Optimizing quality of information in RAw MAterial data collection across Europe

Technical Guidance note: Raw materials import reliance and associated data uncertainties

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Table of Contents

1. Introduction

Import and export data is one of the key data types for primary raw materials that has been considered by the ORAMA project. Collection and harmonisation processes for import and export data are well established across Europe because all countries will collect trade data as part of taxation and customs procedures and there are clear regulations that require the collection of these data. However, despite this, there are still many issues with this data type in terms of data gaps and lack of resolution for specific commodities, which need to be addressed. The following study uses the example of import reliance to highlight some of the issues with European trade and production data and to demonstrate how the data need to be carefully understood when undertaking such analysis to ensure accurate conclusions are drawn.

2. Defining import reliance and its importance

Import reliance (IR) is an indicator often used to measure the extent to which an economy relies upon imports of a commodity in order to satisfy the country's consumption. Economies of scale and globalisation means that most countries worldwide, including the EU, rely on imports from international markets with IR varying for different raw materials depending on geological endowment, production, economic conditions and market dynamics.

Markets are accustomed to the trade of commodities and procedures are in place that have allowed this to happen for many years. However, for materials that are of high demand and/or are produced in small volumes from a limited number of producers globally, market competition can increase rapidly and therefore access to these materials may be highly risky. In addition, protectionist tendencies, such as the recent phenomenon of trade wars have incorporated extra layers of complexity and risk. A high IR, therefore, could imply a lack of security of supply, as economies are more vulnerable to, for example, export limitations applied by producing countries.

In reality however, the assessment of supply risk cannot be done with a single indicator. Instead, several different economic, market, environmental and social considerations have to be accounted for and 'individual' commodity-specific assessments have to be developed. By monitoring the IR, Europe is able to assess dependency in external commodity markets and, therefore, is able to identify potential risks and ways to address them for commodities that may have a problematic supply. Reducing the dependency on imported raw materials, for example, by improving supply within Europe, developing trade agreements, replacing by substitutes or promoting reuse and recycling, may help Europe's economies to increase their resource efficiency.

3. Import reliance calculations

In this guidance note, IR is calculated as a percentage using the following formula, assuming 'consumption' is apparent consumption:

$$\text{import reliance} = [(\text{import} - \text{export}) / \text{apparent consumption}] \times 100,$$
$$\text{where apparent consumption} = \text{production} + \text{import} - \text{export}$$

For the ease of calculation, stock changes are assumed to be zero.

In this study, IR is calculated for selected raw materials (aluminium, cobalt, graphite, gypsum and lithium) at different life cycle stages (where appropriate) for the EU-28 and at a national level for Germany and the United Kingdom. These commodities were selected to provide a range that includes both metals and industrial minerals, as well as those labelled as 'critical' and 'non-critical' raw materials.

Production data from 2013 to 2017 for these commodities were taken from the British Geological Survey's World Mineral Statistics Database (BGS, 2019), where possible. Import and export data were extracted from the Eurostat online database (Eurostat, 2019a) using the Harmonised System (HS) trade codes shown in Table A1 in the Appendix. For some of the calculations, e.g. 'aluminium oxides and hydroxide' and 'natural graphite', import and export data of two HS trade codes were added together to compare these with the appropriate production data from the BGS Database (BGS, 2019). In the case of 'cobalt oxides and hydroxides' and 'cobalt mattes and other intermediate products', trade codes were combined to 'refined cobalt' in order to compare these data with the refined cobalt production from the BGS Database. All cobalt figures used for both trade and production were calculated as cobalt contained. Trade data of 'lithium oxides and hydroxides' and 'lithium carbonates' were combined and calculated to the lithium content. Data for 'secondary aluminium' were taken from the World Bureau of Metal Statistics (WBMS, 2019).

4. Case study: Assessing the EU-28 import reliance

The graphics below show the 5-year total (2013 to 2017) quantities of production, import and export and the calculated apparent consumption for the selected raw materials. Production data in the EU-28 are available for each of the commodities but at different life cycle stages. Production data of 'lithium' is based on lepidolite mineral production and calculated to the lithium content. There are no trade data available for ores and concentrates containing lithium as these cannot be isolated from other types of ores and concentrates in the respective trade codes. Therefore, in the calculation of import reliance for lithium trade data for lithium oxide and hydroxide and lithium carbonate, adjusted for lithium content were used instead.

The calculation of apparent consumption for the EU-28 yields positive results for all of the selected commodities without any discrepancies, e.g. there are no negative values for apparent consumption.

