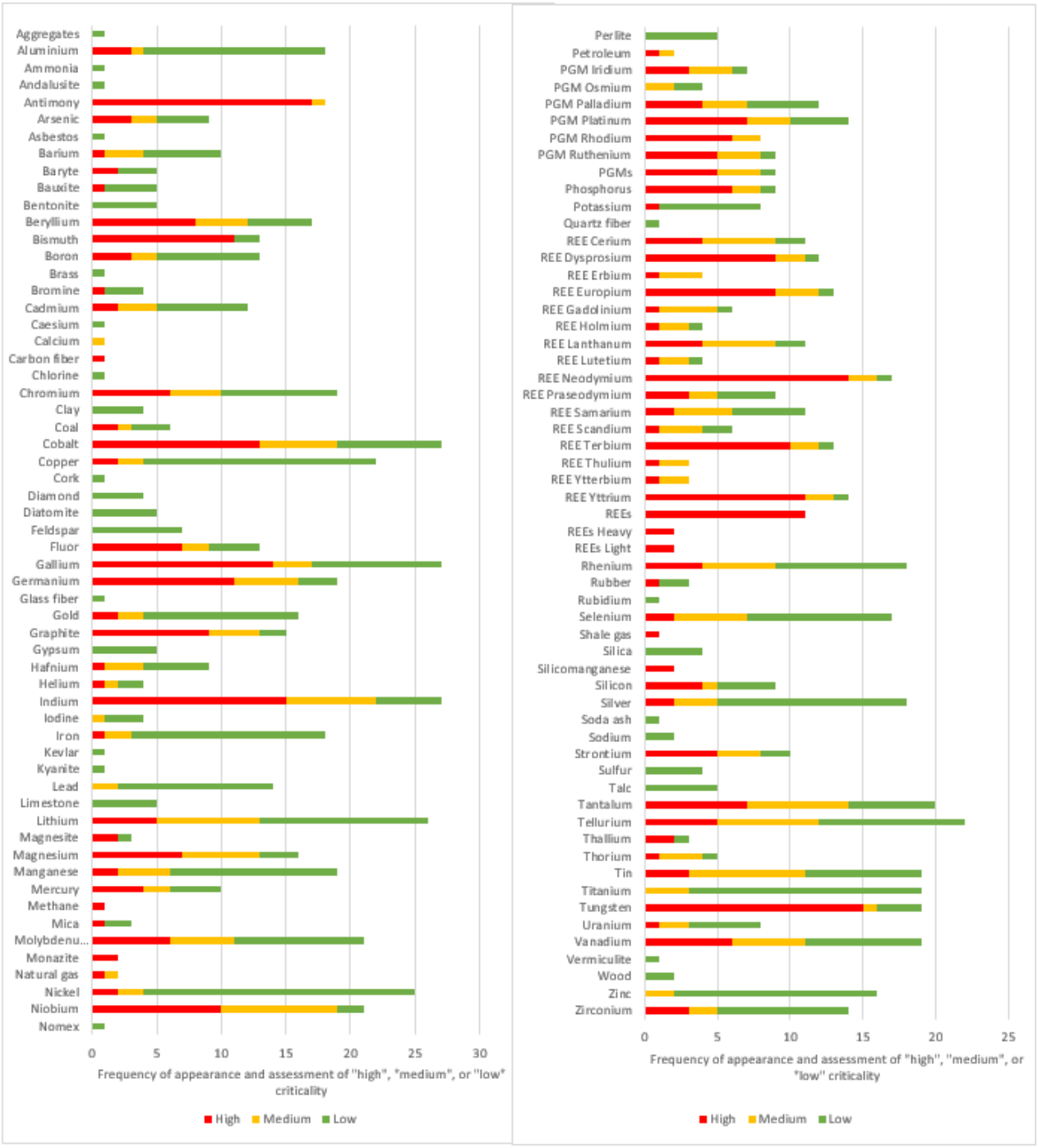


Figure 14: Frequency of appearance in criticality assessments and criticality determination (high, medium, or low) of materials[53] (Schrijvers et al., 2019).

[53] Included methods : NRC, Yale (global and country risk, only the supply risk axis), NSTC (2016 and 2018), EU (2011, 2014, and 2017), Helbig (2016 and 2018), Augsburg, KIRAM/KITECH, NEDO, BRGM, Werner, General Electric, iCIRCE, NIES, GeoPolRisk, SCARCE, Oakdene Hollins, Thomason, Rosenau-Tornow, Öko-Institut, Roelich, SDU, China, BGS (2011, 2012, and 2015), OECD, US DOE (both short term and medium term for 2010 and 2011), Moss (2011 and 2013). Excluded methods are BIRD, VDI and UBA (no results), Granta Design, ESSENZ and EBP/Empa (unaggregated results and/or company-specific), Angerer (no materials identified as critical). Multi-stage analyses and multiple forms of the same material are merged (only bottleneck is included), to avoid double counting of appearances. See SI-B for details on material inclusion and evaluation of methods.

Annex 2. Stages assessed and rationale (only candidate CRMs with single stage screening)

	Stage assessed		Overview of rationales		Detailed rationales for stage assessed	
Material	Extraction	Processing	Data quality / (un)availability	Known bottleneck	Data quality / (un)availability on EU and global supply	Known bottleneck / expert feedback
Aggregates	X		X		Yes	Global supply data was available at both stages (extraction and refining). However, there is no strong evidence for significant refining production in the EU, therefore the extraction stage was selected for the criticality assessment.
Bauxite	X	See rationale under aluminium	X	X	Yes	The criticality of aluminium is assessed for two different life cycle stages, the extraction and processing stage (see Al criticality assessment). Data on global and EU supply was available and used in the assessment. It is important to assess the extraction stage, as the import reliance in Europe is substantial.
Aluminium	See rationale under bauxite	X	X	X	Yes	The criticality of aluminium is assessed for two different life cycle stages, the extraction and refining (see bauxite criticality assessment). Data on global and EU supply was available and used in the assessment. It is important to assess the refining stage, due to the importance of Aluminium in the European manufacturing sector and the competing demand from other global regions/ countries.
Arsenic		X	X	X	Yes	Arsenic is a by-product of copper, zinc, etc
Baryte	X		X	N/A	Global supply data was available at the extraction stage only, therefore this stage was selected for the criticality assessment.	N/A
Bentonite	X		X	X	Yes	Global and EU supply data was available at the extraction stage. Further, there was no robust evidence indicating a bottleneck at the refining stage, therefore the extraction stage was selected. Europe is a major producer of bentonite hence the sector is important for the EU economy.
Bismuth		X	X	N/A	Global supply data was available at the refining stage only, therefore this stage was selected for the criticality assessment.	N/A
Cadmium		X	X	X	Yes	Cadmium is a by-product of zinc

	Stage assessed		Overview of rationales		Detailed rationales for stage assessed	
Material	Extraction	Processing	Data quality / (un)availability	Known bottleneck	Data quality / (un)availability on EU and global supply	Known bottleneck / expert feedback
Diatomite	X		X	X	Global supply data was available at the extraction stage only.	Global supply data was available at the extraction stage only. Further, there is no strong evidence indicating a bottleneck at the refining stage, therefore the extraction stage was selected for the criticality assessment.
Feldspar	X		X	X	Global supply data was available at the extraction stage only.	Global supply data was available at the extraction stage only. Further, there is no strong evidence indicating that there is a bottleneck at the refining stage, therefore the extraction stage was selected for the criticality assessment.
Gallium		X	X	N/A	Global supply data was available at the refining stage only, therefore this stage was selected for the criticality assessment.	N/A
Germanium		X	N/A	X	N/A	Ge is a by-product extracted from Zn ores and there are no Ge ores imports to the EU. Therefore, the processing stage was selected for the criticality assessment as it is assumed the processing stage has the highest supply risk i.e. bottleneck
Gold	X		X		Global supply data was available at the extraction stage only, therefore was selected for the criticality assessment.	N/A
Gypsum	X		X	X	Global and EU supply data was available at the extraction stage only.	Global and EU supply data was available at the extraction stage only. The rationale for the selection of the bottleneck is that for most industrial minerals the extraction stage is the bottleneck, as they are produced and sold in this form to product manufacturers.
Hafnium	-	X	N/A	X	N/A	Hafnium is only obtained as a by-product during the processing of other minerals e.g. zirconium. Therefore, data at the extraction (mine) level cannot exist. As such, the processing stage was selected as the bottleneck for the criticality assessment as the data used represents materials obtained after processing.
Helium		X	X	N/A	Global supply data was available at the refining stage only, therefore the processing stage was selected for the criticality assessment.	N/A
Hydrogen			X	N/A	EU sourcing only	N/A

	Stage assessed		Overview of rationales		Detailed rationales for stage assessed	
Material	Extraction	Processing	Data quality / (un)availability	Known bottleneck	Data quality / (un)availability on EU and global supply	Known bottleneck / expert feedback
Indium		X	X	N/A	Global supply data was available at the refining stage only, therefore the processing stage was selected for the criticality assessment.	N/A
Iridium		X	N/A	X	N/A	Almost all iridium derived from primary source materials (i.e. mine production) is traded in the form of refined metal produced from integrated mining/metallurgical operations. There is only very limited international trade in iridium ores and concentrates, therefore the processing stage was selected for the criticality assessment.
Kaolin clay	X		X	X	Global and EU supply data was available at the extraction stage.	Global supply data was available at the extraction stage only. Further, there is no evidence indicating a bottleneck at the refining stage, therefore the extraction stage was selected for the criticality assessment.
Limestone	X		X	X	Global supply data for high grade limestone are not readily available.	Global supply data for high grade limestone are not readily available. Therefore, based on feedback from experts and data availability and quality, the extraction stage was selected for the criticality assessment, nevertheless data availability is very limited to undertake a detailed assessment.
Magnesite	X		X	N/A	Global supply data was available at the extraction stage only, therefore the extraction stage was selected for the criticality assessment.	N/A
Magnesium		X	X	X	X	There is no production of dolomite (extraction step of magnesium value chain) or refined magnesium (processing step) in the EU, however the refined materials are significantly imported to the EU, therefore indicating that that the processing step represents the highest supply risk. As such, the processing stage was selected for the criticality assessment. It is important to assess the refining stage of magnesium, due to the importance of magnesium metal in the European manufacturing sector and the competing demand from other global regions/ countries.

	Stage assessed		Overview of rationales		Detailed rationales for stage assessed	
Material	Extraction	Processing	Data quality / (un)availability	Known bottleneck	Data quality / (un)availability on EU and global supply	Known bottleneck / expert feedback
Natural cork	X		X	X	Global supply data was available at the extraction stage only.	Global supply data was available at the extraction stage only. Further, there is no strong evidence for significant refining production in the EU, therefore the extraction stage was selected for the criticality assessment.
Natural graphite	X		X	N/A	Global supply data was available at the extraction stage only, therefore the extraction stage was selected for the criticality assessment.	N/A
Natural Rubber	X		X	X	Global supply data was available at the extraction stage only.	Global supply data was available at the extraction stage only. Further, there is no strong evidence for significant refining production in the EU, therefore the extraction stage was selected for the criticality assessment.
Natural Teak wood	X		X	X	Yes	Global supply data was available at both stages (extraction and refining). However, there is no strong evidence for significant refining production in the EU, therefore the extraction stage was selected for the criticality assessment.
Niobium		X	N/A	X	N/A	The processing stage was selected for the criticality assessment based on feedback received from experts indicating that the processing stage (e.g. ferroniobium) represents the most important bottleneck for the EU.
Palladium		X	N/A	X	N/A	Almost all palladium derived from primary source materials (i.e. mine production) is traded in the form of refined metal produced from integrated mining/metallurgical operations. There is only very limited international trade in palladium ores and concentrates. Therefore, the processing stage was selected for the criticality assessment.
Perlite	X		X	X	Global and EU supply data was available at the extraction stage only.	Global and EU supply data was available at the extraction stage only. Similarly to other industrial minerals, the extraction stages is mainly the bottleneck. Europe is a major producer of perlite therefore the extraction stage is of major importance to the EU.
Phosphate rock	X		X	X	Global and EU supply data was available at the extraction stage.	To highlight the difference between an extracted product and a refined product, both phosphate rock and phosphorus (P4) are assessed
Phosphorus		X	X	X	Global and EU supply data was available at the processing stage.	To highlight the difference between an extracted product and a refined product, both phosphate rock and phosphorus (P4) are assessed

	Stage assessed		Overview of rationales		Detailed rationales for stage assessed	
Material	Extraction	Processing	Data quality / (un)availability	Known bottleneck	Data quality / (un)availability on EU and global supply	Known bottleneck / expert feedback
Platinum		X	N/A	X	N/A	Almost all platinum derived from primary source materials (i.e. mine production) is traded in the form of refined metal produced from integrated mining/metallurgical operations. There is only very limited international trade in platinum ores and concentrates. Therefore, the processing stage was selected for the criticality assessment.
Potash	X		X	X	Global supply data was available at the extraction stage only.	Global supply data was available at the extraction stage only. Limitations with data availability is the primary reason for the selection of the extraction stage instead of the refining stage to undertake the assessment.
Rhenium		X	X	X	Global supply data was available at the refining stage only, therefore the processing stage was selected for the criticality assessment.	N/A
Rhodium		X	N/A	X	N/A	Almost all rhodium derived from primary source materials (i.e. mine production) is traded in the form of refined metal produced from integrated mining/metallurgical operations. There is only very limited international trade in rhodium ores and concentrates. Therefore, the processing stage was selected for the criticality assessment.
Ruthenium		X	N/A	X	N/A	Almost all ruthenium derived from primary source materials (i.e. mine production) is traded in the form of refined metal produced from integrated mining/metallurgical operations. There is only very limited international trade in ruthenium ores and concentrates. Therefore, the processing stage was selected for the criticality assessment.
Sapele wood	X		X	X	Yes	Global supply data was available at both stages (extraction and refining). However, there is no strong evidence for significant refining production in the EU, therefore the extraction stage was selected for the criticality assessment.
Scandium		X	X	N/A	Global supply data was available at the refining stage only, therefore the extraction stage was selected for the criticality assessment.	N/A
Selenium		X	X	X	Global and EU supply data was available at the processing stage only.	Global and EU supply data was available at the processing stage only, therefore the processing stage was selected for the criticality assessment. Selenium is a by-product recovered during the refining of copper, therefore it is only the processing stage that is relevant for the assessment.

	Stage assessed		Overview of rationales		Detailed rationales for stage assessed	
Material	Extraction	Processing	Data quality / (un)availability	Known bottleneck	Data quality / (un)availability on EU and global supply	Known bottleneck / expert feedback
Silica sand	X		X	N/A	Global supply data was available at the extraction stage only, therefore the extraction stage was selected for the criticality assessment.	N/A
Silicon metal		X	X	X	Global supply data was available at the refining stage only. Therefore the processing stage was selected for the criticality assessment.	Global supply data was available at the refining stage only. In addition, expert feedback indicated that there is no significant bottleneck at the extraction stage. Therefore, the processing stage was selected for the criticality assessment based on expert feedback and data availability.
Strontium	X		X	X	Yes	Limited data on metal stage
Sulphur		X	X	X	Global supply data was available at the refining stage only.	Global supply data was available at the refining stage only. Therefore the processing stage was selected for the criticality assessment.
Talc	X		X	X	Global supply data was available at the extraction stage only.	Global supply data was available at the extraction stage only. Further, there is no strong evidence indicating a bottleneck at the refining stage, therefore the extraction stage was selected for the criticality assessment.
Tantalum	X		X	X	Global supply data was available at the extraction stage only.	Global supply data was available at the extraction stage only. Further, there is no strong evidence indicating a bottleneck at the refining stage, therefore the extraction stage was selected for the criticality assessment.
Tellurium		X	X	X	Global and EU supply data was available at the processing stage only.	Global and EU supply data was available at the processing stage only, therefore the processing stage was selected for the criticality assessment. Tellurium is mainly produced as a by-product of copper refining, therefore the processing stage is only relevant for this assessment.
Zirconium	X		X	X	Yes	Limited data on metal stage

Annex 3. Additional details on the criticality assessment results

The following additional criticality assessment results are provided:

- Comparison of Supply Risk results using different supply data (Table 15)
- Comparison of the results of previous assessments (Table 16)
- Individual and average EI and SR results of the grouped materials – HREEs, LREEs and PGMs (Table 17)

Table 15 presents the results of the Supply Risk calculation when using different Supply Risk data, which is based either on global supply or EU sourcing data only, or based on both global supply and EU sourcing depending on the availability and quality of the data for a given material, according to 2 stages when available.

Legend

PGMs	Iridium, palladium, platinum, rhodium, ruthenium
LREEs	Cerium, lanthanum, neodymium, praseodymium and samarium
HREEs	Dysprosium, erbium, europium, gadolinium, holmium, lutetium, terbium, thulium, ytterbium, yttrium

Table 15: Comparison of SR results based on scope of supply data used

	Supply Risk parameters							
	I stage				II stage			
Material	GS	EUS	GS+EUS	IR	GS	EUS	GS+EUS	IR
Aggregates	n/a	0.21	0.21	1%				
Aluminium					1.38	0.25	0.59	59%
Antimony	2.41	1.62	2.01	100%	1.54	0.84	0.99	43%
Arsenic					1.73	1.11	1.19	32%
Baryte	1.13	1.33	1.26	70%				
Bauxite	0.68	3.12	2.06	87%				
Bentonite	0.46	0.50	0.50	15%				
Beryllium	2.29	0.00	2.29	0%	1.20	1.28	1.24	100%
Bismuth					3.48	1.80	2.22	50%
Borate	1.23	5.14	3.19	100%	1.37	2.23	1.80	100%
Cadmium					0.54	0.34	0.34	-178%
Cerium	6.65	3.13	4.89	100%	n/a	6.17	6.17	100%
Chromium	1.03	0.83	0.85	20%	1.12	0.72	0.86	66%
Cobalt	2.12	2.85	2.54	86%	1.16	0.39	0.49	27%
Coking coal	2.82	0.47	1.19	62%	3.38	0.34	0.34	-3%
Copper	0.36	0.31	0.32	44%	0.64	0.27	0.27	0%
Diatomite	0.62	0.46	0.46	-1%				
Dysprosium	6.79	3.12	4.95	100%	n/a	6.20	6.20	100%
Erbium	6.66	3.06	4.86	100%	n/a	6.09	6.09	100%
Europium	4.01	1.84	2.92	100%	n/a	3.66	3.66	100%
Feldspar	0.61	0.82	0.78	34%				
Fluorspar	2.45	0.51	1.15	66%	0.82	0.42	0.42	-19%
Gadolinium	6.63	3.05	4.84	100%	n/a	6.06	6.06	100%
Gallium					3.71	0.82	1.26	31%
Germanium					3.89	0.66	3.89	31%
Gold	0.19	0.00	0.19	n/a				
Gypsum	1.39	0.50	0.50	-25%				
Hafnium					1.12	1.72	1.12	0%
Helium					1.33	1.03	1.16	89%
Ho, Tm, Lu, Yb	6.72	3.09	4.91	100%	n/a	6.15	6.15	100%
Hydrogen	0.00	0.39	0.39	0%				
Indium					1.79	0.40	1.79	0%
Iridium					3.22	0.00	3.22	100%

	Supply Risk parameters							
	I stage				II stage			
Material	GS	EUS	GS+EUS	IR	GS	EUS	GS+EUS	IR
Iron ore	0.38	0.50	0.46	72%	1.04	0.17	0.19	4%
Kaolin clay	0.37	0.40	0.40	20%				
Lanthanum	6.50	5.29	5.89	100%	n/a	6.04	6.04	100%
Lead	0.43	0.06	0.09	15%	0.30	0.06	0.06	-1%
Limestone	0.02	0.20	0.20	5%				
Lithium	0.83	1.71	1.33	87%	1.48	1.81	1.64	100%
Magnesite	4.00	0.65	0.65	0%				
Magnesium					3.73	4.08	3.91	100%
Manganese	0.69	1.12	0.93	90%	2.01	0.37	0.53	20%
Molybdenum	1.36	0.52	0.94	100%	n/a	0.58	0.58	87%
Natural cork	0.82	0.98	0.98	0%				
Natural graphite	3.03	1.53	2.27	98%				
Natural Rubber	1.02	0.98	1.00	100%				
Natural Teak wood	1.31	2.47	1.89	100%				
Neodymium	6.54	5.32	5.93	100%	n/a	6.07	6.07	100%
Nickel	0.39	0.50	0.49	28%	0.59	0.26	0.37	67%
Niobium					4.19	3.60	3.90	100%
Palladium					1.27	0.00	1.27	93%
Perlite	0.42	0.97	0.42	-2%				
Phosphate rock	1.76	0.61	1.09	84%				
Phosphorus					3.32	3.78	3.55	100%
Platinum					1.84	0.00	1.84	98%
Potash	0.65	0.82	0.79	27%				
Praseodymium	5.91	4.81	5.36	100%	n/a	5.49	5.49	100%
Rhenium					0.45	0.91	0.45	22%
Rhodium					2.14	n/a	2.14	100%
Ruthenium					3.44	0.00	3.44	100%
Samarium	6.59	5.36	5.98	100%	n/a	6.12	6.12	100%
Sapele wood	0.00	2.27	2.27	100%				
Scandium					3.09	1.90	3.09	100%
Selenium					0.56	0.40	0.41	9%
Silica sand	0.41	0.39	0.39	0%				
Silicon metal					2.81	0.42	1.18	63%
Silver	0.43	0.74	0.68	40%	0.48	0.21	0.21	0%
Strontium	1.14	2.57	2.57	0%				
Sulphur					0.31	0.27	0.27	-35%
Talc	0.57	0.39	0.40	13%				
Tantalum	1.36	1.55	1.36	99%				
Tellurium					1.70	0.51	0.51	-14%
Terbium	6.02	2.77	4.40	100%	n/a	5.51	5.51	100%
Tin	0.90	0.57	0.90	0%	1.32	0.25	0.60	64%
Titanium	0.33	0.37	0.35	100%	1.26	0.00	1.26	100%
Tungsten	3.97	0.37	0.37	-397%	1.61	n/a	1.61	n/a
Vanadium	1.69	n/a	1.69	n/a	2.20	1.19	1.42	47%
Yttrium	4.59	2.11	3.35	100%	n/a	4.20	4.20	100%
Zinc	0.72	0.18	0.34	60%	0.82	0.17	0.17	-2%
Zirconium	0.68	0.99	0.83	100%				

Table 16 compares the results of the 2017 and previous assessments[54].

[54] The 2011 assessment used the following material groups: PGMs - palladium, platinum, iridium, rhodium, ruthenium and osmium. - REEs - yttrium, scandium, lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium and lutetium. Heavy Rare Earth Elements, Light Rare Earth Elements and Scandium were considered together as Rare Earth Elements.

Legend	
Critical	Identified as a critical raw material
Non-critical	Identified as a non-critical raw material
PGMs	Iridium, palladium, platinum, rhodium, ruthenium
LREEs	Cerium, lanthanum, neodymium, praseodymium and samarium
HREEs	Dysprosium, erbium, europium, gadolinium, holmium, lutetium, terbium, thulium, ytterbium, yttrium
-	Not assessed
SR*	In 2011 and 2014 assessments, the SR calculation was based on World Governance indicators

Table 16: Comparison of 2020 results and previous assessments*

Criticality studies	2011		2014		2017		2020	
Material	SR*	EI	SR*	EI	SR	EI	SR	EI
Aggregates	-	-	-	-	0.2	2.3	0.2	2.7
Aluminium	0.2	8.9	0.4	7.6	0.5	6.5	0.6	5.4
Antimony	2.6	5.8	2.5	7.1	4.3	4.3	2.0	4.8
Arsenic	-	-	-	-	-	-	1.2	2.6
Baryte	1.7	3.7	1.7	2.8	1.6	2.9	1.3	3.3
Bauxite	0.3	9.5	0.6	8.6	2	2.6	2.1	2.9
Bentonite	0.3	5.5	0.4	4.6	0.2	2.1	0.5	2.8
Beryllium	1.3	6.2	1.5	6.7	2.4	3.9	2.3	4.2
Bismuth	-	-	-	-	3.8	3.6	2.2	4.0
Borate	0.6	5	1	5.7	3	3.1	3.2	3.5
Cadmium	-	-	-	-	-	-	0.3	4.2
Chromium	0.8	9.9	1	8.9	0.9	6.8	0.9	7.3
Cobalt	1.1	7.2	1.6	6.7	1.6	5.7	2.5	5.9
Coking coal	-	-	1.2	9	1	2.3	1.2	3.0
Copper	0.2	5.7	0.2	5.8	0.2	4.7	0.3	5.3
Diatomite	0.3	3.7	0.2	3	0.3	3.8	0.5	2.2
Feldspar	0.2	5.2	0.4	4.8	0.6	2.4	0.8	2.8
Fluorspar	1.6	7.5	1.7	7.2	1.3	4.2	1.2	3.3
Gallium	2.5	6.5	1.8	6.3	1.4	3.2	1.3	3.5
Germanium	2.7	6.3	1.9	5.5	1.9	3.5	3.9	3.5
Gold	-	-	0.2	3.8	0.2	2	0.2	2.1
Gypsum	0.4	5	0.5	5.5	0.5	2.2	0.5	2.6
Hafnium	-	-	0.4	7.8	1.3	4.2	1.1	3.9
Helium	-	-	-	-	1.6	2.8	1.2	2.6
HREEs	4.9	5.8	4.7	5.4	4.9	3.7	5.6	3.9
Hydrogen	-	-	-	-	-	-	0.4	3.8

* The 2014 assessment used the following material groups: PGMs - palladium, platinum, rhodium, ruthenium, iridium and osmium. - LREEs - lanthanum, cerium, praseodymium, neodymium, and samarium. - HREEs - dysprosium, erbium, europium, gadolinium, holmium, lutetium, terbium, thulium, ytterbium, yttrium.

Indium	2	6.7	1.8	5.6	2.4	3.1	1.8	3.3
Iron ore	0.4	8.1	0.5	7.4	0.8	6.2	0.5	6.8
Kaolin clay	0.3	4.4	0.3	4.8	0.5	2.3	0.4	2.4
Lead	-	-	-	-	0.1	3.7	0.1	4.0
Limestone	0.7	6	0.4	5.8	0.1	2.5	0.2	3.5
Lithium	0.7	5.6	0.6	5.5	1	2.4	1.6	3.1
LREEs	4.9	5.8	3.1	5.2	5	3.6	6.0	4.3
Magnesite	0.9	8.9	2.2	8.3	0.7	3.7	0.6	3.2
Magnesium	2.6	6.5	2.5	5.5	4	7.1	3.9	6.6
Manganese	0.5	9.8	0.4	7.8	0.9	6.1	0.9	6.7
Molybdenum	0.5	8.9	0.9	5.9	0.9	5.2	0.9	6.2
Natural cork	-	-	-	-	1.1	1.5	1.0	1.6
Natural graphite	1.3	8.7	2.2	7.4	2.9	2.9	2.3	3.2
Natural Rubber	-	-	0.9	7.7	1	5.4	1.0	7.1
Natural Teak wood	-	-	-	-	0.9	2	1.9	2.0
Nickel	0.3	9.5	0.2	8.8	0.3	4.8	0.5	4.9
Niobium	2.8	9	2.5	5.9	3.1	4.8	3.9	6.0
Perlite	0.3	4.2	0.3	4.6	0.4	2.1	0.4	2.3
PGMs	3.6	6.7	1.2	6.6	2.5	5	2.4	5.7
Phosphate rock	-	-	1.1	5.8	1	5.1	1.1	5.6
Phosphorus	-	-	-	-	4.1	4.4	3.5	5.3
Potash	-	-	0.2	8.6	0.6	4.8	0.8	5.4
Rhenium	0.8	7.7	0.9	4.5	1	2	0.5	2.0
Sapele wood	-	-	-	-	1.4	1.3	2.3	1.4
Scandium	4.9	5.8	1.1	3.8	2.9	3.7	3.1	4.4
Selenium	-	-	0.2	6.9	0.4	4.5	0.4	4.9
Silica sand	0.2	5.8	0.3	5.8	0.3	2.6	0.4	2.9
Silicon metal	-	-	1.6	7.1	1	3.8	1.2	4.2
Silver	0.3	5.1	0.7	4.8	0.5	3.8	0.7	4.1
Strontium	-	-	-	-	-	-	2.6	3.5
Sulphur	-	-	-	-	0.6	4.6	0.3	4.1
Talc	0.3	4	0.3	5.1	0.4	3	0.4	4.0
Tantalum	1.1	7.4	0.6	7.4	1	3.9	1.4	4.0
Tellurium	0.6	7.9	0.2	6	0.7	3.4	0.5	3.6
Tin	-	-	0.9	6.7	0.8	4.4	0.9	4.2
Titanium	0.1	5.4	0.1	5.5	0.3	4.3	1.3	4.7
Tungsten	1.8	8.8	2	9.1	1.8	7.3	1.6	8.1
Vanadium	0.7	9.7	0.8	9.1	1.6	3.7	1.7	4.4
Zinc	0.4	9.4	0.5	8.7	0.3	4.5	0.3	5.4
Zirconium	-	-	-	-	-	-	0.8	3.2

The average and individual EI and SR scores for each of the individual materials categorised in groups are presented in Table 17 to provide additional information to consider when analysing the results. The SR and EI averages for the PGMs, HREEs and LREEs groups should be considered very carefully because they were not assessed separately in early assessments. PGMs and REEs were treated as single groups in 2011 assessment, and accordingly PGMs, HREEs and LREEs were treated as single groups in 2014. The average results of the five materials that are part of the PGMs group, 10 materials of HREEs group and 5 materials of LREEs group, are presented to allow backwards comparability.

Table 17: Individual and average EI and SR scores for material groups – LREEs, HREEs and PGMs

Materials	Supply Risk	Economic Importance	Import reliance (%)	EOL-RIR (%)	Supply data in SR
Cerium	6.2	3.5	100	1	EU sourcing
Lanthanum	6.0	1.5	100	1	
Neodymium	6.1	4.8	100	1	
Praseodymium	5.5	4.3	100	10	
Samarium	6.1	7.3	100	1	
Dysprosium	6.2	7.2	100	0	EU sourcing
Erbium	6.1	3.1	100	1	
Europium	3.7	3.3	100	38	
Gadolinium	6.1	4.6	100	1	
Ho, Tm, Lu, Yb	6.1	3.4	100	1	
Terbium	5.5	4.1	100	6	
Yttrium	4.2	3.5	100	31	
Iridium	3.2	4.2	100	14	Global supply only
Palladium	1.3	7.0	93	28	
Platinum	1.8	5.9	98	25	
Rhodium	2.1	7.4	100	28	
Ruthenium	3.4	4.1	100	11	
Group averages	Supply Risk	Economic Importance	Import reliance (%)	EOL-RIR (%)	Supply data in SR
LREEs	6.0	4.3	100	3	EU sourcing
HREEs	5.6	3.9	100	8	
PGMs	2.4	5.7	98	21	Global supply only

Annex 4. Substitution indexes

Material	SI (EI)	SI (SR)	Material	SI (EI)	SI (SR)
Aggregates	0.93	0.97	Magnesium	0.93	0.94
Aluminium	0.80	0.88	Manganese	1.00	1.00
Antimony	0.92	0.94	Molybdenum	1.00	1.00
Arsenic	0.85	0.94	Natural cork	0.91	0.91
Baryte	0.95	0.96	Natural graphite	0.99	0.99
Bauxite	0.99	1.00	Natural Rubber	0.99	0.99
Bentonite	0.99	0.99	Natural Teak wood	0.90	0.90
Beryllium	0.99	0.99	Neodymium	0.93	0.98
Bismuth	0.96	0.94	Nickel	0.83	0.90
Borate	1.00	1.00	Niobium	0.97	0.98
Cadmium	0.92	0.91	Palladium	0.92	0.98
Cerium	0.95	0.99	Perlite	0.88	0.92
Chromium	1.00	1.00	Phosphate rock	1.00	1.00
Cobalt	0.92	0.92	Phosphorus	1.00	1.00
Coking coal	0.99	0.99	Platinum	0.85	0.98
Copper	0.93	0.93	Potash	1.00	1.00
Diatomite	0.96	0.96	Praseodymium	0.93	0.97
Dysprosium	0.95	1.00	Rhenium	0.98	1.00
Erbium	0.96	0.99	Rhodium	0.99	0.99
Europium	0.79	0.95	Ruthenium	0.92	0.96
Feldspar	0.99	0.99	Samarium	0.98	0.98
Fluorspar	0.89	0.88	Sapele wood	0.94	0.94
Gadolinium	0.92	0.99	Scandium	1.00	0.95
Gallium	0.98	0.98	Selenium	0.90	0.95
Germanium	0.95	0.95	Silica sand	0.97	0.97
Gold	0.98	0.99	Silicon metal	0.99	0.99
Gypsum	0.88	0.96	Silver	0.95	0.97
Hafnium	0.91	0.96	Strontium	0.93	0.90
Helium	0.94	0.96	Sulphur	0.99	0.99
Ho, Tm, Lu, Yb	1.00	1.00	Talc	0.98	0.99
Hydrogen	1.00	1.00	Tantalum	0.95	0.96
Indium	0.97	0.98	Tellurium	0.86	0.93
Iridium	0.91	0.95	Terbium	0.79	0.95
Iron ore	0.93	0.95	Tin	0.90	0.91
Kaolin clay	0.96	0.97	Titanium	0.92	0.96
Lanthanum	0.89	0.97	Tungsten	0.95	0.98
Lead	0.96	0.96	Vanadium	0.98	0.99
Limestone	0.90	0.98	Yttrium	0.98	0.99
Lithium	0.93	0.93	Zinc	0.93	0.96
Magnesite	0.98	0.99	Zirconium	0.96	0.97

Annex 5. End uses, NACE2 sectors assignement

Material	Application	Share	NACE sector	VA
Aggregates	Construction	100%	C23 - Manufacture of other non-metallic mineral products	57,255
Aluminium	Construction	23%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Aluminium	Mobility (Transport and Automotive)	21%	C29 - Manufacture of motor vehicles, trailers and semi-trailers	160,603
Aluminium	Mobility (Transport and Automotive)	21%	C30 - Manufacture of other transport equipment	44,304
Aluminium	Packaging	17%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Aluminium	High Tech Engineering	12%	C28 - Manufacture of machinery and equipment n.e.c.	182,589
Aluminium	Consumer Durables	6%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Antimony	Flame retardants	43%	C20 - Manufacture of chemicals and chemical products	105,514
Antimony	Lead-acid batteries	32%	C27 - Manufacture of electrical equipment	80,745
Antimony	Lead alloys	14%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Antimony	Plastics (catalysts and stabilisers)	6%	C20 - Manufacture of chemicals and chemical products	105,514
Antimony	Glass and ceramics	5%	C23 - Manufacture of other non-metallic mineral products	57,255
Arsenic	Zinc production	71%	C24 - Manufacture of basic metals	55,426
Arsenic	Glassmaking	18%	C23 - Manufacture of other non-metallic mineral products	57,255
Arsenic	Chemicals	7%	C20 - Manufacture of chemicals and chemical products	105,514
Arsenic	Alloys	5%	C24 - Manufacture of basic metals	55,426
Arsenic	Electronics	0%	C26 - Manufacture of computer, electronic and optical products	65,703
Baryte	Weighting agent in oil and gas well drilling fluids or "muds"	60%	C23 - Manufacture of other non-metallic mineral products	57,255
Baryte	Filler in rubbers, plastics, paints & paper	30%	C22 - Manufacture of rubber and plastic products	75,980
Baryte	Chemical industry	10%	C20 - Manufacture of chemicals and chemical products	105,514
Bauxite	Refining to alumina	90%	C24 - Manufacture of basic metals	55,426

Material	Application	Share	NACE sector	VA
Bauxite	Refractories	3%	C23 - Manufacture of other non-metallic mineral products	57,255
Bauxite	Cement	3%	C23 - Manufacture of other non-metallic mineral products	57,255
Bauxite	Abrasives	2%	C23 - Manufacture of other non-metallic mineral products	57,255
Bauxite	Chemicals	2%	C20 - Manufacture of chemicals and chemical products	105,514
Bentonite	Pet litter	34%	C23 - Manufacture of other non-metallic mineral products	57,255
Bentonite	Foundry molding sands	22%	C24 - Manufacture of basic metals	55,426
Bentonite	Civil engineering	13%	C23 - Manufacture of other non-metallic mineral products	57,255
Bentonite	Food and wine production	3%	C11 - Manufacture of beverages	32,505
Bentonite	Pelletizing of iron ore	8%	C24 - Manufacture of basic metals	55,426
Bentonite	Oil absorbents	8%	C20 - Manufacture of chemicals and chemical products	105,514
Bentonite	Paper	3%	C17 - Manufacture of paper and paper products	38,910
Bentonite	Specialties and drilling fluids	7%	B09 - Mining support service activities	3,400
Bentonite	Others	2%	C20 - Manufacture of chemicals and chemical products	105,514
Beryllium	Electronic and telecommunications equipments	42%	C26 - Manufacture of computer, electronic and optical products	65,703
Beryllium	Transport and Defence : Vehicle electronics	17%	C26 - Manufacture of computer, electronic and optical products	65,703
Beryllium	Transport and Defence : Auto components	17%	C29 - Manufacture of motor vehicles, trailers and semi-trailers	160,603
Beryllium	Transport and Defence : Aerospace components	10%	C30 - Manufacture of other transport equipment	44,304
Beryllium	Energy application	8%	C26 - Manufacture of computer, electronic and optical products	65,703
Beryllium	Industrial components : Moulds	3%	C28 - Manufacture of machinery and equipment n.e.c.	182,589
Beryllium	Industrial components : Metal	3%	C24 - Manufacture of basic metals	55,426
Beryllium	Others	0%	0	0
Bismuth	Chemicals	62%	C20 - Manufacture of chemicals and chemical products	105,514
Bismuth	Low-melting alloys	28%	C32 - Other manufacturing	39,160
Bismuth	Metallurgical additives	10%	C24 - Manufacture of basic metals	55,426
Borate	Glass	55%	C23 - Manufacture of other non-metallic mineral products	57,255

Material	Application	Share	NACE sector	VA
Borate	Frits and Ceramics	17%	C23 - Manufacture of other non-metallic mineral products	57,255
Borate	Fertilisers	15%	C20 - Manufacture of chemicals and chemical products	105,514
Borate	Chemicals manufacture	4%	C20 - Manufacture of chemicals and chemical products	105,514
Borate	Construction materials (flame retardants, plasters, wood preservatives)	4%	C20 - Manufacture of chemicals and chemical products	105,514
Borate	Metals	4%	C24 - Manufacture of basic metals	55,426
Borate	Other	0%	0	0
Cadmium	Batteries	80%	C27 - Manufacture of electrical equipment	80,745
Cadmium	Pigments	11%	C20 - Manufacture of chemicals and chemical products	105,514
Cadmium	Coatings	7%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Cadmium	Stabilizers	2%	C20 - Manufacture of chemicals and chemical products	105,514
Cadmium	Others	0%	0	0
Cerium	Autocatalysts	35%	C20 - Manufacture of chemicals and chemical products	105,514
Cerium	Glass&Ceramics	33%	C23 - Manufacture of other non-metallic mineral products	57,255
Cerium	Polishing powders	11%	C26 - Manufacture of computer, electronic and optical products	65,703
Cerium	Fluid Cracking Catalysts	8%	C19 - Manufacture of coke and refined petroleum products	17,289
Cerium	Metal (excl. Batteries)	6%	C24 - Manufacture of basic metals	55,426
Cerium	Batteries	6%	C27 - Manufacture of electrical equipment	80,745
Cerium	Lighting	1%	C27 - Manufacture of electrical equipment	80,745
Chromium	Products made of Stainless Steel	74%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Chromium	Products made of Alloy Steel	19%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Chromium	Casting Molds	3%	C24 - Manufacture of basic metals	55,426
Chromium	Products made of chromium chemicals	3%	C20 - Manufacture of chemicals and chemical products	105,514
Chromium	Refractory bricks and mortars	1%	C23 - Manufacture of other non-metallic mineral products	57,255

Material	Application	Share	NACE sector	VA
Chromium	Other uses	0%	0	0
Cobalt	Superalloys, hardfacing/HSS and other alloys	36%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Cobalt	Hard materials (carbides and diamond tools)	14%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Cobalt	Pigments and Inks	13%	C20 - Manufacture of chemicals and chemical products	105,514
Cobalt	Catalysts	12%	C20 - Manufacture of chemicals and chemical products	105,514
Cobalt	Tyre adhesives and paint dryers	11%	C20 - Manufacture of chemicals and chemical products	105,514
Cobalt	Magnets	7%	C27 - Manufacture of electrical equipment	80,745
Cobalt	Other – Biotech, Surface Treatment, etc	6%	C20 - Manufacture of chemicals and chemical products	105,514
Cobalt	Battery	3%	C27 - Manufacture of electrical equipment	80,745
Coking coal	Coke for steel production	82%	C24 - Manufacture of basic metals	55,426
Coking coal	Coke for other applications	9%	C23 - Manufacture of other non-metallic mineral products	57,255
Coking coal	Other uses (tar, benzole, electricity and heat)	8%	C20 - Manufacture of chemicals and chemical products	105,514
Copper	Automotive	6%	C29 - Manufacture of motor vehicles, trailers and semi-trailers	160,603
Copper	Digital appliances	14%	C26 - Manufacture of computer, electronic and optical products	65,703
Copper	Jewellery	5%	C32 - Other manufacturing	39,160
Copper	Ships, trucks and armored vehicles	10%	C20 - Manufacture of chemicals and chemical products	105,514
Copper	Subparts of interior	2%	C31 - Manufacture of furniture	26,171
Copper	Oxides and dopants	3%	C20 - Manufacture of chemicals and chemical products	105,514
Copper	Electrolytic refined copper	2%	C24 - Manufacture of basic metals	55,426
Copper	Components and household	22%	C27 - Manufacture of electrical equipment	80,745
Copper	Tubes, plates, wire	21%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Copper	Machinery	15%	C28 - Manufacture of machinery and equipment n.e.c.	182,589
Diatomite	Food industry	48%	C11 - Manufacture of beverages	32,505

Material	Application	Share	NACE sector	VA
Diatomite	Pellettizing iron ore	23%	C23 - Manufacture of other non-metallic mineral products	57,255
Diatomite	Activated raw granules	13%	C23 - Manufacture of other non-metallic mineral products	57,255
Diatomite	Pet litter	7%	C23 - Manufacture of other non-metallic mineral products	57,255
Diatomite	Civil engineering	6%	C23 - Manufacture of other non-metallic mineral products	57,255
Diatomite	Drilling fluids	2%	B09 - Mining support service activities	3,400
Diatomite	Foundry molding sands	1%	C24 - Manufacture of basic metals	55,426
Dysprosium	Magnets	100%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Erbium	Glass - Optical applications	74%	C23 - Manufacture of other non-metallic mineral products	57,255
Erbium	Lighting	26%	C27 - Manufacture of electrical equipment	80,745
Europium	Lighting	100%	C27 - Manufacture of electrical equipment	80,745
Feldspar	Ceramics (tiles, sanitaryware, tableware, glazes)	45%	C23 - Manufacture of other non-metallic mineral products	57,255
Feldspar	Glass (container, float, fiberglass, specialties)	6%	C23 - Manufacture of other non-metallic mineral products	57,255
Feldspar	Constructions, brick, tiles	46%	C23 - Manufacture of other non-metallic mineral products	57,255
Feldspar	Others	3%	0	0
Fluorspar	Steel and iron making	36%	C24 - Manufacture of basic metals	55,426
Fluorspar	Refrigeration and air conditioning	9%	C27 - Manufacture of electrical equipment	80,745
Fluorspar	Refrigeration and air conditioning	9%	C29 - Manufacture of motor vehicles, trailers and semi-trailers	160,603
Fluorspar	Aluminium making and other metallurgy	15%	C24 - Manufacture of basic metals	55,426
Fluorspar	Solid fluoropolymers for cookware coating and cable insulation	11%	C27 - Manufacture of electrical equipment	80,745
Fluorspar	Fluorochemicals	10%	C20 - Manufacture of chemicals and chemical products	105,514
Fluorspar	UF6 in nuclear uranium fuel	6%	C24 - Manufacture of basic metals	55,426
Fluorspar	HF in alkylation process for oil refining	3%	C19 - Manufacture of coke and refined petroleum products	17,289
Gadolinium	Magnets	38%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Gadolinium	Metal (excl. Batteries)	30%	C24 - Manufacture of basic metals	55,426

Material	Application	Share	NACE sector	VA
Gadolinium	Lighting	25%	C27 - Manufacture of electrical equipment	80,745
Gadolinium	Magnetic Resonance Imaging - MRI	8%	C21 - Manufacture of basic pharmaceutical products and pharmaceutical preparations	80,180
Gadolinium	Other	0%	0	0
Gallium	Integrated circuits	70%	C26 - Manufacture of computer, electronic and optical products	65,703
Gallium	Lighting	25%	C27 - Manufacture of electrical equipment	80,745
Gallium	CIGS solar cells	5%	C26 - Manufacture of computer, electronic and optical products	65,703
Germanium	Infrared optics	47%	C26 - Manufacture of computer, electronic and optical products	65,703
Germanium	Optical fibres	40%	C27 - Manufacture of electrical equipment	80,745
Germanium	Satellite solar cells	13%	C26 - Manufacture of computer, electronic and optical products	65,703
Germanium	Others	0%	0	0
Gold	Jewellery	86%	C32 - Other manufacturing	39,160
Gold	Electronics	11%	C26 - Manufacture of computer, electronic and optical products	65,703
Gold	Other industrial applications	2%	C32 - Other manufacturing	39,160
Gold	Dental	1%	C32 - Other manufacturing	39,160
Gypsum	Plasterboard and Wallboard	51%	C23 - Manufacture of other non-metallic mineral products	57,255
Gypsum	Building plaster	26%	C23 - Manufacture of other non-metallic mineral products	57,255
Gypsum	Cement production	17%	C23 - Manufacture of other non-metallic mineral products	57,255
Gypsum	Agriculture	6%	C23 - Manufacture of other non-metallic mineral products	57,255
Hafnium	Superalloy	61%	C24 - Manufacture of basic metals	55,426
Hafnium	Catalyst precursor	7%	C20 - Manufacture of chemicals and chemical products	105,514
Hafnium	Plasma cutting tips	15%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Hafnium	Nuclear control rod	11%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Hafnium	Oxide for Optical	3%	C26 - Manufacture of computer, electronic and optical products	65,703
Hafnium	Semiconductors	3%	C26 - Manufacture of computer, electronic and optical products	65,703

Material	Application	Share	NACE sector	VA
Hafnium	Others	0%	0	0
Helium	Controlled atmospheres	23%	C24 - Manufacture of basic metals	55,426
Helium	Cryogenics	22%	C32 - Other manufacturing	39,160
Helium	Balloons	14%	C32 - Other manufacturing	39,160
Helium	Pressurisation and purging	9%	C32 - Other manufacturing	39,160
Helium	Analysis	9%	C32 - Other manufacturing	39,160
Helium	Welding	8%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Helium	Semiconductors, optic fibres	8%	C26 - Manufacture of computer, electronic and optical products	65,703
Helium	Leak detection	7%	C33 - Repair and installation of machinery and equipment	52,332
Ho, Tm, Lu, Yb	Glass - Optical applications	100%	C26 - Manufacture of computer, electronic and optical products	65,703
Hydrogen	Ammonia production	50%	C20 - Manufacture of chemicals and chemical products	105,514
Hydrogen	Refineries	30%	C19 - Manufacture of coke and refined petroleum products	17,289
Hydrogen	Methanol production	13%	C20 - Manufacture of chemicals and chemical products	105,514
Hydrogen	Metal processing	6%	C24 - Manufacture of basic metals	55,426
Hydrogen	Others	1%	C32 - Other manufacturing	39,160
Indium	Flat panel displays	60%	C26 - Manufacture of computer, electronic and optical products	65,703
Indium	Solders	11%	C26 - Manufacture of computer, electronic and optical products	65,703
Indium	PV cells	9%	C26 - Manufacture of computer, electronic and optical products	65,703
Indium	Thermal interface material	7%	C26 - Manufacture of computer, electronic and optical products	65,703
Indium	Batteries	5%	C27 - Manufacture of electrical equipment	80,745
Indium	Alloys/compounds	4%	C24 - Manufacture of basic metals	55,426
Indium	Semiconductors & LEDs	3%	C26 - Manufacture of computer, electronic and optical products	65,703
Indium	Other	0%	0	0
Iridium	Electrochemical	48%	C20 - Manufacture of chemicals and chemical products	105,514
Iridium	Other	0%	C29 - Manufacture of motor vehicles, trailers and semi-trailers	160,603

Material	Application	Share	NACE sector	VA
Iridium	Electronics	39%	C26 - Manufacture of computer, electronic and optical products	65,703
Iridium	Chemical	13%	C20 - Manufacture of chemicals and chemical products	105,514
Iron ore	Steel in Construction	35%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Iron ore	Steel in Automotive	20%	C29 - Manufacture of motor vehicles, trailers and semi-trailers	160,603
Iron ore	Steel in Mechanical engineering	15%	C28 - Manufacture of machinery and equipment n.e.c.	182,589
Iron ore	Steel in Metalware	14%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Iron ore	Steel in Tubes	11%	C24 - Manufacture of basic metals	55,426
Iron ore	Steel in Domestic appliances	2%	C28 - Manufacture of machinery and equipment n.e.c.	182,589
Iron ore	Steel in Other transport	2%	C30 - Manufacture of other transport equipment	44,304
Iron ore	Other	0%	0	0
Kaolin clay	Ceramics	47%	C23 - Manufacture of other non-metallic mineral products	57,255
Kaolin clay	Paper	29%	C17 - Manufacture of paper and paper products	38,910
Kaolin clay	Fiberglass	6%	C23 - Manufacture of other non-metallic mineral products	57,255
Kaolin clay	Refractories	5%	C23 - Manufacture of other non-metallic mineral products	57,255
Kaolin clay	Catalysts	4%	C19 - Manufacture of coke and refined petroleum products	17,289
Kaolin clay	Others	4%	0	0
Kaolin clay	Paints and adhesives	4%	C20 - Manufacture of chemicals and chemical products	105,514
Kaolin clay	Rubber and plastics	1%	C22 - Manufacture of rubber and plastic products	75,980
Kaolin clay	Cement	1%	C23 - Manufacture of other non-metallic mineral products	57,255
Lanthanum	Fluid Cracking Catalysts	67%	C19 - Manufacture of coke and refined petroleum products	17,289
Lanthanum	Glass&Ceramics	13%	C23 - Manufacture of other non-metallic mineral products	57,255
Lanthanum	Batteries	10%	C27 - Manufacture of electrical equipment	80,745
Lanthanum	Polishing powders	5%	C26 - Manufacture of	65,703

Material	Application	Share	NACE sector	VA
			computer, electronic and optical products	
Lanthanum	Metal (excl.Batteries)	3%	C24 - Manufacture of basic metals	55,426
Lanthanum	Lighting	2%	C27 - Manufacture of electrical equipment	80,745
Lead	Batteries	84%	C27 - Manufacture of electrical equipment	80,745
Lead	Rolled and extruded products	6%	C24 - Manufacture of basic metals	55,426
Lead	Lead compounds	4%	C20 - Manufacture of chemicals and chemical products	105,514
Lead	Shot/ammunition	4%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Lead	Cable sheathing	1%	C27 - Manufacture of electrical equipment	80,745
Lead	Alloys and solders	1%	C24 - Manufacture of basic metals	55,426
Limestone	Cement & concrete, plaster & mortar, roadworks	31%	C23 - Manufacture of other non-metallic mineral products	57,255
Limestone	Manufacture of basic metals	8%	C24 - Manufacture of basic metals	55,426
Limestone	Paper, plastics and rubber	31%	C20 - Manufacture of chemicals and chemical products	105,514
Limestone	Agriculture	5%	C20 - Manufacture of chemicals and chemical products	105,514
Limestone	Others (Glass & ceramics,chemicals, water treatment)	6%	C23 - Manufacture of other non-metallic mineral products	57,255
Limestone	Paint, coating, adhesives	6%	C20 - Manufacture of chemicals and chemical products	105,514
Limestone	Flue Gas Desulfurisation	9%	E39 - Remediation activities and other waste management services	1,301
Limestone	Feed	4%	C10 - Manufacture of food products	155,880
Lithium	Glass and ceramics	66%	C23 - Manufacture of other non-metallic mineral products	57,255
Lithium	Lubricating greases	9%	C20 - Manufacture of chemicals and chemical products	105,514
Lithium	Cement production	9%	C23 - Manufacture of other non-metallic mineral products	57,255
Lithium	Steel casting	5%	C24 - Manufacture of basic metals	55,426
Lithium	Pharmaceutical products	4%	C21 - Manufacture of basic pharmaceutical products and pharmaceutical preparations	80,180
Lithium	Rubber and plastics production	4%	C22 - Manufacture of rubber and plastic products	75,980
Lithium	Al-Li alloys	2%	C25 - Manufacture of fabricated metal products,	148,351

Material	Application	Share	NACE sector	VA
			except machinery and equipment	
Lithium	Batteries and products containing batteries	1%	C27 - Manufacture of electrical equipment	80,745
Magnesite	Steel making	57%	C24 - Manufacture of basic metals	55,426
Magnesite	Paper industry	12%	C17 - Manufacture of paper and paper products	38,910
Magnesite	Cement making	9%	C23 - Manufacture of other non-metallic mineral products	57,255
Magnesite	Agriculture (1 of 2)	7%	C20 - Manufacture of chemicals and chemical products	105,514
Magnesite	Agriculture (2 of 2)	7%	C10 - Manufacture of food products	155,880
Magnesite	Ceramics	5%	C23 - Manufacture of other non-metallic mineral products	57,255
Magnesite	Glass making	3%	C23 - Manufacture of other non-metallic mineral products	57,255
Magnesite	Others	0%	0	0
Magnesium	Transportation (Automotive)	50%	C29 - Manufacture of motor vehicles, trailers and semi-trailers	160,603
Magnesium	Packaging	21%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Magnesium	Desulfurisation agent	12%	C24 - Manufacture of basic metals	55,426
Magnesium	Construction	13%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Magnesium	Transportation (Air, Marine, Train)	4%	C30 - Manufacture of other transport equipment	44,304
Magnesium	Other applications	0%	0	0
Manganese	Steel (construction)	25%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Manganese	Steel (automotive)	14%	C29 - Manufacture of motor vehicles, trailers and semi-trailers	160,603
Manganese	Steel (mechanical engineering)	13%	C24 - Manufacture of basic metals	55,426
Manganese	Steel (structural steelworks)	11%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Manganese	Steel (tubes)	10%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351

Material	Application	Share	NACE sector	VA
Manganese	Steel (metalware)	10%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Manganese	Non-steel alloys	6%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Manganese	Chemical manufacture	5%	C20 - Manufacture of chemicals and chemical products	105,514
Manganese	Steel (domestic appliances)	4%	C27 - Manufacture of electrical equipment	80,745
Manganese	Batteries (cathodes)	2%	C27 - Manufacture of electrical equipment	80,745
Molybdenum	Engineering steels	40%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Molybdenum	Stainless steels	23%	C19 - Manufacture of coke and refined petroleum products	17,289
Molybdenum	Chemicals	13%	C20 - Manufacture of chemicals and chemical products	105,514
Molybdenum	Foundries	8%	C28 - Manufacture of machinery and equipment n.e.c.	182,589
Molybdenum	Tool steels	8%	C28 - Manufacture of machinery and equipment n.e.c.	182,589
Molybdenum	Mo-Metals	6%	C28 - Manufacture of machinery and equipment n.e.c.	182,589
Molybdenum	Nickel alloys	2%	C28 - Manufacture of machinery and equipment n.e.c.	182,589
Natural cork	Wine corks	70%	C11 - Manufacture of beverages	32,505
Natural cork	Insulation, building materials	20%	C16 - Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	27,967
Natural cork	General furniture	5%	C31 - Manufacture of furniture	26,171
Natural cork	Leisure	2%	C32 - Other manufacturing	39,160
Natural cork	Gaskets, expansion	1%	C29 - Manufacture of motor vehicles, trailers and semi-trailers	160,603
Natural cork	Gaskets, expansion	1%	C28 - Manufacture of machinery and equipment n.e.c.	182,589
Natural cork	Gaskets, expansion	1%	C30 - Manufacture of other transport equipment	44,304
Natural graphite	Refractories for steelmaking	53%	C24 - Manufacture of basic metals	55,426
Natural graphite	Foundries	15%	C23 - Manufacture of other non-metallic mineral products	57,255

Material	Application	Share	NACE sector	VA
Natural graphite	Graphite shapes	2%	C28 - Manufacture of machinery and equipment n.e.c.	182,589
Natural graphite	Batteries	9%	C27 - Manufacture of electrical equipment	80,745
Natural graphite	Lubricants	6%	C20 - Manufacture of chemicals and chemical products	105,514
Natural graphite	Recarburising	5%	C24 - Manufacture of basic metals	55,426
Natural graphite	Pencils	5%	C23 - Manufacture of other non-metallic mineral products	57,255
Natural graphite	Friction products	6%	C23 - Manufacture of other non-metallic mineral products	57,255
Natural Rubber	Automotive	75%	C29 - Manufacture of motor vehicles, trailers and semi-trailers	160,603
Natural Rubber	Other transport equipment	14%	C30 - Manufacture of other transport equipment	44,304
Natural Rubber	Machinery and offshore	6%	C28 - Manufacture of machinery and equipment n.e.c.	182,589
Natural Rubber	Furniture	2%	C31 - Manufacture of furniture	26,171
Natural Rubber	Packaging	1%	C22 - Manufacture of rubber and plastic products	75,980
Natural Rubber	Household appliances	1%	C27 - Manufacture of electrical equipment	80,745
Natural Rubber	Sportswear	1%	C32 - Other manufacturing	39,160
Natural Teak wood	Yachts, sailing boats	90%	C30 - Manufacture of other transport equipment	44,304
Natural Teak wood	High end furniture	10%	C31 - Manufacture of furniture	26,171
Neodymium	Magnets	41%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Neodymium	Batteries	14%	C27 - Manufacture of electrical equipment	80,745
Neodymium	Metal (excl. Batteries)	13%	C24 - Manufacture of basic metals	55,426
Neodymium	Ceramics	12%	C23 - Manufacture of other non-metallic mineral products	57,255
Neodymium	Glass	9%	C23 - Manufacture of other non-metallic mineral products	57,255
Neodymium	Catalysts	7%	C20 - Manufacture of chemicals and chemical products	105,514
Neodymium	Lasers	3%	C26 - Manufacture of computer, electronic and optical products	65,703
Neodymium	Other	0%	0	0
Nickel	Engineering (Steel)	39%	C28 - Manufacture of machinery and equipment n.e.c.	182,589