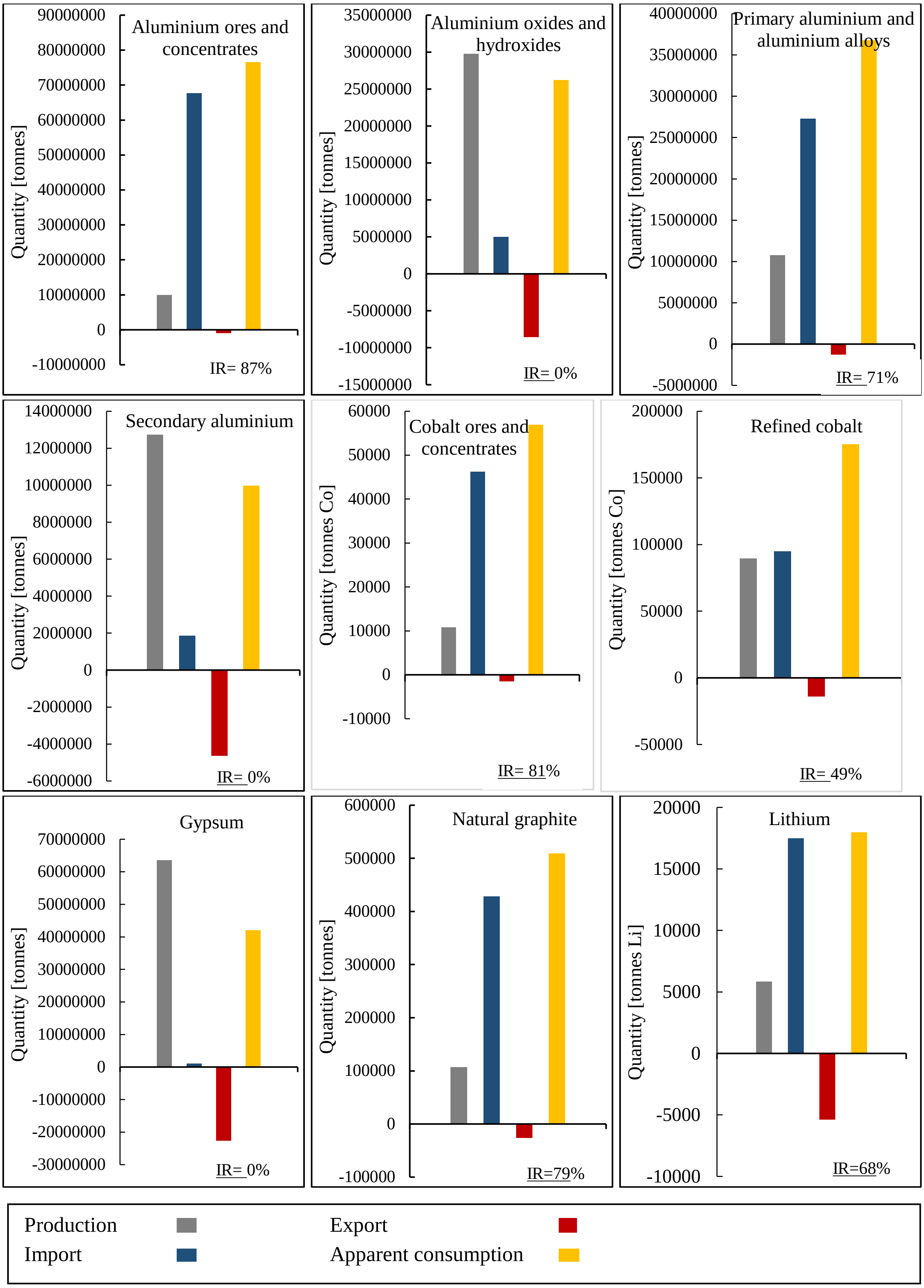

Figure 1 Diagrams showing production, import, export, calculated apparent consumption and import reliance (IR) of a 5-year total (e.g. sum of 5-year production, import, export etc) from 2013 to 2017. Source data can be seen in Appendices A2 and A3.

Figure 2 shows the trend of IR of the selected raw materials for the EU-28 between the years 2013 and 2017. The IR rates for 'aluminium ores and concentrates', 'aluminium oxides and hydroxides', 'primary aluminium and aluminium alloys' and natural graphite vary at a maximum range of ±6% between 2013 and 2017.

The EU-28 has constant negative IR rates for gypsum between 2013 and 2017, which means that it is not dependent on imports. The IR rate is fluctuating between -31% in 2014 to -77% in 2016. These rates vary because of large differences in production and export data in 2014 and 2016. In 2014, the EU-28 produced a large amount of gypsum but exported less quantities. In contrast, in 2016 they comparatively exported a lot more gypsum than in other years and produced much less (see appendix table A2).