Material	Application	Share	NACE sector	VA
Nickel	Metal goods (Steel)	21%	C24 - Manufacture of basic metals	55,426
Nickel	Transport (Steel)	19%	C30 - Manufacture of other transport equipment	44,304
Nickel	Electrical and Electronics (Steel)	11%	C27 - Manufacture of electrical equipment	80,745
Nickel	Building and construction (Steel)	10%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Niobium	Automotive (Steel)	23%	C29 - Manufacture of motor vehicles, trailers and semi-trailers	160,603
Niobium	Construction (Steel)	45%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Niobium	Stainless Steel	10%	C24 - Manufacture of basic metals	55,426
Niobium	Oil & Gas	17%	C24 - Manufacture of basic metals	55,426
Niobium	Special Steel	3%	C30 - Manufacture of other transport equipment	44,304
Palladium	Autocatalyst	87%	C29 - Manufacture of motor vehicles, trailers and semi-trailers	160,603
Palladium	Electronics	4%	C26 - Manufacture of computer, electronic and optical products	65,703
Palladium	Chemical	4%	C20 - Manufacture of chemicals and chemical products	105,514
Palladium	Dental	2%	C32 - Other manufacturing	39,160
Palladium	Jewellery	2%	C32 - Other manufacturing	39,160
Palladium	Other	0%	0	0
Palladium	Investment	0%	0	0
Perlite	Building construction products	59%	C23 - Manufacture of other non-metallic mineral products	57,255
Perlite	Filter aid	24%	C11 - Manufacture of beverages	32,505
Perlite	Horticultural aggregate	11%	C23 - Manufacture of other non-metallic mineral products	57,255
Perlite	Fillers	6%	C23 - Manufacture of other non-metallic mineral products	57,255
Phosphate rock	Mineral fertilizer	86%	C20 - Manufacture of chemicals and chemical products	105,514
Phosphate rock	Animal feed	10%	C10 - Manufacture of food products	155,880
Phosphate rock	Detergents, chemicals, food additives	4%	C20 - Manufacture of chemicals and chemical products	105,514
Phosphorus	Chemicals	90%	C20 - Manufacture of chemicals and chemical products	105,514

Material	Application	Share	NACE sector	VA
Phosphorus	Metals	1%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Phosphorus	Electronics	5%	C26 - Manufacture of computer, electronic and optical products	65,703
Phosphorus	Agrochemicals	4%	C20 - Manufacture of chemicals and chemical products	105,514
Platinum	Autocatalyst	77%	C29 - Manufacture of motor vehicles, trailers and semi-trailers	160,603
Platinum	Jewellery	10%	C32 - Other manufacturing	39,160
Platinum	Chemical	6%	C20 - Manufacture of chemicals and chemical products	105,514
Platinum	Other	0%	0	0
Platinum	Medical and Biomedical	4%	C32 - Other manufacturing	39,160
Platinum	Investment	0%	0	0
Platinum	Petroleum	2%	C19 - Manufacture of coke and refined petroleum products	17,289
Platinum	Electronics	1%	C26 - Manufacture of computer, electronic and optical products	65,703
Platinum	Glass	1%	C23 - Manufacture of other non-metallic mineral products	57,255
Potash	Fertiliser	92%	C20 - Manufacture of chemicals and chemical products	105,514
Potash	Chemical manufacture	8%	C20 - Manufacture of chemicals and chemical products	105,514
Praseodymium	Magnets	27%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Praseodymium	Ceramics	17%	C23 - Manufacture of other non-metallic mineral products	57,255
Praseodymium	Batteries	13%	C27 - Manufacture of electrical equipment	80,745
Praseodymium	Metal (excl. Batteries)	12%	C24 - Manufacture of basic metals	55,426
Praseodymium	Catalysts	11%	C20 - Manufacture of chemicals and chemical products	105,514
Praseodymium	Polishing powders	11%	C26 - Manufacture of computer, electronic and optical products	65,703
Praseodymium	Glass	9%	C23 - Manufacture of other non-metallic mineral products	57,255
Praseodymium	Other	0%	0	0
Rhenium	Aerospace	83%	C30 - Manufacture of other transport equipment	44,304
Rhenium	Catalysts in petroleum industry	17%	C19 - Manufacture of coke and refined petroleum products	17,289

Material	Application	Share	NACE sector	VA
Rhenium	Others	0%	0	0
Rhodium	Autocatalyst	84%	C29 - Manufacture of motor vehicles, trailers and semi-trailers	160,603
Rhodium	Glass	10%	C23 - Manufacture of other non-metallic mineral products	57,255
Rhodium	Chemical	6%	C20 - Manufacture of chemicals and chemical products	105,514
Rhodium	Other	0%	0	0
Rhodium	Electronics	0%	C26 - Manufacture of computer, electronic and optical products	65,703
Ruthenium	Chemical	30%	C20 - Manufacture of chemicals and chemical products	105,514
Ruthenium	Electronics	48%	C26 - Manufacture of computer, electronic and optical products	65,703
Ruthenium	Electrochemical	22%	C20 - Manufacture of chemicals and chemical products	105,514
Ruthenium	Other	0%	0	0
Samarium	Magnets	97%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Samarium	Medical and optical applications	3%	C26 - Manufacture of computer, electronic and optical products	65,703
Sapele wood	Construction material	80%	C16 - Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	27,967
Sapele wood	Furniture	10%	C31 - Manufacture of furniture	26,171
Sapele wood	Boats	10%	C30 - Manufacture of other transport equipment	44,304
Scandium	Solid Oxide Fuel Cells (SOFCs)	91%	C27 - Manufacture of electrical equipment	80,745
Scandium	Al-Sc alloys	9%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Scandium	Others	0%	0	0
Selenium	Metallurgy	40%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Selenium	Glass manufacturing	25%	C23 - Manufacture of other non-metallic mineral products	57,255
Selenium	Electronics	10%	C26 - Manufacture of computer, electronic and optical products	65,703
Selenium	Pigments	10%	C20 - Manufacture of chemicals and chemical products	105,514
Selenium	Agricultural/ biological products	10%	C20 - Manufacture of chemicals and chemical	105,514

Material	Application	Share	NACE sector	VA
			products	
Selenium	Other Applications	5%	C20 - Manufacture of chemicals and chemical products	105,514
Silica sand	Construction and Soil	37%	C23 - Manufacture of other non-metallic mineral products	57,255
Silica sand	Glass	31%	C23 - Manufacture of other non-metallic mineral products	57,255
Silica sand	Others	16%	C23 - Manufacture of other non-metallic mineral products	57,255
Silica sand	Foundry	13%	C24 - Manufacture of basic metals	55,426
Silica sand	Filler, extender and sealant	3%	C22 - Manufacture of rubber and plastic products	75,980
Silica sand	Oil field	0%	B06 - Extraction of crude petroleum and natural gas	19,750
Silicon metal	Chemical applications	54%	C20 - Manufacture of chemicals and chemical products	105,514
Silicon metal	Aluminium alloys	38%	C24 - Manufacture of basic metals	55,426
Silicon metal	Solar applications	6%	C26 - Manufacture of computer, electronic and optical products	65,703
Silicon metal	Electronic applications	2%	C26 - Manufacture of computer, electronic and optical products	65,703
Silver	Jewelery, Silverware, recreative products	31%	C32 - Other manufacturing	39,160
Silver	Paints, oxides, photograph	18%	C20 - Manufacture of chemicals and chemical products	105,514
Silver	Automotive	8%	C29 - Manufacture of motor vehicles, trailers and semi-trailers	160,603
Silver	Batteries	7%	C27 - Manufacture of electrical equipment	80,745
Silver	Industrial machinery	7%	C28 - Manufacture of machinery and equipment n.e.c.	182,589
Silver	Other transport equipment	7%	C30 - Manufacture of other transport equipment	44,304
Silver	Electronic parts	6%	C26 - Manufacture of computer, electronic and optical products	65,703
Silver	Glass	6%	C23 - Manufacture of other non-metallic mineral products	57,255
Silver	Parts like bearings	6%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Silver	Medicine	4%	C21 - Manufacture of basic pharmaceutical products and pharmaceutical preparations	80,180
Strontium	Drilling fluids	70%	C23 - Manufacture of other non-metallic mineral products	57,255

Material	Application	Share	NACE sector	VA
Strontium	Pyrotechnics and signals	9%	C20 - Manufacture of chemicals and chemical products	105,514
Strontium	Magnets	9%	C28 - Manufacture of machinery and equipment n.e.c.	182,589
Strontium	Master alloys	3%	C24 - Manufacture of basic metals	55,426
Strontium	Pigments and fillers	3%	C20 - Manufacture of chemicals and chemical products	105,514
Strontium	Zinc production	3%	C24 - Manufacture of basic metals	55,426
Strontium	Glass	3%	C23 - Manufacture of other non-metallic mineral products	57,255
Sulphur	Chemical applications	71%	C20 - Manufacture of chemicals and chemical products	105,514
Sulphur	Petroleum refining	24%	C19 - Manufacture of coke and refined petroleum products	17,289
Sulphur	Metallurgy	4%	C24 - Manufacture of basic metals	55,426
Sulphur	Paper production	1%	C17 - Manufacture of paper and paper products	38,910
Talc	Polymer for car industry	34%	C22 - Manufacture of rubber and plastic products	75,980
Talc	Paper	21%	C17 - Manufacture of paper and paper products	38,910
Talc	Paint and Coatings	18%	C20 - Manufacture of chemicals and chemical products	105,514
Talc	Feed	8%	C10 - Manufacture of food products	155,880
Talc	Building material	7%	C23 - Manufacture of other non-metallic mineral products	57,255
Talc	Fertilizers	4%	C20 - Manufacture of chemicals and chemical products	105,514
Talc	Others	4%	C21 - Manufacture of basic pharmaceutical products and pharmaceutical preparations	80,180
Talc	Rubber	2%	C22 - Manufacture of rubber and plastic products	75,980
Talc	Cosmetics	1%	C21 - Manufacture of basic pharmaceutical products and pharmaceutical preparations	80,180
Talc	Pharmaceuticals	1%	C21 - Manufacture of basic pharmaceutical products and pharmaceutical preparations	80,180
Tantalum	Capacitors	40%	C26 - Manufacture of computer, electronic and optical products	65,703
Tantalum	Sputtering targets	20%	C26 - Manufacture of computer, electronic and optical products	65,703
Tantalum	Superalloys	14%	C30 - Manufacture of other transport equipment	44,304

Material	Application	Share	NACE sector	VA
Tantalum	Chemicals	12%	C20 - Manufacture of chemicals and chemical products	105,514
Tantalum	Carbides	10%	C28 - Manufacture of machinery and equipment n.e.c.	182,589
Tantalum	Mill products	4%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Tellurium	Solar power	40%	C26 - Manufacture of computer, electronic and optical products	65,703
Tellurium	Thermo-electric devices	30%	C26 - Manufacture of computer, electronic and optical products	65,703
Tellurium	Metallurgy	15%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Tellurium	Chemical manufacture	10%	C20 - Manufacture of chemicals and chemical products	105,514
Tellurium	Rubber vulcanising	5%	C22 - Manufacture of rubber and plastic products	75,980
Terbium	Lighting	68%	C27 - Manufacture of electrical equipment	80,745
Terbium	Magnets	32%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Tin	Solders	47%	C26 - Manufacture of computer, electronic and optical products	65,703
Tin	Chemicals	18%	C20 - Manufacture of chemicals and chemical products	105,514
Tin	Tinplate	13%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Tin	Others	10%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Tin	Lead acid batteries	6%	C27 - Manufacture of electrical equipment	80,745
Tin	Copper alloys	6%	C24 - Manufacture of basic metals	55,426
Titanium	Paints	54%	C20 - Manufacture of chemicals and chemical products	105,514
Titanium	Polymers	24%	C22 - Manufacture of rubber and plastic products	75,980
Titanium	Aerospace	8%	C30 - Manufacture of other transport equipment	44,304
Titanium	Medical equipment	6%	C28 - Manufacture of machinery and equipment n.e.c.	182,589
Titanium	Automotive	3%	C29 - Manufacture of motor vehicles, trailers and semi-trailers	160,603

Material	Application	Share	NACE sector	VA
Titanium	Hand held objects	2%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Titanium	Alloys	2%	C24 - Manufacture of basic metals	55,426
Titanium	Various	1%	C21 - Manufacture of basic pharmaceutical products and pharmaceutical preparations	80,180
Tungsten	Mill and cutting tools	33%	C28 - Manufacture of machinery and equipment n.e.c.	182,589
Tungsten	Mining and construction tools	23%	C28 - Manufacture of machinery and equipment n.e.c.	182,589
Tungsten	Other wear tools	18%	C28 - Manufacture of machinery and equipment n.e.c.	182,589
Tungsten	Catalysts and pigments	8%	C20 - Manufacture of chemicals and chemical products	105,514
Tungsten	Lighting and electronic uses	6%	C26 - Manufacture of computer, electronic and optical products	65,703
Tungsten	High speed steels applications	6%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Tungsten	Aeronautics and energy uses	5%	C28 - Manufacture of machinery and equipment n.e.c.	182,589
Tungsten	others	0%	0	0
Vanadium	High-strength low-alloy steels (HSLA)	60%	C24 - Manufacture of basic metals	55,426
Vanadium	Special steel	30%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Vanadium	Super alloys for high-end uses	3%	C29 - Manufacture of motor vehicles, trailers and semi-trailers	160,603
Vanadium	Chemicals	3%	C20 - Manufacture of chemicals and chemical products	105,514
Vanadium	Cast Iron for rigid structures	2%	C30 - Manufacture of other transport equipment	44,304
Vanadium	Stainless steel	1%	C28 - Manufacture of machinery and equipment n.e.c.	182,589
Vanadium	Energy storage	1%	C27 - Manufacture of electrical equipment	80,745
Yttrium	Lighting	50%	C27 - Manufacture of electrical equipment	80,745
Yttrium	Ceramics	38%	C23 - Manufacture of other non-metallic mineral products	57,255
Yttrium	Alloys	8%	C24 - Manufacture of basic metals	55,426
Yttrium	Glass	4%	C23 - Manufacture of other non-metallic mineral products	57,255
Yttrium	Others	0%	0	0

Material	Application	Share	NACE sector	VA
Zinc	Galvanising	52%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Zinc	Zinc alloys	17%	C24 - Manufacture of basic metals	55,426
Zinc	Brass and bronze	15%	C24 - Manufacture of basic metals	55,426
Zinc	Zinc compounds (incl. dust and powder)	10%	C20 - Manufacture of chemicals and chemical products	105,514
Zinc	Zinc semi-manufactures	6%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351
Zirconium	Ceramics	43%	C23 - Manufacture of other non-metallic mineral products	57,255
Zirconium	Refractories	15%	C23 - Manufacture of other non-metallic mineral products	57,255
Zirconium	Foundry	15%	C24 - Manufacture of basic metals	55,426
Zirconium	Chemicals	12%	C20 - Manufacture of chemicals and chemical products	105,514
Zirconium	Others	10%	C26 - Manufacture of computer, electronic and optical products	65,703
Zirconium	Pigments	3%	C20 - Manufacture of chemicals and chemical products	105,514
Zirconium	Superalloys, Nuclear	2%	C24 - Manufacture of basic metals	55,426

Annex 6. Global supply, trade-related varialble and WGI (2 stages).

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Aluminium					China	52%	5.83	1.10
Aluminium					Russian Federation	6%	6.20	1.10
Aluminium					Other Non Eu Countries	6%	0.00	1.00
Aluminium					Canada	5%	2.26	1.00
Aluminium					United Arab Emirates	4%	3.94	1.00
Aluminium					India	4%	5.45	1.00
Aluminium					Australia	3%	2.36	1.00
Aluminium					United States	3%	2.92	1.00
Aluminium					Norway	2%	2.03	1.00
Aluminium					Brazil	2%	5.08	1.00
Aluminium					Bahrain	2%	5.15	1.00
Aluminium					Iceland	1%	2.52	1.00
Aluminium					South Africa	1%	4.65	1.00
Aluminium					Saudi Arabia	1%	5.51	1.00
Aluminium					Qatar	1%	4.03	1.00
Aluminium					Mozambique	1%	5.93	1.00
Aluminium					Germany	1%	2.47	0.80
Aluminium					Argentina	1%	5.47	1.00
Aluminium					France	1%	3.11	0.80
Aluminium					Spain	1%	3.62	0.80
Aluminium					Romania	<1%	4.70	0.80
Aluminium					Greece	<1%	4.60	0.80
Aluminium					Slovakia	<1%	3.79	0.80
Aluminium					Sweden	<1%	2.05	0.80
Aluminium					Slovenia	<1%	3.50	0.80
Aluminium					Italy	<1%	4.17	0.80
Aluminium					Netherlands	<1%	2.19	0.80
Antimony	China	74%	5.83	1.10	China	59%	5.83	1.10
Antimony	Tajikistan	8%	6.88	1.00	Belgium	12%	2.81	0.80
Antimony	Russian Federation	4%	6.20	1.00	France	4%	3.11	0.80
Antimony	Myanmar	3%	6.95	1.00	Vietnam	3%	5.75	1.00
Antimony	Bolivia	3%	5.97	1.10	Bolivia	3%	5.97	1.10
Antimony	Australia	2%	2.36	1.00	Thailand	3%	5.50	1.00
Antimony	Turkey	2%	5.34	1.00	Japan	2%	2.77	1.00
Antimony	South Africa	1%	4.65	1.00	Other Non Eu Countries	2%	0.00	1.00
Antimony	Kyrgyz Republic	1%	6.30	1.00	India	2%	5.45	1.00
Antimony	Kazakhstan	1%	5.90	1.00	Myanmar	1%	6.95	1.00
Antimony	Iran, Islamic Rep.	<1%	6.65	1.00	Germany	1%	2.47	0.80
Antimony	Lao Pdr	<1%	6.25	1.00	United States	1%	2.92	1.00

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Antimony	Vietnam	<1%	5.75	1.00	Korea, Rep.	1%	3.74	1.00
Antimony	Morocco	<1%	5.48	1.00	Spain	1%	3.62	0.80
Antimony	Thailand	<1%	5.50	1.00	Netherlands	1%	2.19	0.80
Antimony	Pakistan	<1%	6.78	1.00	Other Eu Countries	1%	0.00	0.80
Antimony	Peru	<1%	5.30	1.00	Mexico	1%	5.33	1.00
Antimony	Mexico	<1%	5.33	1.00	United Kingdom	1%	2.60	0.80
Antimony	Guatemala	<1%	6.00	1.00	Tajikistan	1%	6.88	1.00
Antimony	Canada	<1%	2.26	1.00				
Antimony	Ecuador	<1%	5.99	1.00				
Antimony	Honduras	<1%	6.06	1.00				
Arsenic					China	57%	5.83	1.00
Arsenic					Peru	13%	5.30	1.00
Arsenic					Morocco	17%	5.48	1.10
Arsenic					Namibia	5%	4.44	1.00
Arsenic					Russian Federation	3%	6.20	1.00
Arsenic					Belgium	2%	2.81	0.80
Arsenic					Iran, Islamic Rep.	<1%	6.65	1.00
Arsenic					Philippines	<1%	5.49	1.00
Arsenic					Bolivia	<1%	5.97	1.00
Arsenic					Japan	<1%	2.77	1.00
Baryte	China	38%	5.83	1.10				
Baryte	India	12%	5.45	1.00				
Baryte	Morocco	10%	5.48	1.00				
Baryte	Iran, Islamic Rep.	8%	6.65	1.00				
Baryte	Kazakhstan	7%	5.90	1.00				
Baryte	Turkey	6%	5.34	1.00				
Baryte	United States	6%	2.92	1.00				
Baryte	Other Non Eu Countries	3%	0.00	1.00				
Baryte	Russian Federation	2%	6.20	1.00				
Baryte	Mexico	2%	5.33	1.00				
Baryte	Thailand	1%	5.50	1.00				
Baryte	Pakistan	1%	6.78	1.00				
Baryte	Vietnam	1%	5.75	1.00				
Baryte	Other Eu Countries	1%	0.00	0.80				
Baryte	Germany	1%	2.47	0.80				
Baryte	Peru	1%	5.30	1.00				
Bauxite	Australia	28%	2.36	1.00				
Bauxite	China	20%	5.83	1.20				
Bauxite	Brazil	13%	5.08	1.00				
Bauxite	India	8%	5.45	1.10				
Bauxite	Guinea	8%	6.72	1.10				

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Bauxite	Indonesia	7%	5.47	1.10				
Bauxite	Jamaica	3%	4.85	1.00				
Bauxite	Malaysia	3%	4.39	1.00				
Bauxite	Other Non Eu countries	3%	0.00	1.00				
Bauxite	Russian Federation	2%	6.20	1.00				
Bauxite	Kazakhstan	2%	5.90	1.00				
Bauxite	Saudi Arabia	1%	5.51	1.00				
Bauxite	Suriname	1%	5.16	1.00				
Bauxite	Greece	1%	4.60	0.80				
Bauxite	Guyana	1%	5.56	1.00				
Bauxite	Venezuela, Rb	1%	7.30	1.00				
Bauxite	France	<1%	3.11	0.80				
Bauxite	Hungary	<1%	4.06	0.80				
Bauxite	Croatia	<1%	4.27	0.80				
Bentonite	United States	26%	2.92	1.00				
Bentonite	China	21%	5.83	1.00				
Bentonite	Turkey	9%	5.34	1.00				
Bentonite	India	8%	5.45	1.00				
Bentonite	Greece	6%	4.60	0.80				
Bentonite	Other non EU countries	6%	0.00	1.00				
Bentonite	Russian federation	4%	6.20	1.00				
Bentonite	Mexico	3%	5.33	1.00				
Bentonite	Japan	3%	2.77	1.00				
Bentonite	Iran, Islamic Rep.	2%	6.65	1.00				
Bentonite	Other EU countries	2%	0.00	0.80				
Bentonite	Germany	2%	2.47	0.80				
Bentonite	Brazil	2%	5.08	1.00				
Bentonite	Czech Republic	2%	3.47	0.80				
Bentonite	Ukraine	1%	6.23	1.00				
Bentonite	Argentina	1%	5.47	1.00				
Bentonite	Slovakia	1%	3.79	0.80				
Beryllium	United States	88%	2.92	1.00	United States	50%	2.92	1.00
Beryllium	China	8%	5.83	1.00	Kazakhstan	25%	5.90	1.00
Beryllium	Madagascar	2%	6.26	1.00	Japan	17%	2.77	1.00
Beryllium	Mozambique	1%	5.93	1.00	China	8%	5.83	1.00
Beryllium	Other Non Eu Countries	<1%	0.00	1.00				
Bismuth					China	80%	5.83	1.00
Bismuth					Belgium	5%	2.81	0.80
Bismuth					Lao Pdr	4%	6.25	1.00
Bismuth					Mexico	4%	5.33	1.00

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Bismuth					Japan	3%	2.77	1.00
Bismuth					Korea, Rep.	2%	3.74	1.00
Bismuth					Peru	1%	5.30	1.00
Bismuth					Kazakhstan	1%	5.90	1.00
Bismuth					Bolivia	<1%	5.97	1.00
Bismuth					Other non EU countries	<1%	0.00	1.00
Borate	Turkey	42%	5.34	1.00	United States	67%	2.92	1.00
Borate	United States	24%	2.92	1.00	Chile	10%	3.11	1.00
Borate	Chile	11%	3.11	1.00	Russian Federation	8%	6.20	1.00
Borate	Argentina	7%	5.47	1.10	Malaysia	4%	4.39	1.00
Borate	Peru	5%	5.30	1.00	Peru	4%	5.30	1.00
Borate	China	4%	5.83	1.00	Argentina	3%	5.47	1.10
Borate	Bolivia	3%	5.97	1.10	Bolivia	2%	5.97	1.10
Borate	Russian Federation	2%	6.20	1.00	Other Non EU countries	2%	0.00	1.00
Borate	Kazakhstan	1%	5.90	1.00	China	1%	5.83	1.00
Borate	Iran, Islamic Rep.	<1%	6.65	1.00	Turkey	1%	5.34	1.00
Cadmium					China	33%	5.83	1.00
Cadmium					Korea, Rep.	17%	3.74	1.00
Cadmium					Japan	8%	2.77	1.00
Cadmium					Kazakhstan	7%	5.90	1.00
Cadmium					Canada	6%	2.26	1.00
Cadmium					Mexico	6%	5.33	1.00
Cadmium					Russian Federation	4%	6.20	1.00
Cadmium					Peru	3%	5.30	1.00
Cadmium					Netherlands	2%	2.19	0.80
Cadmium					United States	2%	2.92	1.00
Cadmium					Germany	2%	2.47	0.80
Cadmium					Poland	2%	3.60	0.80
Cadmium					Bulgaria	2%	4.73	0.80
Cadmium					Uzbekistan	1%	6.98	1.00
Cadmium					Norway	1%	2.03	1.00
Cadmium					Brazil	1%	5.08	1.00
Cadmium					Korea, Dem. Rep.	1%	7.74	1.00
Cadmium					India	1%	5.45	1.00
Cadmium					Argentina	<1%	5.47	1.00
Cadmium					Armenia	<1%	5.41	1.00
Cerium	China	86%	5.83	1.59				
Cerium	Australia	6%	2.36	1.00				
Cerium	United States	2%	2.92	1.00				
Cerium	Russian Federation	2%	6.20	1.00				
Cerium	India	1%	5.45	1.00				

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Cerium	Brazil	1%	5.08	1.00				
Cerium	Thailand	1%	5.50	1.00				
Cerium	Malaysia	1%	4.39	1.00				
Cerium	Vietnam	<1%	5.75	1.00				
Chromium	South Africa	46%	4.65	1.00	China	37%	5.83	1.10
Chromium	Kazakhstan	16%	5.90	1.00	South Africa	28%	4.65	1.00
Chromium	Turkey	13%	5.34	1.00	Kazakhstan	14%	5.90	1.00
Chromium	India	10%	5.45	1.20	India	9%	5.45	1.00
Chromium	Finland	4%	1.98	0.80	Other Non EU Countries	4%	0.00	1.00
Chromium	Albania	2%	5.16	1.00	Finland	4%	1.98	0.80
Chromium	Oman	2%	4.70	1.00	Russian Federation	4%	6.20	1.00
Chromium	Russian Federation	2%	6.20	1.00	Other EU countries	1%	0.00	0.80
Chromium	Brazil	2%	5.08	1.00				
Chromium	Iran, Islamic Rep.	1%	6.65	1.00				
Chromium	Zimbabwe	1%	7.17	1.01				
Chromium	Madagascar	<1%	6.26	1.00				
Chromium	Australia	<1%	2.36	1.00				
Chromium	Pakistan	<1%	6.78	1.00				
Chromium	Papua New Guinea	<1%	5.94	1.00				
Chromium	China	<1%	5.83	1.10				
Chromium	Philippines	<1%	5.49	1.00				
Chromium	Sudan	<1%	7.70	1.00				
Chromium	Cuba	<1%	5.87	1.00				
Chromium	Afghanistan	<1%	7.53	1.00				
Chromium	Vietnam	<1%	5.75	1.00				
Chromium	Kosovo	<1%	5.64	1.00				
Chromium	Greece	<1%	4.60	0.80				
Cobalt	Congo, Dem. Rep.	59%	7.60	1.10	China	49%	5.83	1.10
Cobalt	China	7%	5.83	1.10	Finland	12%	1.98	0.80
Cobalt	Canada	5%	2.26	1.00	Canada	6%	2.26	1.00
Cobalt	Australia	4%	2.36	1.00	Australia	5%	2.36	1.00
Cobalt	Zambia	4%	5.40	1.10	Zambia	5%	5.40	1.00
Cobalt	French Guiana	3%	3.23	1.00	Japan	4%	2.77	1.00
Cobalt	Cuba	3%	5.87	1.00	Norway	4%	2.03	1.00
Cobalt	Philippines	2%	5.49	1.00	Madagascar	3%	6.26	1.00
Cobalt	Madagascar	2%	6.26	1.00	Russian Federation	3%	6.20	1.00
Cobalt	Brazil	2%	5.08	1.00	Congo, Dem. Rep.	3%	7.60	1.10
Cobalt	Russian Federation	2%	6.20	1.00	Morocco	2%	5.48	1.00
Cobalt	Finland	1%	1.98	0.80	Belgium	2%	2.81	0.80
Cobalt	Indonesia	1%	5.47	1.10	Brazil	1%	5.08	1.00