The IR rate of refined cobalt was 62% in 2013. After an increase in 2014 to 70%, the IR decreased to 22% in 2017. This is a dramatic drop, which does not reflect the market trends observed through other routes. When exploring closer the trade data for refined cobalt, it becomes apparent that significant import flows to countries with major refining capacity (e.g. Finland) are not reported from 2014 onwards. The reasons for this gap in data are not known, but confidentiality, or market competition rules may be liable for suppressing them. We speculate therefore that the IR for refined cobalt is more likely around the 70% figure from 2014 onwards; especially as refined cobalt production in Europe has increased since 2014. Trade data for 'cobalt ores and concentrates' in Europe are also missing making the calculation of import reliance quite difficult. In this case and so that we are able to calculate the EU-28 import reliance, we estimated the import of 'cobalt ores and concentrates' from Finland (missing data) and added this figure to the overall EU import trade data reported by Eurostat. To estimate the import of 'cobalt ores and concentrates' from Finland we assumed that the refined Finish production minus the domestic production and the EU-intra imports represent the missing import data. Subsequently, we calculated the IR rate of 'cobalt ores and concentrates' for the EU-28. We observe that there is very little variation through the years and the EU is highly dependent on imports of 'cobalt ores and concentrates' for the 5-year period explored in this study. This conclusion aligns well with the market trends reported in the wider literature.

The IR of 'lithium' shows a decreasing trend from 78% in 2013 to 51% in 2017, but equally with lithium the missing data for lithium minerals means that the calculation of IR is not highly accurate. In addition, production statistics do not report European production of lithium compounds, which is also needed for the IR calculation.

The import reliance of EU-28 for natural graphite has remained high and with small variation over the 5-years period explored in this study.