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Cobalt	Papua New Guinea	1%	5.94	1.00	South Africa	1%	4.65	1.00
Cobalt	Morocco	1%	5.48	1.00	Uganda	1%	5.99	1.00
Cobalt	South Africa	1%	4.65	1.00	Mexico	<1%	5.33	1.00
Cobalt	United States	<1%	2.92	1.00	India	<1%	5.45	1.00
Cobalt	Zimbabwe	<1%	7.17	1.00	France	<1%	3.11	0.80
Cobalt	Botswana	<1%	3.89	1.00				
Cobalt	Vietnam	<1%	5.75	1.00				
Cobalt	Uganda	<1%	5.99	1.00				
Coking coal	China	55%	5.83	1.55	China	69%	5.83	1.20
Coking coal	Australia	16%	2.36	1.00	Russian Federation	7%	6.20	1.10
Coking coal	Russian Federation	7%	6.20	1.00	Japan	5%	2.77	1.00
Coking coal	United States	6%	2.92	1.00	India	3%	5.45	1.00
Coking coal	India	5%	5.45	1.00	Other Non Eu Countries	3%	0.00	1.00
Coking coal	Canada	3%	2.26	1.00	United States	3%	2.92	1.00
Coking coal	Other Non Eu Countries	2%	0.00	1.00	Korea, Rep.	2%	3.74	1.00
Coking coal	Kazakhstan	1%	5.90	1.00	Poland	1%	3.60	0.80
Coking coal	Ukraine	1%	6.23	1.00	Germany	1%	2.47	0.80
Coking coal	Poland	1%	3.60	0.80	Taiwan, China	1%	3.27	1.00
Coking coal	Mongolia	1%	5.18	1.10	France	<1%	3.11	0.80
Coking coal	Czech Republic	<1%	3.47	0.80	United Kingdom	<1%	2.60	1.00
Coking coal	Germany	<1%	2.47	0.80	Australia	<1%	2.36	1.00
Coking coal					Italy	<1%	4.17	0.80
Coking coal					Czech Republic	<1%	3.47	0.80
Coking coal					Netherlands	<1%	2.19	0.80
Coking coal					Spain	<1%	3.62	0.80
Coking coal					Slovakia	<1%	3.79	0.80
Coking coal					Belgium	<1%	2.81	0.80
Coking coal					Austria	<1%	2.50	0.80
Coking coal					Sweden	<1%	2.05	0.80
Coking coal					Hungary	<1%	4.06	0.80
Coking coal					Finland	<1%	1.98	0.80
Coking coal					Bosnia And Herzegovina	<1%	5.44	1.00
Coking coal					Vietnam	<1%	5.75	1.00
Coking coal					Indonesia	<1%	5.47	1.00
Coking coal					Pakistan	<1%	6.78	1.00
Copper	Chile	30%	3.11	1.00	China	33%	5.83	1.10
Copper	China	9%	5.83	1.10	Chile	12%	3.11	1.00
Copper	Peru	9%	5.30	1.00	Japan	7%	2.77	1.00
Copper	United States	7%	2.92	1.00	United States	5%	2.92	1.00
Copper	Australia	5%	2.36	1.00	Russian federation	4%	6.20	1.10
Copper	Congo, Dem.	5%	7.60	1.10	India	3%	5.45	1.00

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
	Rep.							
Copper	Other Non Eu Countries	4%	0.00	1.00	Congo, Dem. Rep.	3%	7.60	1.10
Copper	Zambia	4%	5.40	1.00	Germany	3%	2.47	0.80
Copper	Russian federation	4%	6.20	1.00	Korea, Rep.	3%	3.74	1.00
Copper	Canada	4%	2.26	1.00	Poland	3%	3.60	0.80
Copper	Mexico	3%	5.33	1.00	Other Non Eu Countries	2%	0.00	1.00
Copper	Indonesia	3%	5.47	1.20	Zambia	2%	5.40	1.00
Copper	Kazakhstan	2%	5.90	1.00	Australia	2%	2.36	1.00
Copper	Poland	2%	3.60	0.80	Mexico	2%	5.33	1.00
Copper	Brazil	2%	5.08	1.00	Spain	2%	3.62	0.80
Copper	Mongolia	1%	5.18	1.20	Belgium	2%	2.81	0.80
Copper	Iran, Islamic Rep.	1%	6.65	1.00	Kazakhstan	2%	5.90	1.00
Copper	Lao Pdr	1%	6.25	1.00	Peru	2%	5.30	1.00
Copper	Other Eu Countries	1%	0.00	0.80	Canada	1%	2.26	1.00
Copper	Spain	1%	3.62	0.80	Bulgaria	1%	4.73	0.80
Copper	Bulgaria	1%	4.73	0.80	Brazil	1%	5.08	1.00
Copper	Turkey	1%	5.34	1.00	Indonesia	1%	5.47	1.00
Copper	Uzbekistan	1%	6.98	1.00	Sweden	1%	2.05	0.80
Copper	Argentina	1%	5.47	1.10	Iran, Islamic Rep.	1%	6.65	1.00
Copper					Philippines	1%	5.49	1.00
Copper					Finland	1%	1.98	0.80
Copper					Other Eu Countries	<1%	0.00	0.80
Diatomite	United States	35%	2.92	1.00				
Diatomite	China	19%	5.83	1.00				
Diatomite	Argentina	10%	5.47	1.00				
Diatomite	Denmark	5%	2.11	0.80				
Diatomite	Peru	5%	5.30	1.00				
Diatomite	Japan	4%	2.77	1.00				
Diatomite	Mexico	4%	5.33	1.00				
Diatomite	France	4%	3.11	0.80				
Diatomite	Turkey	3%	5.34	1.00				
Diatomite	Other non EU countries	3%	0.00	1.00				
Diatomite	Spain	2%	3.62	0.80				
Diatomite	Czech Republic	1%	3.47	0.80				
Diatomite	Korea, Rep.	1%	3.74	1.00				
Diatomite	Chile	1%	3.11	1.00				
Diatomite	Armenia	1%	5.41	1.00				
Diatomite	Other EU countries	<1%	0.00	0.80				
Dysprosium	China	86%	5.83	1.59				
Dysprosium	Australia	6%	2.36	1.00				

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Dysprosium	United States	2%	2.92	1.00				
Dysprosium	Russian Federation	2%	6.20	1.00				
Dysprosium	India	1%	5.45	1.00				
Dysprosium	Brazil	1%	5.08	1.00				
Dysprosium	Thailand	1%	5.50	1.00				
Dysprosium	Malaysia	1%	4.39	1.00				
Dysprosium	Vietnam	<1%	5.75	1.00				
Erbium	China	86%	5.83	1.59				
Erbium	Australia	6%	2.36	1.00				
Erbium	United States	2%	2.92	1.00				
Erbium	Russian Federation	2%	6.20	1.00				
Erbium	India	1%	5.45	1.00				
Erbium	Brazil	1%	5.08	1.00				
Erbium	Thailand	1%	5.50	1.00				
Erbium	Malaysia	1%	4.39	1.00				
Erbium	Vietnam	<1%	5.75	1.00				
Europium	China	86%	5.83	1.59				
Europium	Australia	6%	2.36	1.00				
Europium	United States	2%	2.92	1.00				
Europium	Russian Federation	2%	6.20	1.00				
Europium	India	1%	5.45	1.00				
Europium	Brazil	1%	5.08	1.00				
Europium	Thailand	1%	5.50	1.00				
Europium	Malaysia	1%	4.39	1.00				
Europium	Vietnam	<1%	5.75	1.00				
Feldspar	Turkey	31%	5.34	1.00				
Feldspar	China	10%	5.83	1.00				
Feldspar	Italy	8%	4.17	0.80				
Feldspar	India	5%	5.45	1.00				
Feldspar	Indonesia	5%	5.47	1.00				
Feldspar	Thailand	5%	5.50	1.00				
Feldspar	Iran, Islamic Rep.	4%	6.65	1.00				
Feldspar	Canada	2%	2.26	1.00				
Feldspar	Other Non Eu Countries	2%	0.00	1.00				
Feldspar	France	2%	3.11	0.80				
Feldspar	Spain	2%	3.62	0.80				
Feldspar	United States	2%	2.92	1.00				
Feldspar	Poland	2%	3.60	0.80				
Feldspar	Russian Federation	2%	6.20	1.00				
Feldspar	Korea, Rep.	2%	3.74	1.00				
Feldspar	Czech Republic	2%	3.47	0.80				

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Feldspar	Brazil	1%	5.08	1.00				
Feldspar	Malaysia	1%	4.39	1.00				
Feldspar	Germany	1%	2.47	0.80				
Feldspar	Norway	1%	2.03	1.00				
Feldspar	Other Eu Countries	1%	0.00	0.80				
Feldspar	Argentina	1%	5.47	1.00				
Feldspar	Algeria	1%	6.43	1.00				
Feldspar	Ecuador	1%	5.99	1.00				
Feldspar	Egypt, Arab Rep.	1%	6.48	1.00				
Feldspar	Mexico	1%	5.33	1.00				
Feldspar	Japan	1%	2.77	1.00				
Feldspar	Vietnam	1%	5.75	1.00				
Feldspar	Saudi Arabia	1%	5.51	1.00				
Feldspar	South Africa	<1%	4.65	1.00				
Fluorspar	China	65%	5.83	1.10	China	34%	5.83	1.10
Fluorspar	Mexico	15%	5.33	1.00	Mexico	16%	5.33	1.00
Fluorspar	Mongolia	5%	5.18	1.10	Singapore	8%	2.37	1.00
Fluorspar	South Africa	3%	4.65	1.00	Italy	7%	4.17	0.80
Fluorspar	Spain	2%	3.62	0.80	Germany	6%	2.47	0.80
Fluorspar	Vietnam	2%	5.75	1.00	Other Non Eu Countries	5%	0.00	1.00
Fluorspar	Bulgaria	1%	4.73	0.80	Japan	3%	2.77	1.00
Fluorspar	Morocco	1%	5.48	1.00	Australia	3%	2.36	1.00
Fluorspar	Kenya	1%	6.03	1.10	Spain	2%	3.62	0.80
Fluorspar	Iran, Islamic Rep.	1%	6.65	1.00	India	2%	5.45	1.00
Fluorspar	Germany	1%	2.47	0.80	Canada	2%	2.26	1.00
Fluorspar	Namibia	1%	4.44	1.00	Tunisia	2%	5.40	1.00
Fluorspar	Russian Federation	1%	6.20	1.00	Other Eu Countries	2%	0.00	0.80
Fluorspar	Argentina	1%	5.47	1.00	United Arab Emirates	2%	3.94	1.00
Fluorspar	Brazil	<1%	5.08	1.00	Sweden	1%	2.05	0.80
Fluorspar	United Kingdom	<1%	2.60	1.00	Norway	1%	2.03	1.00
Fluorspar	Thailand	<1%	5.50	1.00	Lithuania	1%	3.50	0.80
Fluorspar	Pakistan	<1%	6.78	1.00	France	1%	3.11	0.80
Fluorspar	Turkey	<1%	5.34	1.00	United States	1%	2.92	1.00
Fluorspar	Korea, Dem. Rep.	<1%	7.74	1.00				
Fluorspar	Afghanistan	<1%	7.53	1.00				
Fluorspar	India	<1%	5.45	1.00				
Fluorspar	Egypt, Arab Rep.	<1%	6.48	1.00				
Fluorspar	Sudan	<1%	7.70	1.00				
Gadolinium	China	86%	5.83	1.59				
Gadolinium	Australia	6%	2.36	1.00				

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Gadolinium	United States	2%	2.92	1.00				
Gadolinium	Russian Federation	2%	6.20	1.00				
Gadolinium	India	1%	5.45	1.00				
Gadolinium	Brazil	1%	5.08	1.00				
Gadolinium	Thailand	1%	5.50	1.00				
Gadolinium	Malaysia	1%	4.39	1.00				
Gadolinium	Vietnam	<1%	5.75	1.00				
Gallium					China	80%	5.83	1.00
Gallium					Germany	8%	2.47	0.80
Gallium					Ukraine	5%	6.23	1.00
Gallium					Japan	3%	2.77	1.00
Gallium					Russian Federation	2%	6.20	1.00
Gallium					Kazakhstan	1%	5.90	1.00
Gallium					Hungary	1%	4.06	0.80
Germanium					China	80%	5.83	1.10
Germanium					Finland	10%	1.98	0.80
Germanium					Russian Federation	5%	6.20	1.00
Germanium					United States	2%	2.92	1.00
Germanium					Japan	2%	2.77	1.00
Germanium					Ukraine	1%	6.23	1.00
Gold	China	14%	5.83	1.10				
Gold	Other Non Eu Countries	10%	0.00	1.00				
Gold	Australia	8%	2.36	1.00				
Gold	Russian Federation	8%	6.20	1.00				
Gold	United States	7%	2.92	1.00				
Gold	Peru	6%	5.30	1.00				
Gold	South Africa	5%	4.65	1.00				
Gold	Canada	4%	2.26	1.00				
Gold	Mexico	4%	5.33	1.00				
Gold	Ghana	3%	4.94	1.00				
Gold	Indonesia	3%	5.47	1.10				
Gold	Brazil	3%	5.08	1.00				
Gold	Uzbekistan	3%	6.98	1.00				
Gold	Papua New Guinea	2%	5.94	1.00				
Gold	Sudan	2%	7.70	1.00				
Gold	Argentina	2%	5.47	1.00				
Gold	Tanzania	2%	5.74	1.00				
Gold	Colombia	2%	5.39	1.00				
Gold	Mali	2%	6.39	1.00				
Gold	Kazakhstan	1%	5.90	1.00				
Gold	Chile	1%	3.11	1.00				
Gold	Burkina Faso	1%	5.74	1.00				

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Gold	Philippines	1%	5.49	1.00				
Gold	Congo, Dem. Rep.	1%	7.60	1.00				
Gold	Turkey	1%	5.34	1.00				
Gold	Dominican Republic	1%	5.40	1.00				
Gold	Other Eu Countries	1%	0.00	0.80				
Gold	Zimbabwe	1%	7.17	1.10				
Gold	Guinea	1%	6.72	1.00				
Gold	Mongolia	1%	5.18	1.00				
Gypsum	China	49%	5.83	1.00				
Gypsum	United States	6%	2.92	1.00				
Gypsum	Iran, Islamic Rep.	6%	6.65	1.00				
Gypsum	Other non EU countries	5%	0.00	1.00				
Gypsum	Thailand	5%	5.50	1.00				
Gypsum	Iraq	4%	7.35	1.00				
Gypsum	Turkey	3%	5.34	1.00				
Gypsum	Mexico	3%	5.33	1.00				
Gypsum	Spain	3%	3.62	0.80				
Gypsum	Russian Federation	2%	6.20	1.00				
Gypsum	Oman	1%	4.70	1.00				
Gypsum	Australia	1%	2.36	1.00				
Gypsum	Brazil	1%	5.08	1.00				
Gypsum	Germany	1%	2.47	0.80				
Gypsum	India	1%	5.45	1.00				
Gypsum	Italy	1%	4.17	0.80				
Gypsum	France	1%	3.11	0.80				
Gypsum	Other EU countries	1%	0.00	0.80				
Gypsum	Saudi Arabia	1%	5.51	1.00				
Gypsum	Canada	1%	2.26	1.00				
Gypsum	Algeria	1%	6.43	1.00				
Gypsum	Ukraine	1%	6.23	1.00				
Gypsum	Argentina	1%	5.47	1.00				
Gypsum	Pakistan	1%	6.78	1.00				
Gypsum	Poland	<1%	3.60	0.80				
Gypsum	United Kingdom	<1%	2.60	1.00				
Gypsum	Chile	<1%	3.11	1.00				
Gypsum	Romania	<1%	4.70	0.80				
Gypsum	Egypt, Arab Rep.	<1%	6.48	1.00				
Gypsum	Austria	<1%	2.50	0.80				
Hafnium					France	49%	3.11	0.80
Hafnium					United States	44%	2.92	1.00

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Hafnium					Russian Federation	3%	6.20	1.10
Hafnium					China	3%	5.83	1.00
Hafnium					Ukraine	1%	6.23	1.00
Helium					United States	63%	2.92	1.00
Helium					Qatar	17%	4.03	1.00
Helium					Algeria	13%	6.43	1.00
Helium					Russian Federation	3%	6.20	1.00
Helium					Australia	2%	2.36	1.00
Helium					Poland	2%	3.60	0.80
Helium					Canada	<1%	2.26	1.00
Helium					China	<1%	5.83	1.00
Helium					India	<1%	5.45	1.00
Helium					Ukraine	<1%	6.23	1.00
Helium					Germany	<1%	2.47	0.80
Ho, Tm, Lu, Yb	China	86%	5.83	1.59	China	97%	5.83	1.67
Ho, Tm, Lu, Yb	Australia	6%	2.36	1.00	Japan	2%	2.77	1.00
Ho, Tm, Lu, Yb	United States	2%	2.92	1.00	Estonia	1%	3.07	0.80
Ho, Tm, Lu, Yb	Russian Federation	2%	6.20	1.00	United Kingdom	1%	2.60	1.00
Ho, Tm, Lu, Yb	India	1%	5.45	1.00				
Ho, Tm, Lu, Yb	Brazil	1%	5.08	1.00				
Ho, Tm, Lu, Yb	Thailand	1%	5.50	1.00				
Ho, Tm, Lu, Yb	Malaysia	1%	4.39	1.00				
Ho, Tm, Lu, Yb	Vietnam	<1%	5.75	1.00				
Indium					China	48%	5.83	1.19
Indium					Korea, Rep.	21%	3.74	1.00
Indium					Japan	8%	2.77	1.00
Indium					Canada	8%	2.26	1.00
Indium					Russian Federation	4%	6.20	1.00
Indium					France	4%	3.11	0.80
Indium					Belgium	3%	2.81	0.80
Indium					Germany	1%	2.47	0.80
Indium					Peru	1%	5.30	1.00
Indium					Brazil	1%	5.08	1.00
Indium					Italy	1%	4.17	0.80
Indium					Netherlands	<1%	2.19	0.80
Iridium					South Africa	92%	4.65	1.00
Iridium					Zimbabwe	5%	7.17	1.00
Iridium					Canada	2%	2.26	1.00
Iridium					Russian Federation	1%	6.20	1.10
Iron ore	Australia	35%	2.36	1.00	China	49%	5.83	1.10
Iron ore	Brazil	18%	5.08	1.00	Japan	7%	2.77	1.00
Iron ore	China	10%	5.83	1.10	India	5%	5.45	1.10

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Iron ore	India	8%	5.45	1.20	United States	5%	2.92	1.00
Iron ore	Russian Federation	5%	6.20	1.00	Other Non Eu Countries	5%	0.00	1.00
Iron ore	Other non EU Countries	5%	0.00	1.00	Russian Federation	4%	6.20	1.00
Iron ore	South Africa	4%	4.65	1.00	Korea, Rep.	4%	3.74	1.00
Iron ore	Ukraine	3%	6.23	1.00	Other Eu Countries	3%	0.00	0.80
Iron ore	United States	2%	2.92	1.00	Germany	3%	2.47	0.80
Iron ore	Iran, Islamic Rep.	2%	6.65	1.00	Turkey	2%	5.34	1.00
Iron ore	Kazakhstan	2%	5.90	1.00	Brazil	2%	5.08	1.00
Iron ore	Canada	2%	2.26	1.00	Ukraine	2%	6.23	1.00
Iron ore	Sweden	2%	2.05	0.80	Italy	1%	4.17	0.80
Iron ore	Mexico	1%	5.33	1.00	Taiwan, China	1%	3.27	1.00
Iron ore	Chile	1%	3.11	1.00	Mexico	1%	5.33	1.00
Iron ore	Other EU Countries	<1%	0.00	0.80	Iran, Islamic Rep.	1%	6.65	1.00
Iron ore					France	1%	3.11	0.80
Iron ore					Spain	1%	3.62	0.80
Iron ore					Canada	1%	2.26	1.00
Iron ore					United Kingdom	1%	2.60	1.00
Iron ore					Poland	1%	3.60	0.80
Kaolin clay	China	15%	5.83	1.00				
Kaolin clay	Ukraine	12%	6.23	1.00				
Kaolin clay	United States	12%	2.92	1.00				
Kaolin clay	Germany	10%	2.47	0.80				
Kaolin clay	India	9%	5.45	1.00				
Kaolin clay	Czech Republic	7%	3.47	0.80				
Kaolin clay	Turkey	5%	5.34	1.00				
Kaolin clay	Brazil	4%	5.08	1.00				
Kaolin clay	United Kingdom	3%	2.60	1.00				
Kaolin clay	Other Non Eu Countries	2%	0.00	1.00				
Kaolin clay	Iran, Islamic Rep.	2%	6.65	1.00				
Kaolin clay	Indonesia	2%	5.47	1.00				
Kaolin clay	Malaysia	2%	4.39	1.00				
Kaolin clay	Italy	2%	4.17	0.80				
Kaolin clay	Vietnam	1%	5.75	1.00				
Kaolin clay	Spain	1%	3.62	0.80				
Kaolin clay	France	1%	3.11	0.80				
Kaolin clay	Portugal	1%	3.34	0.80				
Kaolin clay	Mexico	1%	5.33	1.00				
Kaolin clay	Poland	1%	3.60	0.80				
Kaolin clay	Korea, Rep.	1%	3.74	1.00				
Kaolin clay	Thailand	1%	5.50	1.00				

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Kaolin clay	Bulgaria	1%	4.73	0.80				
Kaolin clay	Belgium	1%	2.81	0.80				
Kaolin clay	Egypt, Arab Rep.	1%	6.48	1.00				
Kaolin clay	Russian Federation	<1%	6.20	1.00				
Kaolin clay	Australia	<1%	2.36	1.00				
Kaolin clay	Other Eu Countries	<1%	0.00	0.80				
Kaolin clay	Serbia	<1%	5.05	1.00				
Kaolin clay	Uzbekistan	<1%	6.98	1.00				
Lanthanum	China	86%	5.83	1.59				
Lanthanum	Australia	6%	2.36	1.00				
Lanthanum	United States	2%	2.92	1.00				
Lanthanum	Russian Federation	2%	6.20	1.00				
Lanthanum	India	1%	5.45	1.00				
Lanthanum	Brazil	1%	5.08	1.00				
Lanthanum	Thailand	1%	5.50	1.00				
Lanthanum	Malaysia	1%	4.39	1.00				
Lanthanum	Vietnam	<1%	5.75	1.00				
Lead	China	49%	5.83	1.20	China	43%	5.83	1.10
Lead	Australia	12%	2.36	1.00	United States	10%	2.92	1.00
Lead	Other Non Eu Countries	8%	0.00	1.00	Other Non Eu Countries	8%	0.00	1.00
Lead	United States	7%	2.92	1.00	Korea, Rep.	6%	3.74	1.00
Lead	Peru	6%	5.30	1.00	India	4%	5.45	1.00
Lead	Mexico	5%	5.33	1.00	Other Eu Countries	4%	0.00	0.80
Lead	Russian Federation	3%	6.20	1.00	Germany	4%	2.47	0.80
Lead	India	2%	5.45	1.00	Mexico	3%	5.33	1.00
Lead	Bolivia	2%	5.97	1.00	United Kingdom	3%	2.60	1.00
Lead	Poland	2%	3.60	0.80	Canada	3%	2.26	1.00
Lead	Other Eu Countries	2%	0.00	0.80	Japan	2%	2.77	1.00
Lead	Sweden	1%	2.05	0.80	Australia	2%	2.36	1.00
Lead	Turkey	1%	5.34	1.00	Italy	2%	4.17	0.80
Lead					Brazil	2%	5.08	1.00
Lead					Spain	2%	3.62	0.80
Lead					Poland	1%	3.60	0.80
Lead					Belgium	1%	2.81	0.80
Lead					Kazakhstan	1%	5.90	1.00
Lead					Russian Federation	1%	6.20	1.00
Limestone	Other Non Eu Countries	72%	0.00	1.00				
Limestone	Other EU countries	5%	0.00	0.80				
Limestone	France	5%	3.11	0.80				

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Limestone	Italy	5%	4.17	0.80				
Limestone	Germany	5%	2.47	0.80				
Limestone	Austria	4%	2.50	0.80				
Limestone	Poland	1%	3.60	0.80				
Limestone	Spain	1%	3.62	0.80				
Limestone	Denmark	1%	2.11	0.80				
Limestone	Greece	1%	4.60	0.80				
Lithium	Chile	38%	3.11	1.00	Chile	44%	3.11	1.00
Lithium	Australia	36%	2.36	1.00	China	39%	5.83	1.00
Lithium	Argentina	12%	5.47	1.10	Argentina	13%	5.47	1.00
Lithium	China	7%	5.83	1.00	United States	3%	2.92	1.00
Lithium	United States	3%	2.92	1.00	Brazil	<1%	5.08	1.00
Lithium	Zimbabwe	2%	7.17	1.00	Others	<1%	0.00	1.00
Lithium	Brazil	1%	5.08	1.00				
Lithium	Portugal	<1%	3.34	0.80				
Lithium	Bolivia	<1%	5.97	1.00				
Magnesite	China	66%	5.83	1.61				
Magnesite	Turkey	11%	5.34	1.00				
Magnesite	Russian Federation	5%	6.20	1.00				
Magnesite	Slovakia	3%	3.79	0.80				
Magnesite	Austria	3%	2.50	0.80				
Magnesite	Brazil	2%	5.08	1.00				
Magnesite	Spain	2%	3.62	0.80				
Magnesite	Australia	2%	2.36	1.00				
Magnesite	Greece	1%	4.60	0.80				
Magnesite	India	1%	5.45	1.00				
Magnesite	Korea, Dem. Rep.	1%	7.74	1.00				
Magnesite	Iran, Islamic Rep.	1%	6.65	1.00				
Magnesite	Other non EU countries	1%	0.00	1.00				
Magnesite	Canada	1%	2.26	1.00				
Magnesite	Mexico	<1%	5.33	1.00				
Magnesite	Poland	<1%	3.60	0.80				
Magnesite	Other EU countries	<1%	0.00	0.80				
Magnesium					China	89%	5.83	1.00
Magnesium					United States	4%	2.92	1.00
Magnesium					Israel	3%	3.83	1.00
Magnesium					Brazil	2%	5.08	1.00
Magnesium					Russian Federation	1%	6.20	1.00
Magnesium					Turkey	1%	5.34	0.00
Magnesium					Malaysia	<1%	4.39	1.00
Magnesium					Korea, Rep.	<1%	3.74	1.00
Magnesium					Kazakhstan	<1%	5.90	1.00

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Magnesium					Ukraine	<1%	6.23	1.00
Magnesium					India	<1%	5.45	1.00
Magnesium					Iran, Islamic Rep.	<1%	6.65	1.00
Manganese	South Africa	28%	4.65	1.00	China	57%	5.83	1.10
Manganese	China	17%	5.83	1.10	India	12%	5.45	1.00
Manganese	Australia	17%	2.36	1.00	South Africa	5%	4.65	1.00
Manganese	Gabon	10%	5.97	1.10	Ukraine	5%	6.23	1.00
Manganese	Brazil	7%	5.08	1.00	Norway	3%	2.03	1.00
Manganese	India	5%	5.45	1.00	Korea, Rep.	3%	3.74	1.00
Manganese	Ghana	3%	4.94	1.00	Japan	3%	2.77	1.00
Manganese	Ukraine	3%	6.23	1.00	Russian Federation	2%	6.20	1.10
Manganese	Kazakhstan	3%	5.90	1.00	Brazil	2%	5.08	1.00
Manganese	Malaysia	2%	4.39	1.00	Australia	1%	2.36	1.00
Manganese	Other Non Eu Countries	2%	0.00	1.00	Spain	1%	3.62	0.80
Manganese	Mexico	1%	5.33	1.00	Georgia	1%	4.47	1.00
Manganese	Côte D'Ivoire	1%	6.21	1.00	Mexico	1%	5.33	1.00
Manganese	Myanmar	1%	6.95	1.00	France	1%	3.11	0.80
Manganese	Other Eu Countries	<1%	0.00	0.80	Other Non Eu Countries	1%	0.00	1.00
Manganese					Kazakhstan	1%	5.90	1.00
Manganese					United States	1%	2.92	1.00
Manganese					Other Eu Countries	<1%	0.00	0.80
Molybdenum	China	47%	5.83	1.36				
Molybdenum	Chile	17%	3.11	1.00				
Molybdenum	United States	16%	2.92	1.00				
Molybdenum	Peru	7%	5.30	1.00				
Molybdenum	Mexico	4%	5.33	1.00				
Molybdenum	Canada	2%	2.26	1.00				
Molybdenum	Armenia	2%	5.41	1.00				
Molybdenum	Other Non Eu Countries	2%	0.00	1.00				
Molybdenum	Russian Federation	1%	6.20	1.10				
Molybdenum	Iran, Islamic Rep.	1%	6.65	1.00				
Natural cork	Portugal	50%	3.34	0.80				
Natural cork	Spain	31%	3.62	0.80				
Natural cork	Morocco	6%	5.48	1.00				
Natural cork	Algeria	5%	6.43	1.00				
Natural cork	Tunisia	3%	5.40	1.00				
Natural cork	Italy	3%	4.17	0.80				
Natural cork	France	3%	3.11	0.80				
Natural graphite	China	69%	5.83	1.10				
Natural graphite	India	12%	5.45	1.00				
Natural graphite	Brazil	8%	5.08	1.00				

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Natural graphite	Korea, Dem. Rep.	3%	7.74	1.00				
Natural graphite	Canada	2%	2.26	1.00				
Natural graphite	Russian Federation	1%	6.20	1.00				
Natural graphite	Turkey	1%	5.34	1.00				
Natural graphite	Mexico	1%	5.33	1.00				
Natural graphite	Ukraine	1%	6.23	1.00				
Natural graphite	Norway	1%	2.03	1.00				
Natural graphite	Zimbabwe	1%	7.17	1.00				
Natural graphite	Madagascar	1%	6.26	1.00				
Natural graphite	Sri Lanka	<1%	5.36	1.00				
Natural graphite	Romania	<1%	4.70	0.80				
Natural graphite	Argentina	<1%	5.47	1.00				
Natural graphite	Germany	<1%	2.47	0.80				
Natural graphite	Austria	<1%	2.50	0.80				
Natural graphite	Sweden	<1%	2.05	0.80				
Natural graphite	Korea, Rep.	<1%	3.74	1.00				
Natural Rubber	Thailand	33%	5.50	1.00				
Natural Rubber	Indonesia	24%	5.47	1.00				
Natural Rubber	Vietnam	7%	5.75	1.00				
Natural Rubber	India	7%	5.45	1.00				
Natural Rubber	China	6%	5.83	1.00				
Natural Rubber	Malaysia	6%	4.39	1.00				
Natural Rubber	Philippines	3%	5.49	1.00				
Natural Rubber	Guatemala	3%	6.00	1.00				
Natural Rubber	Côte D'Ivoire	3%	6.21	1.00				
Natural Rubber	Other non EU countries	2%	0.00	1.00				
Natural Rubber	Myanmar	1%	6.95	1.00				
Natural Rubber	Brazil	1%	5.08	1.00				
Natural Rubber	Nigeria	1%	6.83	1.00				
Natural Rubber	Sri Lanka	1%	5.36	1.00				
Natural Rubber	Liberia	1%	6.29	1.00				
Natural Teak wood	India	40%	5.45	1.00				
Natural Teak wood	Indonesia	30%	5.47	1.00				
Natural Teak wood	Myanmar	9%	6.95	1.00				
Natural Teak wood	Ghana	5%	4.94	1.00				
Natural Teak wood	Nigeria	4%	6.83	1.00				
Natural Teak wood	Other Non Eu Countries	3%	0.00	1.00				
Natural Teak wood	Thailand	3%	5.50	1.00				
Natural Teak wood	Bangladesh	2%	6.41	1.00				
Natural Teak	Brazil	2%	5.08	1.00				

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
wood								
Natural Teak wood	Panama	1%	4.79	1.00				
Natural Teak wood	Côte D'Ivoire	1%	6.21	1.00				
Neodymium	China	86%	5.83	1.59				
Neodymium	Australia	6%	2.36	1.00				
Neodymium	United States	2%	2.92	1.00				
Neodymium	Russian Federation	2%	6.20	1.00				
Neodymium	India	1%	5.45	1.00				
Neodymium	Brazil	1%	5.08	1.00				
Neodymium	Thailand	1%	5.50	1.00				
Neodymium	Malaysia	1%	4.39	1.00				
Neodymium	Vietnam	<1%	5.75	1.00				
Nickel	Indonesia	18%	5.47	1.18	China	29%	5.83	1.29
Nickel	Philippines	17%	5.49	1.00	Russian Federation	12%	6.20	1.00
Nickel	Australia	11%	2.36	1.00	Japan	10%	2.77	1.00
Nickel	Russian Federation	11%	6.20	1.00	Canada	8%	2.26	1.00
Nickel	Canada	10%	2.26	1.00	Australia	7%	2.36	1.00
Nickel	Other non EU	9%	0.00	1.00	Other non EU	6%	0.00	1.00
Nickel	French Guiana	8%	3.23	1.00	Norway	5%	2.03	1.10
Nickel	China	4%	5.83	1.10	Brazil	4%	5.08	1.00
Nickel	Brazil	4%	5.08	1.00	French Guiana	3%	3.23	1.00
Nickel	Cuba	2%	5.87	1.00	Finland	3%	1.98	0.80
Nickel	South Africa	2%	4.65	1.00	Colombia	2%	5.39	1.00
Nickel	Colombia	2%	5.39	1.00	Indonesia	2%	5.47	1.00
Nickel	Greece	1%	4.60	0.80	United Kingdom	2%	2.60	0.80
Nickel	Finland	1%	1.98	0.80	South Africa	2%	4.65	1.00
Nickel	Spain	<1%	3.62	0.80	Korea, Rep.	2%	3.74	1.00
Nickel	Poland	<1%	3.60	0.80	Madagascar	2%	6.26	1.00
Nickel					Greece	1%	4.60	0.80
Nickel					France	1%	3.11	0.80
Nickel					Poland	<1%	3.60	0.80
Nickel					Austria	<1%	2.50	0.80
Niobium					Brazil	92%	5.08	1.00
Niobium					Canada	8%	2.26	1.00
Niobium					Russian Federation	<1%	6.20	1.00
Palladium					Russian Federation	40%	6.20	1.10
Palladium					South Africa	37%	4.65	1.00
Palladium					Canada	10%	2.26	1.00
Palladium					United States	6%	2.92	1.00
Palladium					Zimbabwe	5%	7.17	1.00

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Palladium					Botswana	<1%	3.89	1.00
Palladium					Finland	<1%	1.98	0.80
Palladium					China	<1%	5.83	1.00
Palladium					Australia	<1%	2.36	1.00
Palladium					Poland	<1%	3.60	0.80
Palladium					Serbia	<1%	5.05	1.00
Perlite	Greece	22%	4.60	0.80				
Perlite	Turkey	22%	5.34	1.00				
Perlite	China	17%	5.83	1.00				
Perlite	Iran, Islamic Rep.	14%	6.65	1.00				
Perlite	United States	11%	2.92	1.00				
Perlite	Japan	5%	2.77	1.00				
Perlite	Hungary	2%	4.06	0.80				
Perlite	Italy	1%	4.17	0.80				
Perlite	Russian Federation	1%	6.20	1.00				
Perlite	Thailand	1%	5.50	1.00				
Perlite	Argentina	1%	5.47	1.00				
Perlite	Mexico	1%	5.33	1.00				
Perlite	Slovakia	<1%	3.79	0.80				
Perlite	Ukraine	<1%	6.23	1.00				
Perlite	Philippines	<1%	5.49	1.00				
Perlite	Armenia	<1%	5.41	1.00				
Perlite	Bulgaria	<1%	4.73	0.80				
Perlite	New Zealand	<1%	1.93	1.00				
Perlite	Chile	<1%	3.11	1.00				
Perlite	Australia	<1%	2.36	1.00				
Perlite	South Africa	<1%	4.65	1.00				
Phosphate rock	China	48%	5.83	1.47				
Phosphate rock	Morocco	11%	5.48	1.10				
Phosphate rock	United States	10%	2.92	1.00				
Phosphate rock	Russian Federation	6%	6.20	1.00				
Phosphate rock	Peru	6%	5.30	1.00				
Phosphate rock	Brazil	3%	5.08	1.00				
Phosphate rock	Jordan	3%	5.16	1.00				
Phosphate rock	Egypt, Arab Rep.	2%	6.48	1.02				
Phosphate rock	Other non-EU countries	2%	0.00	1.00				
Phosphate rock	Israel	1%	3.83	1.00				
Phosphate rock	Tunisia	1%	5.40	1.00				
Phosphate rock	Vietnam	1%	5.75	1.10				
Phosphate rock	South Africa	1%	4.65	1.00				
Phosphate rock	Mexico	1%	5.33	1.00				
Phosphate rock	Saudi Arabia	1%	5.51	1.00				

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Phosphate rock	Senegal	1%	5.21	1.00				
Phosphate rock	Algeria	1%	6.43	1.00				
Phosphate rock	Togo	1%	6.34	1.00				
Phosphate rock	Australia	1%	2.36	1.00				
Phosphate rock	Kazakhstan	1%	5.90	1.00				
Phosphate rock	India	<1%	5.45	1.00				
Phosphate rock	Finland	<1%	1.98	0.80				
Phosphorus					China	74%	5.83	1.00
Phosphorus					Kazakhstan	9%	5.90	1.00
Phosphorus					Vietnam	9%	5.75	1.00
Phosphorus					United States	8%	2.92	1.00
Platinum					South Africa	71%	4.65	1.00
Platinum					Russian Federation	13%	6.20	1.10
Platinum					Zimbabwe	7%	7.17	1.10
Platinum					Canada	5%	2.26	1.00
Platinum					United States	2%	2.92	1.00
Platinum					China	1%	5.83	1.00
Platinum					Colombia	1%	5.39	1.00
Platinum					Finland	1%	1.98	0.80
Platinum					Botswana	<1%	3.89	1.00
Platinum					Australia	<1%	2.36	1.00
Platinum					Poland	<1%	3.60	0.80
Platinum					Serbia	<1%	5.05	1.00
Potash	Canada	28%	2.26	1.00				
Potash	Russian Federation	17%	6.20	1.00				
Potash	Belarus	15%	6.18	1.10				
Potash	China	13%	5.83	1.10				
Potash	Germany	8%	2.47	0.80				
Potash	Israel	5%	3.83	1.00				
Potash	Other Non Eu Countries	4%	0.00	1.00				
Potash	Jordan	3%	5.16	1.00				
Potash	Chile	3%	3.11	1.00				
Potash	United States	2%	2.92	1.00				
Potash	Spain	2%	3.62	0.80				
Praseodymium	China	86%	5.83	1.59				
Praseodymium	Australia	6%	2.36	1.00				
Praseodymium	United States	2%	2.92	1.00				
Praseodymium	Russian Federation	2%	6.20	1.00				
Praseodymium	India	1%	5.45	1.00				
Praseodymium	Brazil	1%	5.08	1.00				
Praseodymium	Thailand	1%	5.50	1.00				
Praseodymium	Malaysia	1%	4.39	1.00				
Praseodymium	Vietnam	<1%	5.75	1.00				

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Rhenium					Chile	48%	3.11	1.00
Rhenium					United States	18%	2.92	1.00
Rhenium					Poland	12%	3.60	0.80
Rhenium					Korea, Rep.	7%	3.74	1.00
Rhenium					China	5%	5.83	1.00
Rhenium					Japan	5%	2.77	1.00
Rhenium					Other non Eu countries	5%	0.00	1.00
Rhodium					South Africa	80%	4.65	1.00
Rhodium					Russia	12%	0.00	1.10
Rhodium					Zimbabwe	5%	7.17	1.10
Rhodium					Canada	2%	2.26	1.00
Rhodium					United States	1%	2.92	1.00
Ruthenium					South Africa	93%	4.65	1.10
Ruthenium					Zimbabwe	4%	7.17	1.00
Ruthenium					Canada	2%	2.26	1.00
Ruthenium					Russia	1%	0.00	1.00
Ruthenium					Other Non Eu Countries	<1%	0.00	1.00
Ruthenium					United States	<1%	2.92	1.00
Samarium	China	86%	5.83	1.59				
Samarium	Australia	6%	2.36	1.00				
Samarium	United States	2%	2.92	1.00				
Samarium	Russian Federation	2%	6.20	1.00				
Samarium	India	1%	5.45	1.00				
Samarium	Brazil	1%	5.08	1.00				
Samarium	Thailand	1%	5.50	1.00				
Samarium	Malaysia	1%	4.39	1.00				
Samarium	Vietnam	<1%	5.75	1.00				
Sapele wood	Other Non Eu Countries	100%	0.00	1.00				
Scandium					China	66%	5.83	1.10
Scandium					Russian Federation	26%	6.20	1.00
Scandium					Ukraine	7%	6.23	1.00
Scandium					Kazakhstan	1%	5.90	1.00
Selenium					China	23%	5.83	1.00
Selenium					Japan	23%	2.77	1.00
Selenium					Germany	20%	2.47	0.80
Selenium					Belgium	6%	2.81	0.80
Selenium					Russian Federation	5%	6.20	1.00
Selenium					Canada	5%	2.26	1.00
Selenium					Mexico	3%	5.33	1.00
Selenium					Finland	3%	1.98	0.80
Selenium					Poland	3%	3.60	0.80
Selenium					Other non EU	2%	0.00	1.00

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
					countries			
Selenium					Philippines	2%	5.49	1.00
Selenium					Kazakhstan	2%	5.90	1.00
Selenium					Peru	1%	5.30	1.00
Selenium					Sweden	1%	2.05	0.80
Silica sand	United States	38%	2.92	1.00				
Silica sand	Netherlands	17%	2.19	0.80				
Silica sand	Turkey	5%	5.34	1.00				
Silica sand	Italy	4%	4.17	0.80				
Silica sand	Other Non Eu Countries	4%	0.00	1.00				
Silica sand	Malaysia	3%	4.39	1.00				
Silica sand	France	3%	3.11	0.80				
Silica sand	India	3%	5.45	1.00				
Silica sand	Germany	2%	2.47	0.80				
Silica sand	Bulgaria	2%	4.73	0.80				
Silica sand	Brazil	2%	5.08	1.00				
Silica sand	Spain	2%	3.62	0.80				
Silica sand	Poland	2%	3.60	0.80				
Silica sand	Korea, Rep.	1%	3.74	1.00				
Silica sand	Belgium	1%	2.81	0.80				
Silica sand	United Kingdom	1%	2.60	1.00				
Silica sand	Other Eu Countries	1%	0.00	0.80				
Silica sand	Australia	1%	2.36	1.00				
Silica sand	Japan	1%	2.77	1.00				
Silica sand	Mexico	1%	5.33	1.00				
Silica sand	Canada	1%	2.26	1.00				
Silica sand	New Zealand	1%	1.93	1.00				
Silica sand	South Africa	1%	4.65	1.00				
Silica sand	Iran, Islamic Rep.	1%	6.65	1.00				
Silica sand	Moldova	1%	5.54	1.00				
Silica sand	Latvia	<1%	3.73	0.80				
Silica sand	Argentina	<1%	5.47	1.00				
Silica sand	Austria	<1%	2.50	0.80				
Silica sand	Czech Republic	<1%	3.47	0.80				
Silicon metal					China	66%	5.83	1.10
Silicon metal					United States	8%	2.92	1.00
Silicon metal					Brazil	7%	5.08	1.00
Silicon metal					Norway	6%	2.03	1.00
Silicon metal					France	4%	3.11	0.80
Silicon metal					South Africa	2%	4.65	1.00
Silicon metal					Australia	2%	2.36	1.00
Silicon metal					Russian Federation	2%	6.20	1.00

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Silicon metal					Germany	1%	2.47	0.80
Silicon metal					Spain	1%	3.62	0.80
Silicon metal					Canada	1%	2.26	1.00
Silver	Mexico	21%	5.33	1.00	China	22%	5.83	1.08
Silver	Peru	14%	5.30	1.00	United States	20%	2.92	1.00
Silver	China	13%	5.83	1.10	India	16%	5.45	1.10
Silver	Australia	6%	2.36	1.00	Japan	9%	2.77	1.00
Silver	Russian Federation	5%	6.20	1.00	Germany	3%	2.47	0.80
Silver	Chile	5%	3.11	1.00	Other Non Eu Countries	3%	0.00	1.00
Silver	Poland	5%	3.60	0.80	Canada	3%	2.26	1.00
Silver	Bolivia	5%	5.97	1.10	Thailand	3%	5.50	1.00
Silver	United States	4%	2.92	1.00	Italy	3%	4.17	0.80
Silver	Kazakhstan	4%	5.90	1.00	Russian Federation	2%	6.20	1.00
Silver	Argentina	3%	5.47	1.00	Korea, Rep.	2%	3.74	1.00
Silver	Guatemala	2%	6.00	1.00	United Kingdom	2%	2.60	1.00
Silver	Canada	2%	2.26	1.00	Mexico	2%	5.33	1.00
Silver	Sweden	2%	2.05	0.80	Australia	1%	2.36	1.00
Silver	India	1%	5.45	1.00	France	1%	3.11	0.80
Silver	Other Non Eu Countries	1%	0.00	1.00	Taiwan, China	1%	3.27	1.00
Silver	Turkey	1%	5.34	1.00	Belgium	1%	2.81	0.80
Silver	Morocco	1%	5.48	1.00	Brazil	1%	5.08	1.00
Silver	Indonesia	1%	5.47	1.01	Austria	1%	2.50	0.80
Silver	Other Eu Countries	<1%	0.00	0.80	Indonesia	1%	5.47	1.01
Silver	Dominican Republic	<1%	5.40	1.00	Turkey	1%	5.34	1.00
Silver	Papua New Guinea	<1%	5.94	1.00	Hong Kong Sar, China	1%	2.56	1.00
Silver	South Africa	<1%	4.65	1.00	Spain	<1%	3.62	0.80
Silver	Bulgaria	<1%	4.73	0.80	Bulgaria	<1%	4.73	0.80
Silver	Korea, Dem. Rep.	<1%	7.74	1.00	Czech Republic	<1%	3.47	0.80
Silver	Mongolia	<1%	5.18	1.00	Netherlands	<1%	2.19	0.80
Silver	Honduras	<1%	6.06	1.00	Poland	<1%	3.60	0.80
Silver	Iran, Islamic Rep.	<1%	6.65	1.00	Other Eu Countries	<1%	0.00	0.80
Silver	Lao Pdr	<1%	6.25	1.00	Greece	<1%	4.60	0.80
Silver	Portugal	<1%	3.34	0.80	Sweden	<1%	2.05	0.80
Strontium	Spain	31%	3.62	0.80				
Strontium	Iran, Islamic Rep.	30%	6.65	1.00				
Strontium	China	19%	5.83	1.00				
Strontium	Mexico	17%	5.33	1.00				
Strontium	Argentina	2%	5.47	1.00				
Sulphur					China	15%	5.83	1.00
Sulphur					United States	14%	2.92	1.00

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Sulphur					Russian Federation	10%	6.20	1.00
Sulphur					Canada	8%	2.26	1.00
Sulphur					Saudi Arabia	6%	5.51	1.00
Sulphur					Japan	5%	2.77	1.00
Sulphur					United Arab Emirates	5%	3.94	1.00
Sulphur					Kazakhstan	4%	5.90	1.00
Sulphur					India	4%	5.45	1.00
Sulphur					Other Non Eu Countries	4%	0.00	1.00
Sulphur					Qatar	3%	4.03	1.00
Sulphur					Iran, Islamic Rep.	3%	6.65	1.00
Sulphur					Korea, Rep.	3%	3.74	1.00
Sulphur					Chile	3%	3.11	1.00
Sulphur					Mexico	1%	5.33	1.00
Sulphur					Australia	1%	2.36	1.00
Sulphur					Finland	1%	1.98	0.80
Sulphur					Kuwait	1%	5.24	1.00
Sulphur					Venezuela, Rb	1%	7.30	1.00
Sulphur					Poland	1%	3.60	0.80
Sulphur					Italy	1%	4.17	0.80
Sulphur					Germany	1%	2.47	0.80
Sulphur					Spain	1%	3.62	0.80
Sulphur					Peru	1%	5.30	1.00
Sulphur					Brazil	1%	5.08	1.00
Sulphur					Indonesia	1%	5.47	1.00
Sulphur					Philippines	1%	5.49	1.00
Sulphur					Bulgaria	1%	4.73	0.80
Sulphur					France	1%	3.11	0.80
Sulphur					Other Eu Countries	<1%	0.00	0.80
Talc	China	26%	5.83	1.25				
Talc	India	13%	5.45	1.00				
Talc	Brazil	8%	5.08	1.00				
Talc	United states	8%	2.92	1.00				
Talc	Korea, Rep.	8%	3.74	1.00				
Talc	Mexico	6%	5.33	1.00				
Talc	Japan	5%	2.77	1.00				
Talc	France	5%	3.11	0.80				
Talc	Finland	5%	1.98	0.80				
Talc	Other Non Eu Countries	4%	0.00	1.00				
Talc	Canada	2%	2.26	1.00				
Talc	Italy	2%	4.17	0.80				
Talc	Turkey	2%	5.34	1.00				
Talc	Russian	2%	6.20	1.00				

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
	Federation							
Talc	Austria	2%	2.50	0.80				
Talc	Australia	1%	2.36	1.00				
Talc	Iran, Islamic Rep.	1%	6.65	1.00				
Talc	Other Eu Countries	<1%	0.00	0.80				
Tantalum	Congo, Dem. Rep.	33%	7.60	1.00				
Tantalum	Rwanda	28%	5.17	1.10				
Tantalum	Brazil	9%	5.08	1.00				
Tantalum	China	6%	5.83	1.20				
Tantalum	Ethiopia	6%	6.52	1.00				
Tantalum	Nigeria	5%	6.83	1.00				
Tantalum	Mozambique	5%	5.93	1.00				
Tantalum	Russian Federation	3%	6.20	1.00				
Tantalum	Burundi	2%	7.00	1.10				
Tantalum	Malaysia	1%	4.39	1.00				
Tantalum	Australia	1%	2.36	1.00				
Tantalum	Canada	1%	2.26	1.00				
Tantalum	Bolivia	<1%	5.97	1.00				
Tantalum	France	<1%	3.11	0.80				
Tellurium					China	54%	5.83	1.00
Tellurium					United States	14%	2.92	1.00
Tellurium					Japan	10%	2.77	1.00
Tellurium					Russian Federation	9%	6.20	1.00
Tellurium					Sweden	7%	2.05	0.80
Tellurium					Canada	3%	2.26	1.00
Tellurium					Peru	2%	5.30	1.00
Tellurium					Bulgaria	1%	4.73	0.80
Terbium	China	86%	5.83	1.59				
Terbium	Australia	6%	2.36	1.00				
Terbium	United States	2%	2.92	1.00				
Terbium	Russian Federation	2%	6.20	1.00				
Terbium	India	1%	5.45	1.00				
Terbium	Brazil	1%	5.08	1.00				
Terbium	Thailand	1%	5.50	1.00				
Terbium	Malaysia	1%	4.39	1.00				
Terbium	Vietnam	<1%	5.75	1.00				
Tin	China	35%	5.83	1.29	China	47%	5.83	1.42
Tin	Indonesia	27%	5.47	1.00	Indonesia	19%	5.47	1.00
Tin	Myanmar	10%	6.95	1.00	Malaysia	9%	4.39	1.00
Tin	Peru	7%	5.30	1.00	Peru	6%	5.30	1.00
Tin	Bolivia	6%	5.97	1.10	Thailand	5%	5.50	1.00
Tin	Brazil	6%	5.08	1.00	Brazil	4%	5.08	1.00

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Tin	Australia	2%	2.36	1.00	Bolivia	4%	5.97	1.00
Tin	Congo, Dem. Rep.	2%	7.60	1.00	Belgium	3%	2.81	0.80
Tin	Vietnam	1%	5.75	1.20	Other Non Eu Countries	1%	0.00	1.00
Tin	Other Non Eu Countries	1%	0.00	1.00	Vietnam	1%	5.75	1.10
Tin	Malaysia	1%	4.39	1.00	Poland	1%	3.60	0.80
Tin	Rwanda	1%	5.17	1.10				
Tin	Other Eu Countries	<1%	0.00	0.80				
Titanium	Canada	19%	2.26	1.00	China	45%	5.83	1.00
Titanium	China	15%	5.83	1.10	Russian Federation	22%	6.20	1.00
Titanium	Australia	13%	2.36	1.00	Japan	22%	2.77	1.00
Titanium	South Africa	12%	4.65	1.00	Kazakhstan	7%	5.90	1.00
Titanium	Mozambique	6%	5.93	1.00	Ukraine	4%	6.23	1.00
Titanium	Norway	6%	2.03	1.00	India	<1%	5.45	1.00
Titanium	Ukraine	6%	6.23	1.00	Other Non Eu Countries	<1%	0.00	1.00
Titanium	India	6%	5.45	1.10				
Titanium	Vietnam	5%	5.75	1.20				
Titanium	Madagascar	3%	6.26	1.00				
Titanium	Kenya	2%	6.03	1.00				
Titanium	Korea, Dem. Rep.	2%	7.74	1.00				
Titanium	Senegal	2%	5.21	1.00				
Titanium	United States	1%	2.92	1.00				
Titanium	Sierra Leone	1%	6.17	1.10				
Titanium	Russian Federation	1%	6.20	1.00				
Titanium	Brazil	1%	5.08	1.00				
Titanium	Sri Lanka	<1%	5.36	1.00				
Titanium	Malaysia	<1%	4.39	1.00				
Titanium	Kazakhstan	<1%	5.90	1.00				
Tungsten	China	82%	5.83	1.78	China	69%	5.83	1.00
Tungsten	Russian Federation	4%	6.20	1.10	Vietnam	7%	5.75	1.00
Tungsten	Vietnam	4%	5.75	1.20	United States	6%	2.92	1.00
Tungsten	Canada	2%	2.26	1.00	Russian federation	6%	6.20	1.00
Tungsten	Bolivia	1%	5.97	1.00	Brazil	4%	5.08	1.00
Tungsten	Rwanda	1%	5.17	1.10	Austria	1%	2.50	0.80
Tungsten	Austria	1%	2.50	0.80	Germany	1%	2.47	0.80
Tungsten	Portugal	1%	3.34	0.80	India	1%	5.45	1.00
Tungsten	Spain	1%	3.62	0.80	Japan	1%	2.77	1.00
Tungsten	Mongolia	1%	5.18	1.00	Uzbekistan	1%	6.98	1.00
Tungsten	Brazil	1%	5.08	1.00	Korea, Rep.	1%	3.74	1.00
Tungsten	United Kingdom	1%	2.60	1.00				
Tungsten	Australia	<1%	2.36	1.00				

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Tungsten	Myanmar	<1%	6.95	1.00				
Tungsten	Uzbekistan	<1%	6.98	1.00				
Tungsten	Peru	<1%	5.30	1.00				
Tungsten	Korea, Dem. Rep.	<1%	7.74	1.00				
Tungsten	Burundi	<1%	7.00	1.00				
Tungsten	Thailand	<1%	5.50	1.00				
Tungsten	Congo, Dem. Rep.	<1%	7.60	1.00				
Tungsten	Kyrgyz Republic	<1%	6.30	1.00				
Tungsten	Uganda	<1%	5.99	1.00				
Tungsten	Korea, Rep.	<1%	3.74	1.00				
Vanadium	China	39%	5.83	1.00	China	57%	5.83	1.10
Vanadium	South Africa	31%	4.65	1.00	South Africa	13%	4.65	1.00
Vanadium	Russian Federation	25%	6.20	1.00	Russian Federation	9%	6.20	1.00
Vanadium	Brazil	3%	5.08	1.00	United States	5%	2.92	1.00
Vanadium	Kazakhstan	1%	5.90	1.00	Brazil	3%	5.08	1.00
Vanadium	United States	<1%	2.92	1.00	Japan	2%	2.77	1.00
Vanadium	Australia	<1%	2.36	1.00	Korea, Rep.	1%	3.74	1.00
Vanadium					Taiwan, China	0%	3.27	1.00
Vanadium					India	1%	5.45	1.00
Vanadium					Austria	8%	2.50	0.80
Vanadium					Germany	0%	2.47	0.80
Vanadium					Other Non Eu Countries	0%	0.00	1.00
Yttrium	China	86%	5.83	1.59				
Yttrium	Australia	6%	2.36	1.00				
Yttrium	United States	2%	2.92	1.00				
Yttrium	Russian Federation	2%	6.20	1.00				
Yttrium	India	1%	5.45	1.00				
Yttrium	Brazil	1%	5.08	1.00				
Yttrium	Thailand	1%	5.50	1.00				
Yttrium	Malaysia	1%	4.39	1.00				
Yttrium	Vietnam	<1%	5.75	1.00				
Zinc	China	37%	5.83	1.20	China	42%	5.83	1.10
Zinc	Australia	11%	2.36	1.00	Korea, Dem. Rep.	7%	7.74	1.00
Zinc	Peru	10%	5.30	1.00	India	5%	5.45	1.00
Zinc	United States	6%	2.92	1.00	Canada	5%	2.26	1.00
Zinc	India	6%	5.45	1.00	Japan	4%	2.77	1.00
Zinc	Mexico	5%	5.33	1.00	Spain	4%	3.62	0.80
Zinc	Other Non Eu Countries	4%	0.00	1.00	Australia	4%	2.36	1.00
Zinc	Bolivia	3%	5.97	1.00	Peru	3%	5.30	1.00
Zinc	Canada	3%	2.26	1.00	Other Non Eu Countries	2%	0.00	1.00

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Zinc	Kazakhstan	3%	5.90	1.00	Mexico	2%	5.33	1.00
Zinc	Ireland	2%	2.58	0.80	Kazakhstan	2%	5.90	1.00
Zinc	Other Eu Countries	2%	0.00	0.80	Finland	2%	1.98	0.80
Zinc	Sweden	2%	2.05	0.80	Netherlands	2%	2.19	0.80
Zinc	Russian Federation	2%	6.20	1.00	Brazil	2%	5.08	1.00
Zinc	Turkey	1%	5.34	1.00	Belgium	2%	2.81	0.80
Zinc	Namibia	1%	4.44	1.00	Russian Federation	2%	6.20	1.00
Zinc	Brazil	1%	5.08	1.00	Other Eu Countries	1%	0.00	0.80
Zinc	Iran, Islamic Rep.	1%	6.65	1.00	United States	1%	2.92	1.00
Zinc					Germany	1%	2.47	0.80
Zinc					France	1%	3.11	0.80
Zinc					Norway	1%	2.03	1.00
Zinc					Poland	1%	3.60	0.80
Zinc					Iran, Islamic Rep.	1%	6.65	1.00
Zirconium	Australia	42%	2.36	1.00				
Zirconium	South Africa	25%	4.65	1.00				
Zirconium	China	10%	5.83	1.10				
Zirconium	United States	5%	2.92	1.00				
Zirconium	Mozambique	4%	5.93	1.00				
Zirconium	Indonesia	3%	5.47	1.03				
Zirconium	Ukraine	2%	6.23	1.00				
Zirconium	Brazil	2%	5.08	1.00				
Zirconium	Madagascar	2%	6.26	1.00				
Zirconium	Senegal	2%	5.21	1.00				
Zirconium	India	1%	5.45	1.00				
Zirconium	Vietnam	1%	5.75	1.10				
Zirconium	Kenya	1%	6.03	1.00				
Zirconium	Russian federation	1%	6.20	1.00				
Zirconium	Sierra Leone	<1%	6.17	1.00				
Zirconium	Sri Lanka	<1%	5.36	1.00				
Zirconium	Nigeria	<1%	6.83	1.00				
Zirconium	Turkey	<1%	5.34	1.00				
Zirconium	Malaysia	<1%	4.39	1.00				

Annex 7. EU Sourcing, trade-related variable and WGI (2 stages).