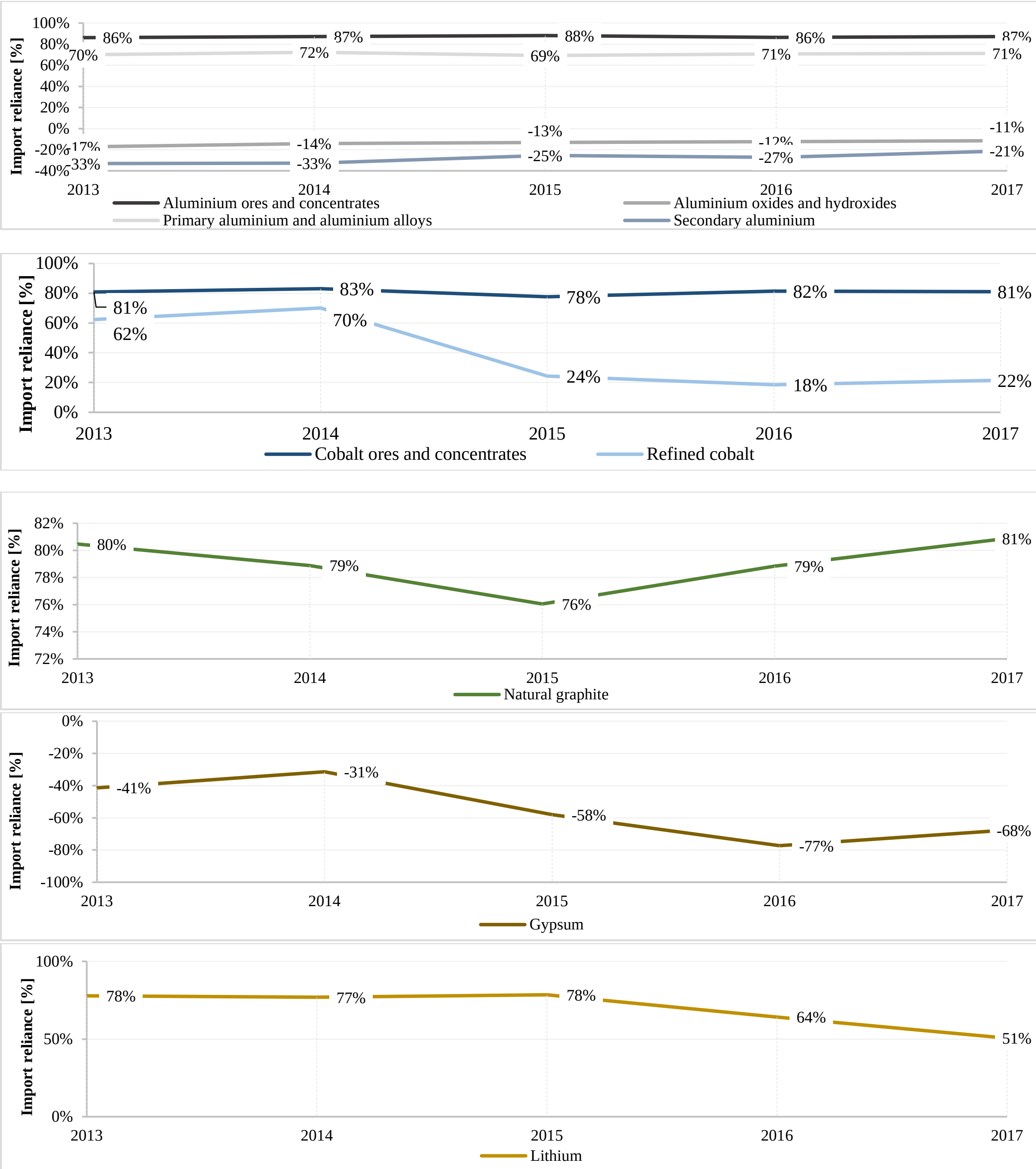

Figure 2 Trend of import reliance of selected raw materials for the EU-28 between 2013 and 2017.

Calculating import reliance for aluminium provides an interesting assessment for different stages of a single life cycle. The IR rate for aluminium ores and concentrates (i.e. bauxite) is quite high (86–88% in all years) and this illustrates that the EU-28 does not source much of the bauxite it needs from within its own borders. Production is around 2 million tonnes per year compared to an apparent consumption of 14–16 million tonnes per year. An assessment of the geology of Europe is needed to determine whether it is possible for the EU-28 countries to produce a greater proportion of its requirement for this mineral.

However, for alumina oxides and hydroxides (i.e. alumina) the IR rate is below zero because the EU-28 produces more alumina than it consumes. The EU-28 countries are, collectively, a net exporter of alumina. Despite this notable production of alumina, however, the IR rate for primary aluminium is approximately 70% because the EU-28 produces around 2 million tonnes per year but consumes approximately 7 million tonnes.

These differences in IR rate demonstrates that the EU-28 could increase its domestic production of primary aluminium, utilising more of its existing alumina production and thereby reducing its IR rate for the metal. However, the maximum effect on the IR rate for primary aluminium would be to reduce it by approximately 10% in 2017. Therefore, to have a larger impact on the IR rate for primary aluminium, the production of alumina would need to be increased.

5. Case study: Assessing import reliance at national level

This case study compares the United Kingdom and Germany, two countries with significant manufacturing capacity in place that require access to raw materials.

In general, Germany has a stronger manufacturing base in comparison to the United Kingdom. Germany's manufacturing sector is twice the size of Britain's if we compare GDP figures (The Guardian, 2019). By comparing the IR rates of the selected commodities, it can be seen that the United Kingdom and Germany differ significantly in their import dependence for 'primary aluminium and aluminium alloys', 'aluminium oxides and hydroxides', 'secondary aluminium' and 'gypsum' (Appendices 2 and 3). The IR rates for the other commodities are similar for both countries.

The IR rates of 'aluminium ores and concentrates' for the United Kingdom and Germany are 100%. In the case of 'aluminium oxides and hydroxides', Germany has a significantly less IR of 10% in contrast to the United Kingdom, which is 100% dependent on the import from other countries since the closure of its alumina refinery in 2000. The United Kingdom and Germany are both highly dependent on cobalt at all the different stages with an IR rate of 100%. Both countries have similar IR rates for natural graphite of 100% (United Kingdom) and 99% (Germany), therefore they are highly dependent on the imports from other countries. For gypsum, Germany is not dependent on imports, but the United Kingdom has an IR of 42%. It appears that both the United Kingdom and Germany are highly dependent on the import of lithium compounds

There are some data discrepancies for primary and secondary aluminium, for example the IR rate of 'primary aluminium and aluminium alloys' is very erratic varying between 40% in 2013, 15% in 2014, 495% in 2015, 392% in 2016 and -498% in 2017 (see appendix table A3). This is because the apparent consumption in 2015 and 2016 is negative (up to -15764 tonnes), while in 2017 it increased up to 8089 tonnes. It is likely this results from deficiencies in the original data used, which may be caused by mis-coding of trade data, under-reporting of production data or non-precise data estimates. In both cases, the IR for the raw material (aluminium ores and concentrates) is 100% so, ultimately, the two countries are dependent on imports to support production of these commodities.