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Aggregates	Germany	22%	2.47	0.80				
Aggregates	France	15%	3.11	0.80				
Aggregates	Poland	11%	3.60	0.80				
Aggregates	Other EU countries	9%	0.00	0.80				
Aggregates	Italy	8%	4.17	0.80				
Aggregates	Spain	5%	3.62	0.80				
Aggregates	Austria	5%	2.50	0.80				
Aggregates	Romania	4%	4.70	0.80				
Aggregates	Finland	4%	1.98	0.80				
Aggregates	Sweden	4%	2.05	0.80				
Aggregates	Belgium	3%	2.81	0.80				
Aggregates	Netherlands	3%	2.19	0.80				
Aggregates	Czech Republic	3%	3.47	0.80				
Aggregates	Hungary	2%	4.06	0.80				
Aggregates	Denmark	2%	2.11	0.80				
Aggregates	Greece	1%	4.60	0.80				
Aggregates	United Kingdom	<1%	2.60	1.00				
Aluminium					Russian Federation	17%	6.20	1.10
Aluminium					Other Non Eu Countries	15%	0.00	1.00
Aluminium					Germany	10%	2.47	0.80
Aluminium					Mozambique	9%	5.93	1.00
Aluminium					France	7%	3.11	0.80
Aluminium					Spain	6%	3.62	0.80
Aluminium					Iceland	6%	2.52	1.00
Aluminium					Norway	6%	2.03	1.00
Aluminium					Romania	5%	4.70	0.80
Aluminium					Greece	3%	4.60	0.80
Aluminium					Slovakia	3%	3.79	0.80
Aluminium					United Arab Emirates	3%	3.94	1.00
Aluminium					Sweden	2%	2.05	0.80
Aluminium					Canada	2%	2.26	1.00
Aluminium					United Kingdom	2%	2.60	1.00
Aluminium					Slovenia	2%	3.50	0.80
Aluminium					Italy	1%	4.17	0.80
Aluminium					Netherlands	1%	2.19	0.80
Antimony	Turkey	62%	5.34	1.00	China	40%	5.83	1.10
Antimony	Bolivia	20%	5.97	1.10	Belgium	29%	2.81	0.80
Antimony	Guatemala	7%	6.00	1.00	France	11%	3.11	0.80
Antimony	Switzerland	5%	2.03	1.00	Germany	3%	2.47	0.80
Antimony	Kosovo	2%	5.64	1.00	Other Non Eu Countries	3%	0.00	1.00

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Antimony	China	2%	5.83	1.10	Korea, Rep.	3%	3.74	1.00
Antimony	Other Non Eu Countries	1%	0.00	1.00	Spain	3%	3.62	0.80
Antimony					Netherlands	2%	2.19	0.80
Antimony					Other Eu Countries	2%	0.00	0.80
Antimony					Bolivia	1%	5.97	1.10
Antimony					United Kingdom	1%	2.60	0.80
Antimony					Vietnam	1%	5.75	1.00
Antimony					Turkey	<1%	5.34	1.00
Antimony					United States	<1%	2.92	1.00
Antimony					India	<1%	5.45	1.00
Antimony					Hong Kong Sar, China	<1%	2.56	1.00
Antimony					Norway	<1%	2.03	1.00
Antimony					Japan	<1%	2.77	1.00
Antimony					Switzerland	<1%	2.03	1.00
Arsenic					Belgium	67%	2.81	0.80
Arsenic					China	29%	5.83	1.00
Arsenic					Japan	2%	2.77	1.00
Arsenic					Hong Kong	1%	2.56	1.00
Arsenic					United Kingdom	1%	2.60	0.80
Arsenic					Other Non EU	<1%	0.00	1.00
Baryte	China	38%	5.83	1.10				
Baryte	Morocco	28%	5.48	1.00				
Baryte	Other Eu Countries	15%	0.00	0.80				
Baryte	Germany	10%	2.47	0.80				
Baryte	Turkey	6%	5.34	1.00				
Baryte	Norway	1%	2.03	1.00				
Baryte	Tunisia	1%	5.40	1.00				
Baryte	Other Non Eu Countries	1%	0.00	1.00				
Bauxite	Guinea	64%	6.72	1.10				
Bauxite	Greece	12%	4.60	0.80				
Bauxite	Brazil	10%	5.08	1.00				
Bauxite	Sierra Leone	7%	6.17	1.00				
Bauxite	Other Non Eu Countries	2%	0.00	1.00				
Bauxite	Ghana	1%	4.94	1.00				
Bauxite	China	1%	5.83	1.00				
Bauxite	Guyana	1%	5.56	1.00				
Bauxite	Turkey	1%	5.34	1.00				
Bauxite	France	1%	3.11	0.80				
Bauxite	Hungary	<1%	4.06	0.80				
Bauxite	Croatia	<1%	4.27	0.80				
Bentonite	Greece	36%	4.60	0.80				
Bentonite	Germany	13%	2.47	0.80				

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Bentonite	Czech Republic	10%	3.47	0.80				
Bentonite	TURKEY	8%	5.34	1.00				
Bentonite	Slovakia	7%	3.79	0.80				
Bentonite	Cyprus	5%	3.36	0.80				
Bentonite	INDIA	5%	5.45	1.00				
Bentonite	Spain	3%	3.62	0.80				
Bentonite	MOROCCO	3%	5.48	1.00				
Bentonite	Bulgaria	2%	4.73	0.80				
Bentonite	Italy	1%	4.17	0.80				
Bentonite	UNITED KINGDOM	1%	2.60	1.00				
Bentonite	UNITED STATES	1%	2.92	1.00				
Bentonite	France	1%	3.11	0.80				
Bentonite	CANADA	1%	2.26	1.00				
Bentonite	Romania	1%	4.70	0.80				
Bentonite	CHINA	1%	5.83	1.00				
Bentonite	other non EU countries	1%	0.00	1.00				
Bentonite	Egypt, Arab Rep.	<1%	6.48	1.00				
Bentonite	Hungary	<1%	4.06	0.80				
Bentonite	GEORGIA	<1%	4.47	1.00				
Bentonite	Poland	<1%	3.60	0.80				
Bentonite	Slovenia	<1%	3.50	0.80				
Beryllium					United States	55%	2.92	1.00
Beryllium					Kazakhstan	23%	5.90	1.00
Beryllium					Japan	17%	2.77	1.00
Beryllium					China	5%	5.83	1.00
Bismuth					China	49%	5.83	1.00
Bismuth					Belgium	47%	2.81	0.80
Bismuth					Other Non Eu Countries	1%	5.30	0.00
Bismuth					Peru	1%	2.26	1.00
Bismuth					Canada	1%	2.77	1.00
Bismuth					Japan	<1%	3.74	1.00
Bismuth					Korea, Rep.	<1%	2.92	1.00
Bismuth					United States	<1%	4.73	1.00
Borate	Turkey	98%	5.34	1.00	Turkey	60%	5.34	1.00
Borate	Argentina	1%	5.47	1.10	United States	35%	2.92	1.00
Borate	Norway	<1%	2.03	1.00	Other Non Eu Countries	2%	0.00	1.00
Borate	Bolivia	<1%	5.97	1.10	Chile	1%	3.11	1.00
Borate	Peru	<1%	5.30	1.00	Peru	1%	5.30	1.00
Borate	Chile	<1%	3.11	1.00	Russian Federation	1%	6.20	1.00
Borate	Other Non Eu Countries	<1%	0.00	1.00	Bolivia	1%	5.97	1.00
Cadmium					Netherlands	30%	2.19	0.80

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Cadmium					Germany	24%	2.47	0.80
Cadmium					Poland	21%	3.60	0.80
Cadmium					Bulgaria	19%	4.73	0.80
Cadmium					Russian Federation	4%	6.20	1.00
Cadmium					China	2%	5.83	1.00
Cadmium					Other Non Eu Countries	<1%	0.00	1.00
Cerium	Russian Federation	64%	6.20	1.10	China	99%	5.83	1.10
Cerium	China	26%	5.83	1.00	United Kingdom	1%	2.60	1.00
Cerium	United Kingdom	6%	2.60	1.00	Other non EU Countries	<1%	0.00	1.00
Cerium	Other non EU countries	2%	0.00	1.00	Vietnam	<1%	5.75	1.00
Cerium	Japan	2%	2.77	1.00				
Chromium	Finland	77%	1.98	0.80	South Africa	41%	4.65	1.00
Chromium	South Africa	14%	4.65	1.00	Finland	25%	1.98	0.80
Chromium	Other Non EU Countries	4%	0.00	1.00	Other Non Eu Countries	10%	0.00	1.00
Chromium	Turkey	4%	5.34	1.00	Other Eu countries	5%	0.00	0.80
Chromium	India	<1%	5.45	1.20	Russian Federation	5%	6.20	1.00
Chromium	Albania	<1%	5.16	1.00	Zimbabwe	5%	7.17	1.00
Chromium	Pakistan	<1%	6.78	1.00	Kazakhstan	3%	5.90	1.00
Chromium	Greece	<1%	4.60	0.80	Turkey	3%	5.34	1.00
Chromium					India	2%	5.45	1.00
Chromium					Albania	2%	5.16	1.00
Chromium					Oman	<1%	4.70	1.00
Chromium					China	<1%	5.83	1.10
Cobalt	Congo, Dem. Rep.	68%	7.60	1.10	Finland	54%	1.98	0.80
Cobalt	Finland	14%	1.98	0.80	Belgium	7%	2.81	0.80
Cobalt	French Guiana	5%	3.23	1.00	Norway	7%	2.03	1.00
Cobalt	Russian Federation	5%	6.20	1.00	United States	7%	2.92	1.00
Cobalt	Canada	5%	2.26	1.10	Zambia	4%	5.40	1.00
Cobalt	Other Non Eu Countries	2%	0.00	1.00	Madagascar	4%	6.26	1.00
Cobalt	Australia	1%	2.36	1.00	China	4%	5.83	1.00
Cobalt	South Africa	<1%	4.65	1.00	United Kingdom	3%	2.60	1.00
Cobalt					Russian Federation	2%	6.20	1.10
Cobalt					Congo, Dem. Rep.	2%	7.60	1.00
Cobalt					France	1%	3.11	0.80
Cobalt					Japan	1%	2.77	1.00
Cobalt					Uganda	1%	5.99	1.00
Cobalt					Congo, Rep.	1%	6.73	1.00
Cobalt					Brazil	1%	5.08	1.00
Cobalt					South Africa	1%	4.65	1.00

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Cobalt					Morocco	<1%	5.48	1.00
Cobalt					Other non EU	<1%	0.00	1.00
Cobalt					Qatar	<1%	4.03	1.00
Cobalt	United Kingdom	<1%	2.60	1.00				
Coking coal	Australia	24%	2.36	1.00	Poland	24%	3.60	0.80
Coking coal	Poland	23%	3.60	0.80	Germany	23%	2.47	0.80
Coking coal	United States	21%	2.92	1.00	France	9%	3.11	0.80
Coking coal	Czech Republic	8%	3.47	0.80	Italy	6%	4.17	0.80
Coking coal	Germany	8%	2.47	0.80	Czech Republic	6%	3.47	0.80
Coking coal	Russian Federation	7%	6.20	1.00	Netherlands	5%	2.19	0.80
Coking coal	Canada	5%	2.26	1.00	Spain	4%	3.62	0.80
Coking coal	Other Non Eu Countries	3%	0.00	1.00	Slovakia	4%	3.79	0.80
Coking coal	Mozambique	1%	5.93	1.00	Belgium	4%	2.81	0.80
Coking coal	Colombia	1%	5.39	1.00	Austria	3%	2.50	0.80
Coking coal	Ukraine	1%	6.23	1.00	Sweden	3%	2.05	0.80
Coking coal	Kazakhstan	<1%	5.90	1.00	Hungary	3%	4.06	0.80
Coking coal					Finland	2%	1.98	0.80
Coking coal					Russian Federation	1%	6.20	1.10
Coking coal					China	<1%	5.83	1.20
Coking coal					Ukraine	<1%	6.23	1.00
Coking coal					Colombia	<1%	5.39	1.00
Coking coal					United Kingdom	<1%	2.60	1.00
Coking coal					Australia	<1%	2.36	1.00
Coking coal					United States	<1%	2.92	1.00
Coking coal					Bosnia And Herzegovina	<1%	5.44	1.00
Coking coal					Chile	<1%	3.11	1.00
Coking coal					Canada	<1%	2.26	1.00
Coking coal					India	<1%	5.45	1.00
Coking coal					Other Non Eu Countries	<1%	0.00	1.00
Coking coal					Japan	<1%	2.77	1.00
Copper	Poland	27%	3.60	0.80	Germany	22%	2.47	0.80
Copper	Chile	13%	3.11	1.00	Poland	19%	3.60	0.80
Copper	Peru	10%	5.30	1.00	Spain	13%	3.62	0.80
Copper	Other Eu Countries	8%	0.00	0.80	Belgium	13%	2.81	0.80
Copper	Spain	8%	3.62	0.80	Bulgaria	7%	4.73	0.80
Copper	Bulgaria	7%	4.73	0.80	Russian Federation	7%	6.20	1.10
Copper	Brazil	7%	5.08	1.00	Sweden	7%	2.05	0.80
Copper	Argentina	4%	5.47	1.10	Finland	5%	1.98	0.80
Copper	Canada	3%	2.26	1.00	Other Eu Countries	4%	0.00	0.80
Copper	United States	3%	2.92	1.00	Kazakhstan	1%	5.90	1.00

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Copper	Georgia	2%	4.47	1.00	United Kingdom	1%	2.60	0.80
Copper	Indonesia	2%	5.47	1.20	Serbia	1%	5.05	1.00
Copper	Other Non Eu Countries	1%	0.00	1.00	South Africa	<1%	4.65	1.00
Copper	Turkey	1%	5.34	1.00	Norway	<1%	2.03	1.00
Copper	Australia	1%	2.36	1.00	Mexico	<1%	5.33	1.00
Copper	Morocco	1%	5.48	1.00	Other Non Eu countries	<1%	0.00	1.00
Copper	Macedonia, Fyr	1%	5.07	1.00	China	<1%	5.83	1.10
Copper	Armenia	1%	5.41	1.00	Brazil	<1%	5.08	1.00
Copper	Papua New Guinea	<1%	5.94	1.00				
Copper	Mexico	<1%	5.33	1.00				
Copper	Colombia	<1%	5.39	1.00				
Diatomite	Denmark	35%	2.11	0.80				
Diatomite	France	26%	3.11	0.80				
Diatomite	Spain	16%	3.62	0.80				
Diatomite	Czech Republic	10%	3.47	0.80				
Diatomite	UNITED STATES	7%	2.92	1.00				
Diatomite	TURKEY	3%	5.34	1.00				
Diatomite	MEXICO	2%	5.33	1.00				
Diatomite	RUSSIAN FEDERATION	1%	6.20	1.00				
Diatomite	Other non EU countries	<1%	0.00	1.00				
Diatomite	CHINA	<1%	5.83	1.00				
Diatomite	ARMENIA	<1%	5.41	1.00				
Diatomite	Poland	<1%	3.60	0.80				
Diatomite	UNITED KINGDOM	<1%	2.60	1.00				
Dysprosium	China	68%	5.83	1.10	China	98%	5.83	1.10
Dysprosium	Japan	18%	2.77	1.00	Other non EU Countries	1%	0.00	1.00
Dysprosium	United kingdom	6%	2.60	1.00	United Kingdom	1%	2.60	1.00
Dysprosium	Russian Federation	5%	6.20	1.00				
Dysprosium	Other non EU countries	2%	0.00	1.00				
Erbium	China	69%	5.83	1.10	China	98%	5.83	1.10
Erbium	Japan	18%	2.77	1.00	Other non EU Countries	1%	0.00	1.00
Erbium	United Kingdom	6%	2.60	1.00	United Kingdom	1%	2.60	1.00
Erbium	Russian Federation	5%	6.20	1.00				
Erbium	Other non EU countries	2%	0.00	1.00				
Europium	China	69%	5.83	1.10	China	98%	5.83	1.10
Europium	Japan	18%	2.77	1.00	Other non EU Countries	1%	0.00	1.00
Europium	United	6%	2.60	1.00	United Kingdom	1%	2.60	1.00

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
	Kingdom							
Europium	Russian Federation	5%	6.20	1.00				
Europium	Other non EU countries	2%	0.00	1.00				
Feldspar	Turkey	32%	5.34	1.00				
Feldspar	Italy	29%	4.17	0.80				
Feldspar	France	7%	3.11	0.80				
Feldspar	Spain	7%	3.62	0.80				
Feldspar	Poland	7%	3.60	0.80				
Feldspar	Czech Republic	6%	3.47	0.80				
Feldspar	Germany	4%	2.47	0.80				
Feldspar	Norway	2%	2.03	1.00				
Feldspar	Portugal	1%	3.34	0.80				
Feldspar	Bulgaria	1%	4.73	0.80				
Feldspar	Finland	1%	1.98	0.80				
Feldspar	Austria	<1%	2.50	0.80				
Feldspar	Sweden	<1%	2.05	0.80				
Feldspar	Other Eu Countries	<1%	0.00	0.80				
Feldspar	Canada	<1%	2.26	1.00				
Feldspar	Russian Federation	<1%	6.20	1.00				
Feldspar	Macedonia, Fyr	<1%	5.07	1.00				
Feldspar	Morocco	<1%	5.48	1.00				
Feldspar	Other Non Eu Countries	<1%	0.00	1.00				
Fluorspar	Mexico	25%	5.33	1.00	Germany	42%	2.47	0.80
Fluorspar	Spain	14%	3.62	0.80	Italy	15%	4.17	0.80
Fluorspar	South Africa	12%	4.65	1.00	Spain	12%	3.62	0.80
Fluorspar	Bulgaria	10%	4.73	0.80	France	8%	3.11	0.80
Fluorspar	China	8%	5.83	1.10	Norway	3%	2.03	1.00
Fluorspar	Germany	6%	2.47	0.80	Lithuania	3%	3.50	0.80
Fluorspar	United Kingdom	6%	2.60	1.00	Mexico	2%	5.33	1.00
Fluorspar	Kenya	6%	6.03	1.00	United Kingdom	2%	2.60	0.80
Fluorspar	Namibia	5%	4.44	1.00	Sweden	2%	2.05	0.80
Fluorspar	Morocco	4%	5.48	1.00	Netherlands	1%	2.19	0.80
Fluorspar	Vietnam	2%	5.75	1.00	Belgium	1%	2.81	0.80
Fluorspar	Mongolia	1%	5.18	1.10	Hungary	1%	4.06	0.80
Fluorspar	Pakistan	<1%	6.78	1.00	Tunisia	1%	5.40	1.00
Fluorspar	Egypt, Arab Rep.	<1%	6.48	1.00	Czech Republic	1%	3.47	0.80
Fluorspar	Canada	<1%	2.26	1.00	Other Eu Countries	1%	0.00	0.80
Fluorspar	Brazil	<1%	5.08	1.00	Canada	1%	2.26	1.00
Fluorspar	Russian Federation	<1%	6.20	1.00	United States	1%	2.92	1.00
Fluorspar	United States	<1%	2.92	1.00	Other Non Eu Countries	1%	0.00	1.00

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Fluorspar	Norway	<1%	2.03	1.00	Singapore	<1%	2.37	1.00
Fluorspar	India	<1%	5.45	1.00	Japan	<1%	2.77	1.00
Fluorspar	Argentina	<1%	5.47	1.00	Iceland	<1%	2.52	1.00
Fluorspar	Turkey	<1%	5.34	1.00	China	<1%	5.83	1.10
Fluorspar	Other Non Eu Countries	<1%	0.00	1.00	Belarus	<1%	6.18	1.00
Fluorspar	Japan	<1%	2.77	1.00	Mozambique	<1%	5.93	1.00
Fluorspar	Switzerland	<1%	2.03	1.00	Taiwan, China	<1%	3.27	1.00
Fluorspar	Iran, Islamic Rep.	<1%	6.65	1.00				
Gadolinium	China	69%	5.83	1.10	China	98%	5.83	1.10
Gadolinium	Japan	18%	2.77	1.00	Other non EU Countries	1%	0.00	1.00
Gadolinium	United Kingdom	6%	2.60	1.00	United Kingdom	1%	2.60	1.00
Gadolinium	Russian Federation	5%	6.20	1.00				
Gadolinium	Other non EU countries	2%	0.00	1.00				
Gallium					Germany	35%	2.47	0.80
Gallium					United Kingdom	28%	2.60	0.80
Gallium					China	27%	5.83	1.00
Gallium					United States	4%	2.92	1.00
Gallium					Hungary	2%	4.06	0.80
Gallium					Japan	1%	2.77	1.00
Gallium					Korea, Rep.	1%	3.74	1.00
Gallium					Taiwan, China	1%	3.27	1.00
Gallium					Hong Kong Sar, China	1%	2.56	1.00
Gallium					Canada	<1%	2.26	1.00
Gallium					Russian Federation	<1%	6.20	1.00
Gallium					Switzerland	<1%	2.03	1.00
Gallium					Singapore	<1%	2.37	1.00
Gallium					India	<1%	5.45	1.00
Germanium					Finland	51%	1.98	0.80
Germanium					China	17%	5.83	1.10
Germanium					United Kingdom	11%	2.60	0.80
Germanium					Russian Federation	10%	6.20	1.00
Germanium					United States	10%	2.92	1.00
Germanium					Taiwan, China	1%	3.27	1.00
Germanium					Japan	<1%	2.77	1.00
Germanium					Canada	<1%	2.26	1.00
Germanium					Other Non Eu countries	<1%	0.00	1.00
Gypsum	Spain	36%	3.62	0.80				
Gypsum	Germany	15%	2.47	0.80				
Gypsum	Italy	13%	4.17	0.80				
Gypsum	France	11%	3.11	0.80				

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Gypsum	Poland	6%	3.60	0.80				
Gypsum	Romania	4%	4.70	0.80				
Gypsum	Austria	3%	2.50	0.80				
Gypsum	Greece	3%	4.60	0.80				
Gypsum	Other EU countries	2%	0.00	0.80				
Gypsum	Portugal	1%	3.34	0.80				
Gypsum	Latvia	1%	3.73	0.80				
Gypsum	Ireland	1%	2.58	0.80				
Gypsum	Croatia	1%	4.27	0.80				
Gypsum	Bulgaria	<1%	4.73	0.80				
Gypsum	Morocco	<1%	5.48	1.00				
Gypsum	Norway	<1%	2.03	1.00				
Gypsum	Bosnia And Herzegovina	<1%	5.44	1.00				
Gypsum	Ukraine	<1%	6.23	1.00				
Gypsum	Thailand	<1%	5.50	1.00				
Gypsum	N. Macedonia	<1%	0.00	1.00				
Gypsum	Vietnam	<1%	5.75	1.00				
Gypsum	Tunisia	<1%	5.40	1.00				
Gypsum	United States	<1%	2.92	1.00				
Gypsum	China	<1%	5.83	1.00				
Gypsum	Turkey	<1%	5.34	1.00				
Gypsum	Egypt, Arab Rep.	<1%	6.48	1.00				
Gypsum	United Kingdom	<1%	2.60	1.00				
Gypsum	Other non EU countries	<1%	0.00	1.00				
Hafnium					France	84%	3.11	0.80
Hafnium					United States	5%	2.92	1.00
Hafnium					United Kingdom	4%	2.60	1.00
Hafnium					Russian Federation	2%	6.20	1.10
Hafnium					China	2%	5.83	1.00
Hafnium					Ukraine	1%	6.23	1.00
Hafnium					Canada	<1%	2.26	1.00
Hafnium					Turkey	<1%	5.34	1.00
Hafnium					Taiwan, China	<1%	3.27	1.00
Hafnium					Switzerland	<1%	2.03	1.00
Helium					United States	34%	2.92	1.00
Helium					Algeria	31%	6.43	1.00
Helium					Qatar	15%	4.03	1.00
Helium					Poland	8%	3.60	0.80
Helium					Russian Federation	3%	6.20	1.00
Helium					United Kingdom	3%	2.60	0.80
Helium					United Arab Emirates	3%	3.94	1.00

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Helium					China	1%	5.83	1.00
Helium					Other Non EU Countries	1%	0.00	1.00
Helium					Germany	<1%	2.47	0.80
Ho, Tm, Lu, Yb	China	69%	5.83	1.10	China	98%	5.83	1.10
Ho, Tm, Lu, Yb	Japan	18%	2.77	1.00	Other non EU Countries	1%	0.00	1.00
Ho, Tm, Lu, Yb	United Kingdom	6%	2.60	1.00	United Kingdom	1%	2.60	1.00
Ho, Tm, Lu, Yb	Russian Federation	5%	6.20	1.00				
Ho, Tm, Lu, Yb	Other non EU countries	2%	0.00	1.00				
Hydrogen	Germany	27%	2.47	0.80				
Hydrogen	Netherlands	20%	2.19	0.80				
Hydrogen	Spain	16%	3.62	0.80				
Hydrogen	Belgium	12%	2.81	0.80				
Hydrogen	Italy	12%	4.17	0.80				
Hydrogen	France	8%	3.11	0.80				
Hydrogen	United Kingdom	3%	2.60	1.00				
Hydrogen	Other Eu Countries	2%	0.00	0.80				
Indium					France	28%	3.11	0.80
Indium					Belgium	23%	2.81	0.80
Indium					United Kingdom	12%	2.60	0.80
Indium					Germany	10%	2.47	0.80
Indium					China	6%	5.83	1.10
Indium					United States	5%	2.92	1.00
Indium					Italy	5%	4.17	0.80
Indium					Taiwan, China	4%	3.27	1.00
Indium					Japan	3%	2.77	1.00
Indium					Netherlands	2%	2.19	0.80
Indium					Korea, Rep.	1%	3.74	1.00
Indium					Hong Kong Sar, China	1%	2.56	1.00
Indium					Russian Federation	1%	6.20	1.00
Indium					Canada	<1%	2.26	1.00
Indium					Liechtenstein	<1%	2.32	1.00
Indium					Switzerland	<1%	2.03	1.00
Indium					Malaysia	<1%	4.39	1.00
Indium					India	<1%	5.45	1.00
Iron ore	Brazil	33%	5.08	1.00	Other Eu Countries	31%	0.00	0.80
Iron ore	Sweden	24%	2.05	0.80	Germany	26%	2.47	0.80
Iron ore	Ukraine	11%	6.23	1.00	Italy	15%	4.17	0.80
Iron ore	Canada	11%	2.26	1.00	France	9%	3.11	0.80
Iron ore	Other Non Eu Countries	5%	0.00	1.00	Spain	9%	3.62	0.80
Iron ore	Russian	5%	6.20	1.00	Poland	5%	3.60	0.80

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
	Federation							
Iron ore	South Africa	3%	4.65	1.00	Russian Federation	2%	6.20	1.00
Iron ore	Mauritania	2%	6.42	1.00	Ukraine	2%	6.23	1.00
Iron ore	Other Eu Countries	2%	0.00	0.80	Brazil	<1%	5.08	1.00
Iron ore	Norway	2%	2.03	1.00	United Kingdom	<1%	2.60	1.00
Iron ore	Liberia	2%	6.29	1.00	Switzerland	<1%	2.03	1.00
Iron ore					Other Non Eu Countries	<1%	0.00	1.00
Iron ore					China	<1%	5.83	1.10
Iron ore					Serbia	<1%	5.05	1.00
Iron ore					Belarus	<1%	6.18	1.00
Iron ore					Turkey	<1%	5.34	1.00
Iron ore					India	<1%	5.45	1.10
Iron ore					Norway	<1%	2.03	1.00
Iron ore					Oman	<1%	4.70	1.00
Kaolin clay	Germany	31%	2.47	0.80				
Kaolin clay	Czech Republic	21%	3.47	0.80				
Kaolin clay	Ukraine	10%	6.23	1.00				
Kaolin clay	Brazil	6%	5.08	1.00				
Kaolin clay	Italy	5%	4.17	0.80				
Kaolin clay	United Kingdom	5%	2.60	1.00				
Kaolin clay	Spain	4%	3.62	0.80				
Kaolin clay	France	4%	3.11	0.80				
Kaolin clay	United States	4%	2.92	1.00				
Kaolin clay	Portugal	3%	3.34	0.80				
Kaolin clay	Poland	3%	3.60	0.80				
Kaolin clay	Bulgaria	2%	4.73	0.80				
Kaolin clay	Belgium	2%	2.81	0.80				
Kaolin clay	Other Non Eu Countries	1%	0.00	1.00				
Kaolin clay	Romania	<1%	4.70	0.80				
Kaolin clay	Hungary	<1%	4.06	0.80				
Kaolin clay	Turkey	<1%	5.34	1.00				
Kaolin clay	Morocco	<1%	5.48	1.00				
Kaolin clay	Austria	<1%	2.50	0.80				
Kaolin clay	Serbia	<1%	5.05	1.00				
Kaolin clay	Slovakia	<1%	3.79	0.80				
Kaolin clay	China	<1%	5.83	1.00				
Lanthanum	China	93%	5.83	1.10	China	99%	5.83	1.10
Lanthanum	Other non EU countries	4%	0.00	1.00	United Kingdom	1%	2.60	1.00
Lanthanum	United Kingdom	3%	2.60	1.00	Other non EU Countries	<1%	0.00	1.00
Lanthanum					Vietnam	<1%	5.75	1.00
Lead	Poland	18%	3.60	0.80	Other Eu Countries	27%	0.00	0.80

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Lead	Sweden	16%	2.05	0.80	Germany	25%	2.47	0.80
Lead	Other Eu Countries	9%	0.00	0.80	Italy	12%	4.17	0.80
Lead	Ireland	8%	2.58	0.80	Spain	11%	3.62	0.80
Lead	Peru	7%	5.30	1.00	Poland	10%	3.60	0.80
Lead	Macedonia, Fyr	7%	5.07	1.00	Belgium	9%	2.81	0.80
Lead	Australia	7%	2.36	1.00	United Kingdom	3%	2.60	1.00
Lead	United States	6%	2.92	1.00	Russian Federation	1%	6.20	1.00
Lead	Mexico	6%	5.33	1.00	Kazakhstan	1%	5.90	1.00
Lead	Argentina	3%	5.47	1.00	Korea, Rep.	1%	3.74	1.00
Lead	Morocco	3%	5.48	1.00	Lebanon	<1%	6.25	1.00
Lead	Turkey	2%	5.34	1.00	Other Non Eu Countries	<1%	0.00	1.00
Lead	Bolivia	2%	5.97	1.00	Ukraine	<1%	6.23	1.00
Lead	Other Non Eu Countries	2%	0.00	1.00	Israel	<1%	3.83	1.00
Lead	Serbia	2%	5.05	1.00	Morocco	<1%	5.48	1.00
Lead	Chile	1%	3.11	1.00	Belarus	<1%	6.18	1.00
Lead	Bosnia And Herzegovina	1%	5.44	1.00				
Lead	Kosovo	<1%	5.64	1.00				
Limestone	Other EU countries	17%	0.00	0.80				
Limestone	France	16%	3.11	0.80				
Limestone	Italy	16%	4.17	0.80				
Limestone	Germany	15%	2.47	0.80				
Limestone	Austria	14%	2.50	0.80				
Limestone	Norway	6%	2.03	1.00				
Limestone	Poland	4%	3.60	0.80				
Limestone	Spain	3%	3.62	0.80				
Limestone	Denmark	3%	2.11	0.80				
Limestone	Greece	2%	4.60	0.80				
Limestone	Turkey	2%	5.34	1.00				
Limestone	Other non-EU countries	<1%	0.00	1.00				
Lithium	Australia	87%	2.36	1.00	Chile	78%	3.11	1.00
Lithium	Portugal	13%	3.34	0.80	United States	8%	2.92	1.00
Lithium					Russian Federation	4%	6.20	1.00
Lithium					China	3%	5.83	1.00
Lithium					United Kingdom	3%	2.60	1.00
Lithium					Argentina	3%	5.47	1.10
Lithium					Mexico	<1%	5.33	1.00
Lithium					India	<1%	5.45	1.00
Lithium					Switzerland	<1%	2.03	1.00
Lithium					Canada	<1%	2.26	1.00
Lithium					Australia	<1%	2.36	1.00

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Lithium					Norway	<1%	2.03	1.00
Lithium					Japan	<1%	2.77	1.00
Lithium					Indonesia	<1%	5.47	1.00
Lithium					Lebanon	<1%	6.25	1.00
Lithium					Israel	<1%	3.83	1.00
Lithium					Syrian Arab Republic	<1%	7.96	1.00
Lithium					Korea, Rep.	<1%	3.74	1.00
Magnesite	Slovakia	32%	3.79	0.80				
Magnesite	Austria	26%	2.50	0.80				
Magnesite	Spain	22%	3.62	0.80				
Magnesite	Greece	14%	4.60	0.80				
Magnesite	Poland	3%	3.60	0.80				
Magnesite	Finland	1%	1.98	0.80				
Magnesite	Other non eu countries	<1%	0.00	1.00				
Magnesium					China	93%	5.83	1.00
Magnesium					United Kingdom	2%	2.60	1.00
Magnesium					Israel	2%	3.83	1.00
Magnesium					Serbia	2%	5.05	1.00
Magnesium					Russian Federation	1%	6.20	1.00
Magnesium					Other Non EU Countries	1%	0.00	1.00
Magnesium					Other EU countries	<1%	0.00	0.80
Manganese	South Africa	33%	4.65	1.00	Norway	19%	2.03	1.00
Manganese	Gabon	26%	5.97	1.10	Spain	15%	3.62	0.80
Manganese	Brazil	22%	5.08	1.00	South Africa	15%	4.65	1.00
Manganese	Bulgaria	5%	4.73	0.80	France	13%	3.11	0.80
Manganese	Hungary	3%	4.06	0.80	India	11%	5.45	1.00
Manganese	Ukraine	2%	6.23	1.00	Ukraine	8%	6.23	1.00
Manganese	Other Non Eu Countries	2%	0.00	1.00	Other countries, NES	6%	0.00	1.00
Manganese	Australia	2%	2.36	1.00	Slovakia	3%	3.79	0.80
Manganese	Ghana	2%	4.94	1.00	Korea, Rep.	2%	3.74	1.00
Manganese	Argentina	1%	5.47	1.00	Other Non Eu Countries	2%	0.00	1.00
Manganese	Other countries, NES	1%	0.00	1.00	Italy	1%	4.17	0.80
Manganese	Romania	1%	4.70	0.80	Georgia	1%	4.47	1.00
Manganese	Mexico	1%	5.33	1.00	Romania	1%	4.70	0.80
Manganese					Russian Federation	1%	6.20	1.10
Manganese					Brazil	1%	5.08	1.00
Manganese					Venezuela, Rb	<1%	7.30	1.00
Manganese					Gabon	<1%	5.97	1.00
Manganese					Poland	<1%	3.60	0.80
Molybdenum	United States	47%	2.92	1.00	Chile	35%	3.11	1.00

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Molybdenum	Other Non EU Countries	23%	0.00	1.00	United Kingdom	26%	2.60	1.00
Molybdenum	Chile	14%	3.11	1.00	United States	17%	2.92	1.00
Molybdenum	Canada	7%	2.26	1.00	Other Non Eu Countries	17%	0.00	1.00
Molybdenum	Peru	7%	5.30	1.00	Korea, Rep.	10%	3.74	1.00
Molybdenum	Mexico	2%	5.33	1.00	Armenia	10%	5.41	1.00
Molybdenum					Russian Federation	9%	6.20	1.10
Molybdenum					Mexico	7%	5.33	1.00
Molybdenum					Iran, Islamic Rep.	4%	6.65	1.00
Molybdenum					China	2%	5.83	1.10
Molybdenum					Thailand	1%	5.50	1.00
Natural cork					Congo, Dem. Rep.	100%	7.60	1.00
Natural cork	Portugal	55%	3.34	0.80				
Natural cork	Spain	34%	3.62	0.80				
Natural cork	Italy	3%	4.17	0.80				
Natural cork	Morocco	3%	5.48	1.00				
Natural cork	France	3%	3.11	0.80				
Natural cork	Tunisia	1%	5.40	1.00				
Natural cork	China	<1%	5.83	1.00				
Natural graphite	China	47%	5.83	1.10				
Natural graphite	Brazil	12%	5.08	1.00				
Natural graphite	Norway	8%	2.03	1.00				
Natural graphite	Other Non Eu Countries	8%	0.00	1.00				
Natural graphite	Zimbabwe	7%	7.17	1.00				
Natural graphite	Ukraine	4%	6.23	1.00				
Natural graphite	Belarus	4%	6.18	1.00				
Natural graphite	Madagascar	2%	6.26	1.00				
Natural graphite	Russian Federation	2%	6.20	1.00				
Natural graphite	Canada	2%	2.26	1.00				
Natural graphite	Romania	2%	4.70	0.80				
Natural graphite	Sri Lanka	1%	5.36	1.00				
Natural graphite	United States	1%	2.92	1.00				
Natural graphite	Germany	<1%	2.47	0.80				
Natural graphite	Austria	<1%	2.50	0.80				
Natural graphite	Sweden	<1%	2.05	0.80				
Natural Rubber	Indonesia	31%	5.47	1.00				
Natural Rubber	Thailand	18%	5.50	1.00				
Natural Rubber	Malaysia	16%	4.39	1.00				
Natural Rubber	Côte D'Ivoire	15%	6.21	1.00				
Natural Rubber	Vietnam	7%	5.75	1.00				
Natural Rubber	Cameroon	3%	6.59	1.00				
Natural Rubber	Nigeria	2%	6.83	1.00				

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Natural Rubber	Other non Eu countries	2%	0.00	1.00				
Natural Rubber	Gabon	1%	5.97	1.00				
Natural Rubber	Liberia	1%	6.29	1.00				
Natural Rubber	Ghana	1%	4.94	1.00				
Natural Rubber	Guinea	1%	6.72	1.00				
Natural Rubber	United Kingdom	1%	2.60	1.00				
Natural Teak wood	Myanmar	61%	6.95	1.00				
Natural Teak wood	Malaysia	13%	4.39	1.00				
Natural Teak wood	Indonesia	5%	5.47	1.00				
Natural Teak wood	Cameroon	5%	6.59	1.00				
Natural Teak wood	Congo, Rep.	4%	6.73	1.00				
Natural Teak wood	Congo, Dem. Rep.	4%	7.60	1.00				
Natural Teak wood	Brazil	2%	5.08	1.00				
Natural Teak wood	Ghana	2%	4.94	1.00				
Natural Teak wood	Côte D'Ivoire	2%	6.21	1.00				
Natural Teak wood	Other Non Eu Countries	1%	0.00	1.00				
Natural Teak wood	India	<1%	5.45	1.00				
Natural Teak wood	China	<1%	5.83	1.00				
Natural Teak wood	United States	<1%	2.92	1.00				
Neodymium	China	93%	5.83	1.10	China	99%	5.83	1.10
Neodymium	Other non EU countries	4%	0.00	1.00	United Kingdom	1%	2.60	1.00
Neodymium	United Kingdom	3%	2.60	1.00	Other non EU Countries	<1%	0.00	1.00
Neodymium					Vietnam	<1%	5.75	1.00
Nickel	South Africa	28%	4.65	1.00	Russian Federation	17%	6.20	1.10
Nickel	Greece	20%	4.60	0.80	Finland	14%	1.98	0.80
Nickel	Finland	18%	1.98	0.80	Other non EU	11%	0.00	1.00
Nickel	Canada	14%	2.26	1.00	United Kingdom	10%	2.60	0.80
Nickel	Brazil	8%	5.08	1.00	Russian Federation	9%	6.20	1.00
Nickel	Spain	6%	3.62	0.80	Norway	9%	2.03	1.00
Nickel	United States	2%	2.92	1.00	Greece	4%	4.60	0.80
Nickel	Norway	1%	2.03	1.00	Australia	4%	2.36	1.00
Nickel	Poland	1%	3.60	0.80	Ukraine	4%	6.23	1.00
Nickel	Other non EU	<1%	0.00	1.00	Canada	4%	2.26	1.00
Nickel	Indonesia	<1%	5.47	1.10	Brazil	3%	5.08	1.00
Nickel					Madagascar	3%	6.26	1.00
Nickel					French Guiana	2%	3.23	1.00

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Nickel					France	2%	3.11	0.80
Nickel					Macedonia, Fyr	2%	5.07	1.00
Nickel					Poland	<1%	3.60	0.80
Nickel					Austria	<1%	2.50	0.80
Niobium					Brazil	85%	5.08	1.00
Niobium					Canada	13%	2.26	1.00
Niobium					United Kingdom	1%	2.60	1.00
Niobium					Switzerland	<1%	2.03	1.00
Niobium					Belize	<1%	5.31	1.00
Niobium					Russian Federation	<1%	6.20	1.00
Niobium					United Arab Emirates	<1%	3.94	1.00
Niobium					South Africa	<1%	4.65	1.00
Niobium					Norway	<1%	2.03	1.00
Niobium					United States	<1%	2.92	1.00
Niobium					Turkey	<1%	5.34	1.00
Niobium					Japan	<1%	2.77	1.00
Niobium					Serbia	<1%	5.05	1.00
Perlite	Greece	68%	4.60	0.80				
Perlite	Turkey	13%	5.34	1.00				
Perlite	Hungary	5%	4.06	0.80				
Perlite	South Africa	5%	4.65	1.00				
Perlite	Italy	4%	4.17	0.80				
Perlite	Slovakia	2%	3.79	0.80				
Perlite	Other Non Eu Countries	1%	0.00	1.00				
Perlite	China	<1%	5.83	1.00				
Perlite	Mozambique	<1%	5.93	1.00				
Perlite	United States	<1%	2.92	1.00				
Perlite	Bulgaria	<1%	4.73	0.80				
Perlite	Switzerland	<1%	2.03	1.00				
Perlite	Australia	<1%	2.36	1.00				
Perlite	Uzbekistan	<1%	6.98	1.00				
Perlite	Russian Federation	<1%	6.20	1.00				
Perlite	Hong Kong Sar, China	<1%	2.56	1.00				
Perlite	Ukraine	<1%	6.23	1.00				
Perlite	Canada	<1%	2.26	1.00				
Perlite	Syrian Arab Republic	<1%	7.96	1.00				
Perlite	Iran, Islamic Rep.	<1%	6.65	1.00				
Perlite	Macedonia, Fyr	<1%	5.07	1.00				
Perlite	Israel	<1%	3.83	1.00				
Perlite	Serbia	<1%	5.05	1.00				
Perlite	Japan	<1%	2.77	1.00				

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Perlite	Moldova	<1%	5.54	1.00				
Perlite	Tunisia	<1%	5.40	1.00				
Perlite	Pakistan	<1%	6.78	1.00				
Perlite	Norway	<1%	2.03	1.00				
Perlite	Korea, Rep.	<1%	3.74	1.00				
Perlite	Kuwait	<1%	5.24	1.00				
Perlite	Other Eu Countries	<1%	0.00	0.80				
Perlite	Sri Lanka	<1%	5.36	1.00				
Phosphate rock	Morocco	24%	5.48	1.00				
Phosphate rock	Russian Federation	20%	6.20	1.00				
Phosphate rock	Finland	16%	1.98	0.80				
Phosphate rock	Algeria	11%	6.43	1.00				
Phosphate rock	Israel	7%	3.83	1.00				
Phosphate rock	Syrian Arab Republic	6%	7.96	1.00				
Phosphate rock	Senegal	4%	5.21	1.00				
Phosphate rock	Egypt, Arab Rep.	4%	6.48	1.04				
Phosphate rock	South Africa	3%	4.65	1.00				
Phosphate rock	Jordan	3%	5.16	1.00				
Phosphate rock	Togo	2%	6.34	1.00				
Phosphate rock	Other non-EU countries	1%	0.00	1.00				
Phosphate rock	Mozambique	1%	5.93	1.00				
Phosphorus					Kazakhstan	71%	5.90	1.20
Phosphorus					Vietnam	18%	5.75	1.00
Phosphorus					China	9%	5.83	1.20
Phosphorus					Other Non Eu Countries	3%	0.00	1.00
Potash	Germany	57%	2.47	0.80				
Potash	Spain	12%	3.62	0.80				
Potash	Russian Federation	11%	6.20	1.00				
Potash	Belarus	9%	6.18	1.10				
Potash	United Kingdom	4%	2.60	1.00				
Potash	Chile	3%	3.11	1.00				
Potash	Canada	2%	2.26	1.00				
Potash	Israel	2%	3.83	1.00				
Potash	Other Non Eu Countries	1%	0.00	1.00				
Praseodymium	China	93%	5.83	1.10	China	99%	5.83	1.10
Praseodymium	Other non EU countries	4%	0.00	1.00	United Kingdom	1%	2.60	1.00
Praseodymium	United Kingdom	3%	2.60	1.00	Other non EU Countries	<1%	0.00	1.00
Praseodymium					Vietnam	<1%	5.75	1.00
Rhenium					Poland	78%	3.60	0.80
Rhenium					Korea, Rep.	7%	3.74	1.00

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Rhenium					Uzbekistan	7%	6.98	1.00
Rhenium					Iran, Islamic Rep.	7%	6.65	1.00
Samarium	China	93%	5.83	1.10	China	99%	5.83	1.10
Samarium	Other non EU countries	4%	0.00	1.00	United Kingdom	1%	2.60	1.00
Samarium	United Kingdom	3%	2.60	1.00	Other non EU Countries	<1%	0.00	1.00
Samarium					Vietnam	<1%	5.75	1.00
Sapele wood					Congo, Dem. Rep.	<1%	7.60	1.00
Sapele wood	Cameroon	55%	6.59	1.00				
Sapele wood	Congo, Rep.	18%	6.73	1.00				
Sapele wood	Congo, Dem. Rep.	13%	7.60	1.00				
Sapele wood	Malaysia	9%	4.39	1.00				
Sapele wood	Other Non Eu Countries	4%	0.00	1.00				
Sapele wood	Gabon	1%	5.97	1.00				
Scandium					United Kingdom	98%	2.60	0.80
Scandium					Russian Federation	1%	6.20	1.00
Scandium					Kazakhstan	<1%	5.90	1.00
Scandium					Hong Kong Sar, China	<1%	2.56	1.00
Scandium					United States	<1%	2.92	1.00
Selenium					Germany	42%	2.47	0.80
Selenium					Belgium	12%	2.81	0.80
Selenium					Other Non Eu Countries	11%	0.00	1.00
Selenium					Russian Federation	6%	6.20	1.00
Selenium					Finland	6%	1.98	0.80
Selenium					Poland	5%	3.60	0.80
Selenium					United Kingdom	4%	2.60	1.00
Selenium					Taiwan, China	4%	3.27	1.00
Selenium					China	3%	5.83	1.00
Selenium					Japan	3%	2.77	1.00
Selenium					Sweden	2%	2.05	0.80
Selenium					Norway	2%	2.03	1.00
Silica sand	Netherlands	47%	2.19	0.80				
Silica sand	Italy	12%	4.17	0.80				
Silica sand	France	8%	3.11	0.80				
Silica sand	Germany	6%	2.47	0.80				
Silica sand	Bulgaria	6%	4.73	0.80				
Silica sand	Spain	5%	3.62	0.80				
Silica sand	Poland	4%	3.60	0.80				
Silica sand	Belgium	3%	2.81	0.80				
Silica sand	Latvia	1%	3.73	0.80				
Silica sand	Austria	1%	2.50	0.80				

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Silica sand	Czech Republic	1%	3.47	0.80				
Silica sand	Denmark	1%	2.11	0.80				
Silica sand	Sweden	1%	2.05	0.80				
Silica sand	Romania	1%	4.70	0.80				
Silica sand	Slovakia	<1%	3.79	0.80				
Silica sand	Tunisia	<1%	5.40	1.00				
Silica sand	Egypt, Arab Rep.	<1%	6.48	1.00				
Silica sand	Slovenia	<1%	3.50	0.80				
Silica sand	United Kingdom	<1%	2.60	1.00				
Silica sand	Croatia	<1%	4.27	0.80				
Silica sand	Other Non Eu Countries	<1%	0.00	1.00				
Silica sand	Hungary	<1%	4.06	0.80				
Silica sand	Greece	<1%	4.60	0.80				
Silica sand	Lithuania	<1%	3.50	0.80				
Silica sand	Serbia	<1%	5.05	1.00				
Silica sand	Portugal	<1%	3.34	0.80				
Silica sand	Estonia	<1%	3.07	0.80				
Silica sand	Ireland	<1%	2.58	0.80				
Silicon metal					Norway	30%	2.03	1.00
Silicon metal					France	20%	3.11	0.80
Silicon metal					China	11%	5.83	1.10
Silicon metal					Brazil	7%	5.08	1.00
Silicon metal					Germany	6%	2.47	0.80
Silicon metal					Spain	6%	3.62	0.80
Silicon metal					Other Non Eu Countries	5%	0.00	1.00
Silicon metal					Russian Federation	4%	6.20	1.00
Silicon metal					Bosnia And Herzegovina	3%	5.44	1.00
Silicon metal					Australia	3%	2.36	1.00
Silicon metal					United Kingdom	2%	2.60	1.00
Silicon metal					Iceland	1%	2.52	1.00
Silicon metal					United States	1%	2.92	1.00
Silicon metal					Thailand	1%	5.50	1.00
Silver	Mexico	27%	5.33	1.00	Germany	22%	2.47	0.80
Silver	Peru	27%	5.30	1.00	Italy	16%	4.17	0.80
Silver	Poland	15%	3.60	0.80	France	9%	3.11	0.80
Silver	Argentina	13%	5.47	1.00	Belgium	8%	2.81	0.80
Silver	Sweden	5%	2.05	0.80	United States	7%	2.92	1.00
Silver	Canada	3%	2.26	1.00	Switzerland	6%	2.03	1.00
Silver	United States	2%	2.92	1.00	United Kingdom	6%	2.60	1.00
Silver	Bolivia	2%	5.97	1.10	Austria	5%	2.50	0.80
Silver	Morocco	1%	5.48	1.00	Japan	4%	2.77	1.00
Silver	Norway	1%	2.03	1.00	Argentina	2%	5.47	1.00

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Silver	South Africa	1%	4.65	1.00	Spain	1%	3.62	0.80
Silver	Panama	1%	4.79	1.00	Turkey	1%	5.34	1.00
Silver	Bulgaria	1%	4.73	0.80	Bulgaria	1%	4.73	0.80
Silver	Portugal	<1%	3.34	0.80	Other Non Eu Countries	1%	0.00	1.00
Silver	Greece	<1%	4.60	0.80	Czech Republic	1%	3.47	0.80
Silver	Spain	<1%	3.62	0.80	Netherlands	1%	2.19	0.80
Silver	Romania	<1%	4.70	0.80	Morocco	1%	5.48	1.00
Silver	Finland	<1%	1.98	0.80	Poland	1%	3.60	0.80
Silver	Ireland	<1%	2.58	0.80	Brazil	1%	5.08	1.00
Silver	Tajikistan	<1%	6.88	1.00	Canada	1%	2.26	1.00
Silver	Other Non Eu Countries	<1%	0.00	1.00	Norway	1%	2.03	1.00
Silver	Slovakia	<1%	3.79	0.80	Other Eu Countries	1%	0.00	0.80
Silver					China	1%	5.83	1.00
Silver					Greece	<1%	4.60	0.80
Silver					Sweden	<1%	2.05	0.80
Silver					Korea, Rep.	<1%	3.74	1.00
Silver					Bolivia	<1%	5.97	1.00
Silver					Peru	<1%	5.30	1.00
Strontium	Spain	100%	3.62	0.80				
Strontium	China	<1%	5.83	1.00				
Strontium	Japan	<1%	2.77	1.00				
Strontium	Other Non-EU countries	<1%	0.00	1.00				
Strontium	Mexico	<1%	5.33	1.00				
Strontium	Canada	<1%	2.26	1.00				
Sulphur					Finland	16%	1.98	0.80
Sulphur					Poland	14%	3.60	0.80
Sulphur					Italy	14%	4.17	0.80
Sulphur					Other Eu Countries	14%	0.00	0.80
Sulphur					Germany	13%	2.47	0.80
Sulphur					Spain	12%	3.62	0.80
Sulphur					Bulgaria	8%	4.73	0.80
Sulphur					Kazakhstan	3%	5.90	1.00
Sulphur					Russian Federation	3%	6.20	1.00
Sulphur					Other Non Eu Countries	1%	0.00	1.00
Sulphur					Turkey	<1%	5.34	1.00
Sulphur					Serbia	<1%	5.05	1.00
Sulphur					Norway	<1%	2.03	1.00
Talc	France	28%	3.11	0.80				
Talc	Finland	28%	1.98	0.80				
Talc	Italy	12%	4.17	0.80				
Talc	Austria	10%	2.50	0.80				

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Talc	Pakistan	10%	6.78	1.00				
Talc	China	4%	5.83	1.10				
Talc	Australia	3%	2.36	1.00				
Talc	Other Eu Countries	1%	0.00	0.80				
Talc	India	1%	5.45	1.00				
Talc	Egypt, Arab Rep.	1%	6.48	1.00				
Talc	Other Non Eu Countries	1%	0.00	1.00				
Talc	United States	1%	2.92	1.00				
Talc	Korea, Rep.	<1%	3.74	1.00				
Talc	Norway	<1%	2.03	1.00				
Talc	Korea, Dem. Rep.	<1%	7.74	1.00				
Tantalum	Congo, Dem. Rep.	36%	7.60	1.00				
Tantalum	Rwanda	30%	5.17	1.10				
Tantalum	Brazil	13%	5.08	1.00				
Tantalum	Ethiopia	6%	6.52	1.00				
Tantalum	Nigeria	5%	6.83	1.00				
Tantalum	Mozambique	5%	5.93	1.00				
Tantalum	Burundi	3%	7.00	1.10				
Tantalum	Australia	2%	2.36	1.00				
Tantalum	France	1%	3.11	0.80				
Tellurium					Other non EU countries	42%	0.00	1.00
Tellurium					Ukraine	28%	6.23	1.00
Tellurium					Sweden	9%	2.05	0.80
Tellurium					China	7%	5.83	1.00
Tellurium					Russian Federation	5%	6.20	1.00
Tellurium					Canada	2%	2.26	1.00
Tellurium					Hong Kong Sar, China	2%	2.56	1.00
Tellurium					United Kingdom	2%	2.60	1.00
Tellurium					Bulgaria	1%	4.73	0.80
Tellurium					Peru	1%	5.30	1.00
Tellurium					Japan	1%	2.77	1.00
Tellurium					Philippines	<1%	5.49	1.00
Terbium	China	69%	5.83	1.10	China	98%	5.83	1.10
Terbium	Japan	18%	2.77	1.00	Other non EU Countries	1%	0.00	1.00
Terbium	United Kingdom	6%	2.60	1.00	United Kingdom	1%	2.60	1.00
Terbium	Russian Federation	5%	6.20	1.00				
Terbium	Other non EU countries	2%	0.00	1.00				
Tin	United States	44%	2.92	1.00	Belgium	26%	2.81	0.80
Tin	Portugal	33%	3.34	0.80	United Kingdom	15%	2.60	1.00

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Tin	Spain	8%	3.62	0.80	Peru	14%	5.30	1.00
Tin	Thailand	7%	5.50	1.00	Other Non Eu Countries	14%	0.00	1.00
Tin	Hong Kong Sar, China	2%	2.56	1.00	Malaysia	10%	4.39	1.00
Tin	United Arab Emirates	1%	3.94	1.00	Thailand	6%	5.50	1.00
Tin	Other Non Eu Countries	1%	0.00	1.00	Poland	6%	3.60	0.80
Tin	United Kingdom	1%	2.60	1.00	Singapore	4%	2.37	1.00
Tin	Tanzania	1%	5.74	1.00	China	3%	5.83	1.10
Tin	Japan	1%	2.77	1.00	Brazil	3%	5.08	1.00
Tin	China	1%	5.83	1.10	Spain	<1%	3.62	0.80
Tin	Other Eu Countries	<1%	0.00	0.80				
Titanium	Norway	25%	2.03	1.00				
Titanium	South Africa	18%	4.65	1.00				
Titanium	Canada	16%	2.26	1.00				
Titanium	Australia	11%	2.36	1.00				
Titanium	Mozambique	9%	5.93	1.00				
Titanium	India	7%	5.45	1.10				
Titanium	Ukraine	5%	6.23	1.00				
Titanium	Sierra Leone	3%	6.17	1.10				
Titanium	Brazil	3%	5.08	1.00				
Titanium	Kenya	1%	6.03	1.00				
Titanium	China	1%	5.83	1.10				
Titanium	Egypt, Arab Rep.	<1%	6.48	1.00				
Titanium	United States	<1%	2.92	1.00				
Titanium	Vietnam	<1%	5.75	1.20				
Titanium	Other Non Eu Countries	<1%	0.00	1.00				
Titanium	Russian Federation	<1%	6.20	1.00				
Titanium	Georgia	<1%	4.47	1.00				
Titanium	Senegal	<1%	5.21	1.00				
Titanium	Sri Lanka	<1%	5.36	1.00				
Titanium	Turkey	<1%	5.34	1.00				
Tungsten	Austria	35%	2.50	0.80				
Tungsten	Portugal	27%	3.34	0.80				
Tungsten	Spain	27%	3.62	0.80				
Vanadium					Austria	52%	2.50	0.80
Vanadium					Russian Federation	32%	6.20	1.00
Vanadium					China	6%	5.83	1.10
Vanadium					South Africa	5%	4.65	1.00
Vanadium					Brazil	1%	5.08	1.00
Vanadium					Germany	1%	2.47	0.80
Vanadium					Taiwan, China	1%	3.27	1.00

	I stage				II stage			
Material	Country	Share	WGI	t	Country	Share	WGI	t
Vanadium					Thailand	1%	5.50	1.00
Vanadium					United States	<1%	2.92	1.00
Vanadium					other non eu countries	<1%	0.00	1.00
Yttrium	China	69%	5.83	1.10	China	98%	5.83	1.10
Yttrium	Japan	18%	2.77	1.00	Other non EU Countries	1%	0.00	1.00
Yttrium	United Kingdom	6%	2.60	1.00	United Kingdom	1%	2.60	1.00
Yttrium	Russian Federation	5%	6.20	1.00				
Yttrium	Other non EU countries	2%	0.00	1.00				
Zinc	Australia	17%	2.36	1.00	Spain	21%	3.62	0.80
Zinc	Ireland	13%	2.58	0.80	Finland	13%	1.98	0.80
Zinc	Peru	13%	5.30	1.00	Netherlands	12%	2.19	0.80
Zinc	Other Eu Countries	12%	0.00	0.80	Belgium	11%	2.81	0.80
Zinc	Sweden	11%	2.05	0.80	Other Eu Countries	9%	0.00	0.80
Zinc	United States	9%	2.92	1.00	Germany	7%	2.47	0.80
Zinc	Bolivia	5%	5.97	1.00	France	7%	3.11	0.80
Zinc	Turkey	3%	5.34	1.00	Poland	7%	3.60	0.80
Zinc	Mexico	3%	5.33	1.00	Peru	3%	5.30	1.00
Zinc	Canada	3%	2.26	1.00	Norway	3%	2.03	1.00
Zinc	Other Non Eu Countries	3%	0.00	1.00	Namibia	3%	4.44	1.00
Zinc	Macedonia, Fyr	2%	5.07	1.00	United Kingdom	1%	2.60	1.00
Zinc	Chile	2%	3.11	1.00	Mexico	1%	5.33	1.00
Zinc	Namibia	1%	4.44	1.00	Other Non Eu Countries	1%	0.00	1.00
Zinc	Morocco	1%	5.48	1.00	Kazakhstan	1%	5.90	1.00
Zinc	Burkina Faso	1%	5.74	1.00	Brazil	<1%	5.08	1.00
Zinc	Serbia	1%	5.05	1.00	India	<1%	5.45	1.00
Zinc	Honduras	1%	6.06	1.00				
Zirconium	South Africa	43%	4.65	1.00				
Zirconium	Australia	31%	2.36	1.00				
Zirconium	Mozambique	9%	5.93	1.00				
Zirconium	Senegal	6%	5.21	1.00				
Zirconium	Ukraine	4%	6.23	1.00				
Zirconium	Kenya	3%	6.03	1.00				
Zirconium	Other non EU countries	2%	0.00	1.00				
Zirconium	Madagascar	1%	6.26	1.00				
Zirconium	United States	1%	2.92	1.00				

Annex 8. Worked example of assessment calculation

For the purpose of illustration, step-by-step criticality assessment calculations for Cobalt are shown here. Emphasis is given on the double stage assessment.