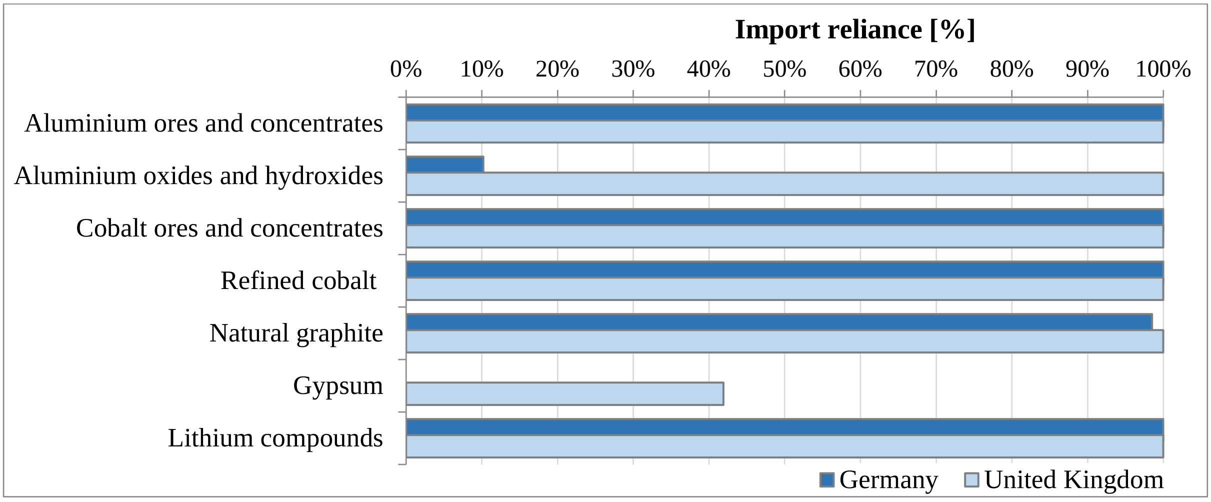

Figure 2 Import reliance rate over the years 2013 to 2017 for Germany (dark blue) and United Kingdom (light blue).

6. Uncertainties associated with the import reliance indicator

During the calculations of IR for the EU-28 and at a national level for Germany and the United Kingdom, several issues were revealed, which are described as follows.

6.1 Uncertainties and issues associated with import and export data

In the Eurostat database, import and export data for ‘secondary aluminium’ under the 8-digit code are only available until 2012. Therefore, the 6-digit code (760200) for ‘waste and scrap of aluminium’ was used for the calculation of apparent consumption and IR in this guidance note. In effect, these calculations for secondary aluminium are using ‘waste and scrap of aluminium’ as a proxy for secondary aluminium trade and assume that all the traded waste and scrap is recycled into aluminium metal. This assumption is not entirely accurate because some losses of material is likely to occur. Imports or exports of secondary aluminium that are not considered to be ‘waste and scrap’ may also occur.

Another issue is the import and export data of ‘cobalt mattes and other intermediate products’ being combined with ‘unwrought cobalt’ and ‘cobalt powders’ under the 8-digit code 81052000. The comparison of production and trade data of ‘cobalt oxides and hydroxides’ as well as ‘cobalt mattes and other intermediate products’ has little significance. In order to do detailed calculations, all production and trade data must be calculated to the cobalt content of each product. This is something that we attempted to do in this study, using the metal content figures utilised in the EC Study on the review of the list of critical raw material 2017 (EC, 2017). However, the figures used in this study are highly uncertain. In reality, there are not enough information to calculate the cobalt content of individual products, as cobalt contents are highly variable and the trade codes include several forms of cobalt under a single code. In both cases of IR calculation for ‘cobalt ores and concentrates’ and ‘refined cobalt’ the underlying trade data have important gaps and the reasons for these gaps are unknown.

In the case of lithium, there are no import and export data for lithium ores and concentrates or lithium metal available. Therefore, only import and export data of ‘lithium oxides and hydroxides’ as well as ‘lithium carbonates’ could be used but this does not include the import of lithium as minerals (ores and concentrates).The lithium content of these compounds were used to calculate apparent consumption and import reliance for the EU-28.

Uncertainties in import or export data might result in problems with the calculated apparent consumption or import reliance data, i.e. they result in negative figures. This may indicate: 1) mis-coding; 2) net exports; 3) hidden trade, e.g., import of cobalt in a nickel ore or matte but producing cobalt from it; or 4) “free trade zones” where material goes in and out without registration. Uncertainties could also be caused by re-exports, i.e. where material is imported to one country while in transit to another and is therefore exported in the same form, because the export may occur before the import has been registered. In some instances transiting material may not be recorded as an import at all. It is also possible for material to be exported then immediately re-imported, for example if an order has been cancelled or if changes in demand require the material to be brought back.

6.2 Uncertainties and issues associated with production data

Uncertainties exist with data sources, especially with regards to whether the production data is reported by primary sources (e.g. statistics offices, ministries, geological surveys, company data) or secondary sources (e.g. international trade associations, estimates). This can have an impact on the precision and/or accuracy of the published data.

In addition, missing data leads to many uncertainties. For example, there is no reported production of ‘cobalt oxides and hydroxides’ and ‘cobalt mattes and other intermediate products’ for the United Kingdom and Germany. The United Kingdom has a negative apparent consumption of 5683 tonnes, because its exports are much greater than its imports, (see appendix table 1). However, the difference is likely to be production of these forms within the country. Nickel refineries located in the United Kingdom may produce cobalt mattes and other intermediate products, which are subsequently exported for further refining elsewhere, but there are no reported figures. These nickel refineries import raw materials as feed, but the cobalt content of these materials is not published. This is sometimes referred to as ‘hidden trade’.

In the case of lithium, production data is only available for lepidolite, a lithium-bearing mica. It is assumed that mainly lithium oxide is produced from lepidolite. Production data is calculated to lithium content only but this is very uncertain as production of ‘lithium oxides and hydroxides’ is not included. There are no data available for the production of lithium oxides, hydroxides or carbonate within Europe.

6.3 Uncertainties associated with the calculations in this study

Another uncertainty may persist through in-country stockpile warehouses and company stockpiles, but data are not available. Stocks can lead to temporal delays between reported production, import and export data. In this study, we simplified the calculation by excluding the stocks but any stock change (increase or decrease) will have an impact on the calculation of apparent consumption.

In some cases, a negative IR rate has resulted. However, this might be because a country is a major net exporter with a lot of production and consequently the IR is 0%.

6.4 Uncertainties associated with metal content figures

Production statistics for metals often report metal contained figures, whereas trade statistics in most cases reflect gross weight without any supporting information about the metal content of the traded commodity. This is particularly problematic, when trade codes amalgamate more than one form of material, for example in the case of 'cobalt mattes and other intermediate products' or 'lithium oxide and hydroxide'. In addition, there are no supporting information about the share of participation of a particular material form in these aggregated trade data, so again it becomes impossible to estimate with accuracy their metal content. In the case of calculating indicators such as IR, this becomes essential as production and trade data both need to be used. The development of supplementary information and metadata on the metal content of commodities, whether these are ores, concentrates, intermediate forms or products is very important for any assessment where different datasets need to be combined together.

7. Conclusion

In conclusion, the import reliance can be used as a potential indicator in criticality and other economic assessment, but the reliability of the results will have to be assessed on a commodity-by-commodity basis. As discussed in the 'Uncertainties' section of this report, there are many factors that can adversely influence import reliance and many assumptions that we are often required to enable this calculation to be made. There are important factors that need to be considered when calculating apparent consumption as well as import reliance, e.g. the use of HS trade codes and related import/export data in combination with production data of different commodity forms. All data used in the calculations should be assessed for quality before use and it is important that uncertainty is communicated transparently together with the IR calculations.

An IR figure, although important, cannot be used solely to raise supply risk concerns. It is important that IR calculations are accompanied by a detailed analysis of the involved trading partners. Only then geopolitical and economic risks can be considered. Another common mistake often made when using IR figures in criticality assessments is the assumption that high domestic production, which may translate into low IR, equals lower dependency to external markets. Unfortunately, this is not always the case as commodities are often produced in one place, but transformed into different forms somewhere else before being used in manufacture. Low IR will equal low dependency only if domestic vertical integration stages are in place to ensure that all or the majority of domestic production is directly used in manufacturing. An assessment of IR across different material forms and life cycle stages can identify such issues and provide a fuller picture on dependencies to external markets.

The key to all the above is the availability of robust data on production and trade across the whole life cycle of commodities. Although steps have been made in Europe through the various raw materials data-oriented research projects (for example see H2020 deliverables from MinFuture and ORAMA projects) significant gaps still exist which require additional datasets and harmonisation rules to be developed.

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Appendix

Table A1 HS trade codes of selected raw materials.