Economic importance (EI)

Raw material end-use applications are assigned to the EU's manufacturing sectors at NACE Rev.2 (2 digit level). The weighted sum of application share of by manufacturing sector and Gross Value-Added (GVA) is calculated:

Table 18: Weighted sum of application share by manufacturing sector and GVA

Application	Share	2-digit NACE sector	NACE sector GVA (M€)	Contribution to EI (Share x sector GVA)
Source: Cobalt Institute		Source: ESTAT		JRC elaboration*
Superalloys, hardfacing/HSS and other alloys	36%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351	53,407
Hard materials (carbides and diamond tools)	14%	C25 - Manufacture of fabricated metal products, except machinery and equipment	148,351	20,324
Pigments and Inks	13%	C20 - Manufacture of chemicals and chemical products	105,514	13,717
Catalysts	12%	C20 - Manufacture of chemicals and chemical products	105,514	12,556
Tyre adhesives and paint dryers	11%	C20 - Manufacture of chemicals and chemical products	105,514	11,290
Magnets	7%	C27 - Manufacture of electrical equipment	80,745	5,329
Battery	3%	C27 - Manufacture of electrical equipment	80,745	2,180
Other – Biotech, Surface Treatment, etc	6%	C20 - Manufacture of chemicals and chemical products 0	105,514	5,803
Total				**124,606**

**Selecting the correspondence between applications and NACE 2 sectors is done by JRC and validated during stakeholders consultation*

The sum of "contribution to EI" is ponderated using the Substitute Index for Economic Importance – SI(EI)[55] linked to substitute cost and technical performance:

$$SI(EI)_{Cobalt} = 0.92$$

$$\textbf{EI (unscaled)}_{\textbf{Cobalt}} = 124{,}606 \times 0.92 = \textbf{114,733}$$

The result is scaled by dividing the calculated EI score by the highest value of the manufacturing sector NACE Rev.2 at the 2-digit level and multiplied by 10, in order to obtain the value in the scale between 0-10:

$$\textbf{EI (scaled)}_{\textbf{Cobalt}} = 114{,}733 / 196{,}055 \times 10 = \textbf{5.85}$$

Supply risk (SR)

Production data for cobalt, both extraction and processing stage, are given below. To move from fractional shares to a supply risk score, which is based on the Herfindahl-Hirschmann-Index (HHI), the square of the shares is needed. In the calculation of supply risk, the square of the shares are first multiplied by the scaled World governance Index (WGI), leading to a "contribution to HHI_{WGI}". This calculation is performed for both the global supply (GS) and the EU supply (EU) and for the two stages, separately.

A trade variable (t), representing export taxes, export quotas and export prohibitions is used to adjust the HHI_{WGI} into $HHI_{WGI\text{-}t}$

Table 19: Stage I (ores and intermediates). Concentration risk for global supply: Global Supply Risk – $(HHI_{WGI\text{-}t})_{GS}$

Country	Share of production	WGI_{scaled}	Contribution to $(HHI_{WGI})_{GS}$	T (trade variable)*	Contribution to $(HHI_{WGI\text{-}t})_{GS}$
Source: WMD		Source: WorldBank	JRC elaboration		
DR Congo	58.7%	7.60	2.62	1.10	2.88
China	7%	5.83	0.03	1.10	0.03
Canada	5%	2.26	0.01	1.00	0.01
Australia	4%	2.36	<0.01	1.00	<0.01
Zambia	4%	5.40	0.01	1.10	0.01
French Guiana	3%	3.23	<0.01	1.00	<0.01
Cuba	3%	5.87	<0.01	1.00	<0.01
Philippines	2%	5.49	<0.01	1.00	<0.01

[55] JRC elaboration o multiple sources – see Factsheet for list of references

Country	Share of production	WGI_{scaled}	Contribution to $(HHI_{WGI})_{GS}$	T (trade variable)*	Contribution to $(HHI_{WGI-t})_{GS}$
Madagascar	2%	6.26	<0.01	1.00	<0.01
Brazil	2%	5.08	<0.01	1.00	<0.01
Russia	2%	6.20	<0.01	1.00	<0.01
Finland	1%	1.98	<0.01	0.80	<0.01
Indonesia	1%	5.47	<0.01	1.10	<0.01
Papua New Guinea	1%	5.94	<0.01	1.00	<0.01
Morocco	1%	5.48	<0.01	1.00	<0.01
South Africa	1%	4.65	<0.01	1.00	<0.01
United States	<0%	2.92	<0.01	1.00	<0.01
Zimbabwe	<0%	7.17	<0.01	1.00	<0.01
Botswana	<0%	3.89	<0.01	1.00	<0.01
Vietnam	<0%	5.75	<0.01	1.00	<0.01
Uganda	<0%	5.99	<0.01	1.00	<0.01
			2.68		**2.95**

**based on OECD database of export restrictions and European Commission database on trade agreements*

Table 20: Stage I (ores and intermediates). Concentration risk for EU supply: EU Supply Risk – $(HHI_{WGI-t})_{EU}$

Country	Share of production	WGI_{scaled}	Contribution to $(HHI_{WGI})_{EU}$	T (trade variable)*	Contribution to $(HHI_{WGI-t})_{EU}$
Source: WMD, Eurostat Comext, Roskill		Source: WorldBank	JRC elaboration		
DR Congo	68%	7.60	3.55	1.10	3.90
Finland	14%	1.98	0.04	0.80	0.03
Canada	5%	2.26	0.01	1.00	0.01
Russia	5%	6.20	0.02	1.00	0.02
French Guiana	5%	3.23	0.01	1.00	0.01
South Africa	0%	4.65	<0.01	1.00	<0.01
Australia	1%	2.36	<0.01	1.00	<0.01

Other non EU countries	2%	0.00	0.00	1.00	0.00
			3.62		**3.97**

**based on OECD database of export restrictions and European Commission database on trade agreements*

Table 21: Stage II (metal). Concentration risk for global supply: Global Supply Risk – $(HHI_{WGI-t})_{GS}$

Country	Share of production	WGI_{scaled}	Contribution to $(HHI_{WGI})_{GS}$	T (trade variable)*	Contribution to $(HHI_{WGI-t})_{GS}$
Source: USGS, Cobalt Market Review		Source: WorldBank	JRC elaboration		
China	49%	5.83	1.40	1.10	5.83
Finland	12%	1.98	0.03	0.80	0.02
Canada	6%	2.26	0.01	1.00	0.01
Australia	5%	2.36	0.01	1.00	0.01
Zambia	5%	5.40	0.01	1.00	0.01
Japan	4%	2.77	<0.01	1.00	<0.01
Norway	4%	2.03	<0.01	1.00	<0.01
Madagascar	3%	6.26	<0.01	1.00	<0.01
Russian Federation	3%	6.20	<0.01	1.00	<0.01
Congo, Dem. Rep.	3%	7.60	<0.01	1.10	0.01
Morocco	2%	5.48	<0.01	1.00	<0.01
Belgium	2%	2.81	<0.01	0.80	<0.01
Brazil	1%	5.08	<0.01	1.00	<0.01
South Africa	1%	4.65	<0.01	1.00	<0.01
Uganda	1%	5.99	<0.01	1.00	<0.01
Mexico	<1%	5.33	<0.01	1.00	<0.01
India	<1%	5.45	<0.01	1.00	<0.01
France	<1%	3.11	<0.01	0.80	<0.01
			1.48		**1.61**

**based on OECD database of export restrictions and European Commission database on trade agreements*

Table 22: Stage II (ores and intermediates). Concentration risk for EU supply: EU Supply Risk – (HHI_{WGI-t})$_{EU}$

Country	Share of production	WGI_{scaled}	Contribution to (HHI_{WGI})$_{EU}$	T (trade variable)*	Contribution to (HHI_{WGI-t})$_{EU}$
Source: Eurostat Comext, USGS, Cobalt Market Review		Source: WorldBank	JRC elaboration		
Finland	54%	1.98	0.58	0.80	0.46
Belgium	7%	2.81	0.01	0.80	0.01
Norway	7%	2.03	0.01	1.00	0.01
United States	7%	2.92	0.01	1.00	0.01
Zambia	4%	5.40	0.01	1.00	0.01
Madagascar	4%	6.26	0.01	1.00	0.01
China	4%	5.83	0.01	1.00	0.01
UK	3%	2.60	<0.01	1.00	<0.01
Russia	2%	6.20	<0.01	1.10	<0.01
DR Congo	2%	7.60	<0.01	1.00	<0.01
France	1%	3.11	<0.01	0.80	<0.01
Japan	1%	2.77	<0.01	1.00	<0.01
Uganda	1%	5.99	<0.01	1.00	<0.01
Congo, Rep.	1%	6.73	<0.01	1.00	<0.01
Brazil	1%	5.08	<0.01	1.00	<0.01
South Africa	1%	4.65	<0.01	1.00	<0.01
Morocco	<1%	5.48	<0.01	1.00	<0.01
Qatar	<1%	4.03	<0.01	1.00	<0.01
Other non EU countries	<1%	0.00	0.00	1.00	0.00
			0.65		**0.54**

**based on OECD database of export restrictions and European Commission database on trade agreements*

The following formula is used to calculate SR:

$$SR = \left[\left(HHI_{WGI,t}\right)_{GS} \cdot \frac{IR}{2} + \left(HHI_{WGI,t}\right)_{EU} \cdot \left(1 - \frac{IR}{2}\right)\right] \cdot (1 - EoL_{RIR}) \cdot SI_{SR}$$

Import reliance (IR) is based on EU import, export (Eurostat Comext) and domestic production (WMD, USGS, Cobalt Market Review) and for cobalt is:

$$IR_{I\ stage} = 86\%$$
$$IR_{II\ stage} = 27\%$$

The weighted sum of HHI for GS and EU is then ponderated using the **Substitute Index for Supply Risk – SI(SR)** and the **End-of-life Recycling Input Rate (EoL-RIR)**[56]:

$$SI(SR)_{Cobalt} = 0.92$$
$$EoL\text{-}RIR_{Cobalt} = 22\%$$

SR results for the first and second stages of cobalt:

$$SR_{Cobalt,\ ores\ and\ intermediates} = \left[2.95 \cdot \frac{0.86}{2} + 3.97 \cdot \left(1 - \frac{0.86}{2}\right)\right] \cdot (1 - 0.22) \cdot 0.92 = \mathbf{2.5}$$

$$SR_{Cobalt,\ metal} = \left[1.61 \cdot \frac{0.27}{2} + 0.54 \cdot \left(1 - \frac{0.27}{2}\right)\right] \cdot (1 - 0.22) \cdot 0.92 = \mathbf{0.5}$$

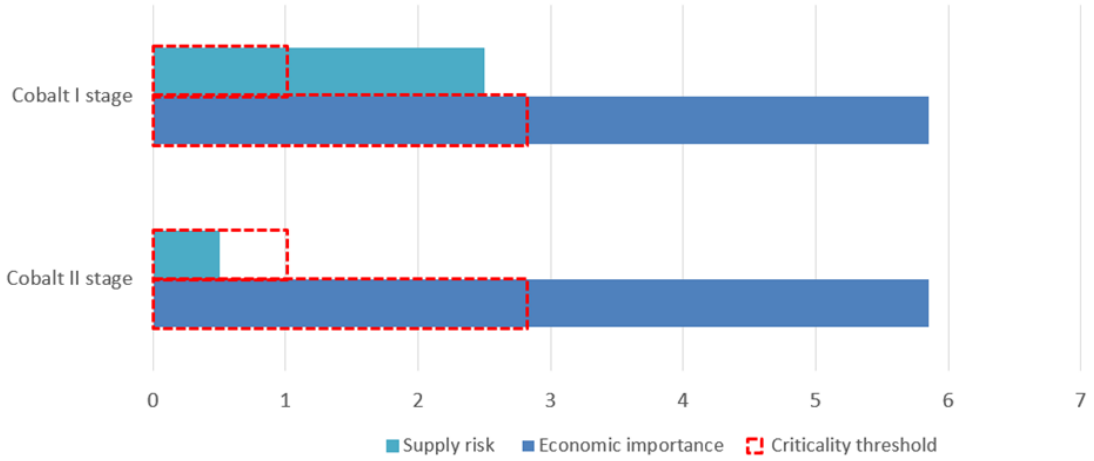
The thresholds for the criticality assessment are set at 2.8 for economic importance and 1 for supply risk. Therefore cobalt is assessed as critical for the first stage due to both economic importance and supply risk exceed the thresholds, while the second stage results as no critical. If at least one stage exceed the two thresholds, the candidate raw material is assessed as critical.

Table 23: EI and SR results for cobalt

I stage (ores and intermediates)	II stage (metal)
EI = 5.9	EI = 5.9
SR = 2.5	SR = 0.5

[56] JRC elaboration of multiple sources – see Factsheet for list of references

Figure 15: EI and SR results for cobalt



Annex 9. Summary report of the stakeholder validation workshops

Workshop preparation

In addition to bilateral exchanges during the data collection for the criticality assessment, a key aspect of the overall stakeholder consultation approach includes also the stakeholder data collection and validation workshops co-organised with the H2020 project SCRREEN. These meetings were aimed to review the data used for the purpose of criticality calculations and information used in the factsheets. The stakeholder workshops also provided the opportunity to present the data sources used and contributions delivered by stakeholders as well as discuss any recommendations to improve results.

Three stakeholder data collection and validation workshops took place on 10, 11 and 12 September 2019 at the Hotel Thon in Brussels. The aim of these stakeholder workshops was not to discuss the revised criticality methodology, which had been validated by the AHWG and the Commission, but to discuss in detail the criticality calculations for each of the materials covered during each workshop and to review and validate the data used in criticality assessments. Experts were also asked to contribute to relevant sections of the factsheets.

A balance between the involvement of relevant stakeholders and methodological rigour is essential. For example, in order to maintain objective and transparent results, the workshops should not allow for extensive participation, or even decision making of particular stakeholders regarding the project itself. On the other hand, the affirmation of a majority of stakeholder groups is essential to ensure that the results of the criticality assessments in particular, and the study as a whole, have the desired impact on EU business and policy making

Prior to the workshops, several background documents have been submitted to participants by the consultants. This was to allow the opportunity for participants to familiarise themselves with the study and methodology used, as well as come prepared with any questions discussed during the introduction plenary session of the workshop.

The background documents sent to confirmed participants include:

Detailed agenda of the workshop(s):

- Details on the conference centre location and key contact information
- Rules of the day specifying the main aims of the workshop in terms of what is expected from participants
- Timetable and agenda of the day, including when the parallel discussions will take place for each material
- List of expected participants (both present and through teleconference)

Protected detailed calculation files: sent to the relevant stakeholder participants based on the materials attribution list described above.

A 1-page summary summarising the content of the excel calculation files.

Draft factsheets

Non-disclosure agreement (NDA): the NDA on information discussed during the workshops and related background documents was sent to all stakeholders who indicated their participation through teleconference. These participants were informed that their participation is dependent on timely reception of a signed NDA e.g. before the workshop. NDAs were distributed for signature at the start of each workshop for participants who are physically present.

Final workshop organisation

Table 24 provides details on the materials that were covered during the stakeholder validation workshops that were held on 11-12-13September 2019.

Table 24: Organisation of the stakeholder workshops

Workshop I: 10 September 2019					
9:30	Registrations				
10:00	Welcome by the European Commission and SCRREEN				
	Background and guidance for the workshop				
11:00	Zinc	11:00	Germanium	11:00	Potash
11:30	Sulphur	11:30	Tellurium	11:30	Bauxite
12:00	Vanadium (45min)	12:00	Fluorspar	12:00	Aluminum
12:45	Copper	12:30	Bismuth (45min)	12:30	Aggregates
13:15	LUNCH BREAK				
14:00	Light Rare Earth	14:00	Feldspar	14:00	Baryte (45min)
14:30		14:30	Gypsum	14:45	Natural Rubber (45min)
15:00		15:00	Diatomite		
15:30	Heavy Rare Earth	15:30	Rhenium	15:30	Natural Teak Wood
16:00		16:00	Molybdenum	16:00	Natural Cork
16:30		16:30	Lead	16:30	Sapele Wood
17:00	Wrap up				

Workshop II: 11 September 2019					
9:30	Registrations				
10:00	Welcome by the European Commission and SCRREEN				
	Background and guidance for the workshop				
11:00	Lithium	11:00	Magnesite	11:00	Coking Coal
11:30		11:30	Magnesium	11:30	Kaolin Clay
12:00	Cobalt	12:00	Perlite	12:00	Boron/Borates
12:30		12:30	Limestone	12:30	Selenium
13:00	LUNCH BREAK				
14:00	Nickel	14:00	Beryllium	14:00	Helium (45min)
14:30		14:30	Bentonite	14:45	Hafnium (45min)
15:00	Manganese	15:00	Gallium		
15:30		15:30	Titanium	15:30	Antimony
16:00	Natural Graphite	16:00	Talc	16:00	Gold
16:30		16:30	Silica Sand	16:30	ARSENIC
17:00	Wrap up				

Workshop III: 12 September 2019					
9:30	Registrations				
10:00	Welcome by the European Commission and SCRREEN				
	Background and guidance for the workshop				
11:00	Tin	11:00	Chromium	11:00	Indium
11:30	Palladium	11:30	Phosphate Rock	11:30	Silver
12:00	Ruthenium + Iridium	12:00	Phosphorus (45min)	12:00	Silicon metal
12:30	Platinum			12:30	Cadmium
13:00	LUNCH BREAK				
14:00	Rhodium	14:00	Tungsten	14:00	HYDROGEN
14:30	Scandium	14:30	Niobium	14:30	STRONTIUM
15:00	Iron Ore	15:00	Tantalum (45min)	15:00	ZIRCONIUM
15:45	Wrap up				

Follow-up of the validation workshops

Several follow-up actions were carried out after the SCRREEN workshops:

- A summary of key discussion points raised by workshop attendees related to the overall work carried out on the criticality assessments.
- Follow-up with individual stakeholders who indicated willingness and capability to contribute relevant data and input for specific criticality assessments. Participants were reminded during the introduction session and throughout the day of the workshop that any of the data provided should be publishable and able to be sourced and cited. In other words, any (confidential) data provided that cannot be sourced or published could not have been accepted.
- E-mails were sent out to all participants thanking them for their interest, time and contributions as well as indicating any relevant follow-up actions e.g. deadlines for input, clarifications on specific input provided, etc.

The list of SCRREEN experts is displayed in Table 25.

Table 25: Validation workshops attendance list

Family Name	First Name	Organisation	Country
Almeida Azevedo	Joao Paulo	Sinergeo, SAGHA, Lda.	Portugal
Anastasatou	Marianthi	National and Kapodistrian University of Athens	Greece
Areas Alonso	Antonio	MInas y Geologia	Spain
Arvanitidis	Nikolaos	Geological Survey of Sweden (SGU)	Sweden
Balomenos	Efthymios	NTUA / MYTILINEOS METALLURGY	Greece
Bhagwat	Mukund	Mukund Bhagwat Consultancy Comm V	Belgium
Bonoli	Alessandra	University of Bologna	Italy
Braconi	Aurelio	EUROFER	Belgium
Braibant	Caroline	International Antimony Association	Belgium
Branche	Nathalie	AMG Antimony	France
Brown	Teresa	British Geological Survey	United Kingdom
Carpantier	Jean-Francois	Universit Aix-Marseille	France
Carpels	Mark	Campine	Belgium
Castresana-Pelayo	Jose M.	MAXAM	Spain
Ceschini	Lorella	University of Bologna	Italy
Chanson	Claude	RECHARGE	Belgium
Chavasse	roland	Tantalum-Niobium International Study Centre (T.I.C.)	Belgium
Coles	George	Roskill Information Services Ltd	United Kingdom
Corti	Fabrizio	IMERYS GRAPHITE AND CARBON	Switzerland
Cristo	Nelson	ASSIMAGRA - Mineral Resources of Portugal	Portugal
de la Feld	Marco	ENCO srl	Italy
De Oliveira	Daniel P.	LNEG - Laboratorio Nacional Energia e Geologia	Portugal
Deschamps	Yves	Orano Mining	France
Di Girolamo	Giovanni	ENEA	Italy
Dodds	Chris	The University of Nottingham	United Kingdom
Dondi	Michele	CNR-ISTEC	Italy
Eilu	Pasi	Geological Survey of Finland	Finland
Eriksen	Dag Oistein	Primus.inter.pares AS	Norway
Ferrero	Anna Maria	University of Turin	Italy
Fontbote	Lluis	University of Geneva, Switzerland	Switzerland
Forrière	Barbara	RENAULT SA	France
Forsgren	Christer	Stena Recycling International	Sweden
Ganev	Iva	EUROALLIAGES	Belgium
Garcia-Balbuena	David	Terrafame Oy	Finland
Gauss	Roland	EIT RawMaterials GmbH	Germany
Gautneb	Havard	Geologial survey of Norway	Norway
Girardi	Francesca	IMA Europe	Belgium
Gloaguen	Eric	BRGM (French Geological Survey)	France
Gomez-Barreiro	Juan	Universidad de Salamanca	Spain
Goovaerts	Hilde	Campine	Belgium
Gutierrez Peinador	Vicente	CONFEDEM	Spain
Hagelueken	Christian	Umicore	Germany
Hebestreit	Corina	Euromines	Belgium

Hitzman	Murray	Irish Centre for Research in Applied Geosciences	Ireland
Horvathz	Zoltan	Mining and Geological Survey of Hungary	Hungary
Humar	Miha	University of Ljubljana, Biotechnical Faculty	Slovenia
Huttunen-Saarivirta	Elina	VTT Technical research Centre of Finland Ltd	Finland
Huxtable	Peter	Huxtable associates	United Kingdom
Jaouen	Frederic	CNRS	France
JULIENNE	DIDIER	JULIENNE RESOURCES	France
Kapyaho	Asji	Geological Survey of Finland	Finland
Kalvig	Per	GEUS	Denmark
Karas	Henryk	Advisory Mining Board; Ministry of Environment; Poland	Poland
Koehle	Julian	International Platinum Group Metals Association	Germany
Koukouzas	Nikolaos	CERTH	GREECE
Kulczycka	Joanna	Waste Management and Recycling Cluster	Poland
Lapkovskis	Vjaceslavs	Riga Technical University	Latvia
Ledoux pedailles	Vincent	Infinity Lithium	United Kingdom
Llorens	Teresa	Strategic Minerals Spain, S.L.	Spain
Macedo	Gustavo	CBMM	The Netherlands
Maehlmann	Peter	TROPAG Oscar H. Ritter Nachf. GmbH	Germany
Manuel	Regueiro	Spanish Geological Survey	Spain
Marchan	Carmen	Minsitry for Ecological Transition	Spain
Martini	Carla	Alma Mater Studiorum University of Bologna	Italy
Mayoral Fernandez	Gonzalo Roberto	none	Spain
Meier	Michael	ORANO TN	France
Melegari	Silvia	European Organisation of the Sawmill Industry	Belgium
Menad	Nour-Eddine	BRGM	France
Mirabile Gattia	Daniele	ENEA	Italy
Mistry	Mark	Nickel Institute	Belgium
Mlynarczyk	Michal Stanislaw	Redstone Exploration Services Sp. z o.o.	Poland
Monnet	Antoine	LGI Consulting	France
Mourette	Aurore	FEAD	Belgium
Mueller-B	Birgit	Freiberger Compound Materials GmbH	Germany
Mueller-S	Soeren	Extrusion R&D Center, TU Berlin	Germany
Oliveira	Jorge	Sinergeo.pt	Portugal
Papavasileiou	Konstantinos	National and Kapodistrian University of Athens-Faculty of Geology and Geoenvironment	GREECE
Pares	Josep M	CENIEH	Spain
Pearce	Jeremy	International Tin Association	United Kingdom
Peck	David	Delft University of Technology (TU Delft)	Netherlands
Pereira	Bruno	Sinergeo	Portugal
Peres	Marta	Association Cluster Portugal Mineral Resources	Portugal
Pérez De Asis	Pilar	Magnesitas Navarras	Spain
Petros	Koutsovitis	CERTH	GREECE
Pettit	Carol-Lynne	Cobalt Institute	United Kingdom
Pinto	Filipe	BTW	Portugal
Plaiasu	Adriana-Gabriela	University of Pitesti	Romania

Renier	Angélique	NGK BERYLCO France & BeST	France
Ricci	Carlo	University of Cagliari	Italy
Salo	Aleksi	GTK	Finland
Scheja	Oscar	Scandinavian Steel AB	Sweden
Schmid	Marc	Martin-Luther-Universit	Germany
Schurmans	Maarten	Umicore	Belgium
Schwela	Ulric	Salus Mineralis Limited	United Kingdom
Ściążko	Marek	IChPW Institute for Chemical Processing of Coal	Poland
Sezerer kuru	Gulay	GSK geology consulting	Turkey
Shtiza	Aurela	Industrial Minerals Association Europe, IMA-Europe	Belgium
Slupek	Kamila	Eurometaux	Belgium
Smolnik	Grzegorz	Silesian University of Technology	Poland
Soltes	Stanislav	SGUDS	Slovakia
Straze	Ales	University of Ljubljana, Biotechnical Faculty	Slovenia
Sundqvist Öqvist	Lena	Swerim AB	Sweden
Talens Peiro	Laura	ICTA-UAB	Spain
Taverne	Jean-Pierre	ETRMA	Belgium
Tercero Espinoza	Luis	Fraunhofer ISI	Germany
Tornos	Fernando	Instituto de Geociencias (CSIC-UCM)	Spain
Valentim	Bruno	Porto University	Portugal
Van Acker	Karel	KU Leuven	Belgium
Vieira	Castorina	University of Porto - Faculty of Engineering	Portugal
Vinck	Nadia	Euroalliages	Belgium
Vyboldina	Elena	Eurometaux	Belgium
Väisänen	Ari	University of Jyväskylä	Finland
Sievers	Henrike	BGR	Germany
Thornton	Christopher	European Sustainable Phosphorus Platform	Belgium

Annex 10. Key authors and contributors

JRC core team:

Gian Andrea Blengini
Cynthia EL Latunussa
Umberto Eynard
Cristina Torres de Matos
Dominic Wittmer
Konstantinos Georgitzikis
Claudiu Pavel
Samuel Carrara
Lucia Mancini
Manuela Unguru
Fabrice Mathieux
David Pennington

Other JRC contributors:

Jaco Huisman
Silvia Bobba
Darina Blagoeva

External support:

Michele Dondi (CNR-ISTEC)
George Barakos (TU Freiberg)
Marie-Theres Krueger (UniLeoben)
Maïté Le Gleuher (BRGM)
Kostas Komnitsas (TU Crete)
Elmer Rietveld (TNO)

Contributions from MSA Studies

Cristina Torres de Matos (co-ordination)
Maren Lundhaug (NTNU)
Daniel Muller (NTNU)
Maria Fernanda (Godoy Leon Univ Ghent)
Jo Dewulf (Univ Ghent)
Luca Ciacci (Univ Bologna)
Andreas Auberger (IFEU)
MonikaDittrich (IFEU)
Mariane Planchon (Deloitte)
Chloé Devauze (Deloitte)

GETTING IN TOUCH WITH THE EU

In person

All over the European Union there are hundreds of Europe Direct information centres. You can find the address of the centre nearest you at: http://europa.eu/contact

On the phone or by email

Europe Direct is a service that answers your questions about the European Union. You can contact this service:
– by freephone: 00 800 6 7 8 9 10 11 (certain operators may charge for these calls),
– at the following standard number: +32 22999696 or
– by email via: http://europa.eu/contact

Finding information about the EU

Online

Information about the European Union in all the official languages of the EU is available on the Europa website at: http://europa.eu

EU publications

You can download or order free and priced EU publications from EU Bookshop at: http://publications.europa.eu/eubookshop. Multiple copies of free publications may be obtained by contacting Europe Direct or your local information centre (see http://europa.eu/contact).

EU law and related documents

For access to legal information from the EU, including all EU law since 1951 in all the official language versions, go to EUR-Lex at: http://eur-lex.europa.eu

Open data from the EU

The EU Open Data Portal (http://data.europa.eu/euodp) provides access to datasets from the EU. Data can be downloaded and reused for free, both for commercial and non-commercial purposes.

ET-01-20-491-EN-N

Publications Office
of the European Union

doi:10.2873/11619
ISBN 978-92-76-21049-8