Selected raw materials	HS trade code
Aluminium ores and concentrates	26060000
Aluminium oxides	28182000
Aluminium hydroxides	28183000
Aluminium, not alloyed, unwrought	760110
Primary aluminium alloys, unwrought	760120
Secondary aluminium (waste and scrap of aluminium)	760200
Cobalt ores and concentrates	2605 0000
Cobalt oxides and hydroxides	2822 0000
Cobalt mattes and other intermediate products	81052000
Natural graphite	25041000 and 25049000
Gypsum	25201000
Lithium oxides and hydroxides	28252000
Lithium carbonates	28369100

Table A2 Calculations of apparent consumption and import reliance rate based on import, export and production data between 2013 and 2017 for the EU-28. Trade, production data and apparent consumption are given in tonnes. For cobalt and lithium the figures represent tonnes of metal content.

	Import					Export					Production				
	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Aluminium ores and concentrates	13014800	13738009	14528325	12520889	13781887	263156	239784	237778	83439	100028	2045920	1970550	1921200	1976480	2013200
Aluminium oxides and hydroxides	938039	1171481	879060	969208	1002386	1823792	1891895	1533070	1643080	1634150	6008460	5831518	5653061	6137545	6136063
Primary aluminium and aluminium alloys	4860803	5473794	5221965	5764446	5970898	176859	199658	239436	312692	335246	2009083	2019008	2215056	2249367	2262623
Secondary aluminium	322640	361776	357759	404555	426093	922649	982710	867506	946907	907161	2410900	2512600	2516900	2533300	2756000
Cobalt ores and concentrates	8715	10347	7395	10009	9809	5	28	40	48	26	2061	2104	2119	2260	2300
Refined cobalt	30634	45466	6354	5500	6798	3318	1818	1211	1226	1457	16521	18620	16054	18841	19486
Natural graphite	76360	92897	75597	85824	97615	4446	4114	4620	5687	6983	17459	23757	22351	21502	21422
Synthetic graphite	98036	96690	96985	86375	115566	93291	88262	73508	93897	128202	181671	154200	198873	149052	175512
Gypsum	173693	187687	217215	236192	291132	3744612	4199512	4417782	5161840	5074776	20357248	24881472	20717687	21888413	22748612
Lithium	3457	2877	3394	4055	3707	944	796	875	1441	1297	714	625	690	1459	2354
	Apparent consumption					**Import reliance**					**Total 5-year**				
	2013	**2014**	**2015**	**2016**	**2017**	**2013**	**2014**	**2015**	**2016**	**2017**	**Import**	**Export**	**Production**	**Apparent consumptio n**	**Import reliance**
Aluminium ores and concentrates	14797564	15468774	16211747	14413930	15695059	86%	87%	88%	86%	87%	67583909	924185	9927350	76587074	87%
Aluminium oxides and hydroxides	5122706	5111104	4999051	5463673	5504299	-17%	-14%	-13%	-12%	-11%	4960174	8525987	29766647	26200834	0%
Primary aluminium and aluminium alloys	6693027	7293143	7197585	7701121	7898275	70%	72%	69%	71%	71%	27291905	1263891	10755137	36783151	71%
Secondary aluminium	1810890	1891666	2007153	1990948	2274933	-33%	-33%	-25%	-27%	-21%	1872822	4626933	12729700	9975589	0%
Cobalt ores and concentrates	10771	12424	9473	12222	12083	81%	83%	78%	82%	81%	46275	146	10844	56973	81%
Refined cobalt	43837	62267	21197	23115	24828	62%	70%	24%	18%	22%	94752	9029	89522	175244	49%
Natural graphite	89373	112541	2007154	101639	112054	80%	79%	4%	79%	81%	428293	25850	106491	508934	79%
Synthetic graphite	186416	162628	222350	141530	162876	3%	5%	11%	-5%	-8%	493652	477160	859308	875800	2%
Gypsum	16786329	20869648	16517120	16962765	17964968	-21%	-19%	-25%	-29%	-27%	1105919	22598521	110593432	89100831	0%
Lithium	3227	2705	3209	4073	4764	78%	77%	78%	64%	51%	17490	5353	5842	17978	68%

Table A3 Calculations of apparent consumption and import reliance rate based on import, export and production data between 2013 and 2017 for the United Kingdom and Germany. Trade, production data and apparent consumption are given in tonnes.

	Import					Export					Production				
	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Aluminium ores and concentrates															
UNITED KINGDOM	40964	34505	35852	19619	14029	4804	4319	3455	4879	4495	0	0	0	0	0
GERMANY	2410523	2623107	2767920	2230366	2325405	25365	29333	26110	22353	28393	0	0	0	0	0
Aluminium oxides and hydroxides															
UNITED KINGDOM	131050	121462	104675	205922	192526	3916	5160	5742	10101	4050	0	0	0	0	0
GERMANY	997281	858973	735894	1030354	1196225	837849	747739	757642	867340	1040849	1000000	1000000	1000000	1000000	1000000
Primary aluminium and aluminium alloys															
UNITED KINGDOM	227039	232315	220006	229444	234712	197506	224989	281379	291208	274622	45000	41000	48000	46000	48000
GERMANY	2413846	2591158	2504429	2615557	2541810	424412	409446	433797	491182	475395	492368	530683	541379	546806	549995
Secondary aluminium															
UNITED KINGDOM	113462	161195	113549	113780	135711	402061	452313	405504	437637	370082	148800	148800	148800	148800	148800
GERMANY	560693	656637	790139	780943	791742	935339	1056231	1064274	1064456	1038790	597400	599400	630600	595300	765800
Cobalt ores and concentrates															
UNITED KINGDOM	14	14	13	8	3	2	1	1	1	2	0	0	0	0	0
GERMANY	8	7	4	0	1	0	17	8	8	19	0	0	0	0	0
Refined cobalt															
UNITED KINGDOM	2498	2263	2028	3125	3188	1514	1384	1308	1499	1366	0	0	0	0	0
GERMANY	2543	2459	2423	2623	2641	376	371	322	325	426	0	0	0	0	0
Natural graphite															
UNITED KINGDOM	4951	3823	3451	2667	3815	2011	1451	1762	1588	1851	0	0	0	0	0
GERMANY	40323	45806	33653	45697	45935	14288	16994	15376	15339	14569	269	517	398	502	422
Gypsum															
UNITED KINGDOM	376972	500058	730856	1591274	1523565	4745	4061	5609	4619	9202	700000	1100000	1800000	1600000	1300000
GERMANY	8335	16815	27791	25466	22610	432371	438906	552937	637431	649602	1778000	4090000	4200000	3970000	4450000
Lithium compounds															
UNITED KINGDOM	155	191	105	287	461	28	45	70	119	215	0	0	0	0	0
GERMANY	1125	1149	1272	1321	1031	528	583	519	631	567	0	0	0	0	0

	Apparent consumption					Import reliance					Total 5-year				
	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	Import	Export	Production	Apparent consumption	Import reliance
Aluminium ores and concentrates															
UNITED KINGDOM	36161	30186	32397	14740	9535	100%	100%	100%	100%	100%	144969	21951	0	123018	100%
GERMANY	2385158	2593775	2741810	2208013	2297013	100%	100%	100%	100%	100%	12357321	131553	0	12225768	100%
Aluminium oxides and hydroxides															
UNITED KINGDOM	127134	116302	98934	195820	188475	100%	100%	100%	100%	100%	755634	28969	0	726665	100%
GERMANY	1159432	1111234	978253	1163014	1155377	14%	10%	-2%	14%	13%	4818728	4251419	5000000	5567309	10%
Primary aluminium and aluminium alloys															
UNITED KINGDOM	74534	48326	-13373	-15764	8089	40%	15%	459%	392%	-493%	1143516	1269704	228000	101812	-124%
GERMANY	2481803	2712395	2612012	2671181	2616411	80%	80%	79%	80%	79%	12666801	2234231	2661231	13093801	80%
Secondary aluminium															
UNITED KINGDOM	-139798	-142318	-143154	-175057	-85572	206%	205%	204%	185%	274%	637697	2067596	744000	-685899	208%
GERMANY	222754	199806	356465	311788	518752	-168%	-200%	-77%	-91%	-48%	3580154	5159090	3188500	1609564	-98%
Cobalt ores and concentrates															
UNITED KINGDOM	11	13	12	8	2	100%	100%	100%	100%	100%	52	6	0	46	100%
GERMANY	8	-10	-4	-8	-18	100%	100%	100%	100%	100%	19	53	0	-34	100%
Refined cobalt															
UNITED KINGDOM	985	879	720	1626	1822	100%	100%	100%	100%	100%	13102	7070	0	6031	100%
GERMANY	2167	2088	2101	2299	2216	100%	100%	100%	100%	100%	12690	1819	0	10871	100%
Natural graphite															
UNITED KINGDOM	2940	2372	1689	1079	1964	100%	100%	100%	100%	100%	18707	8664	0	10043	100%
GERMANY	26304	29329	18675	30860	31788	99%	98%	98%	98%	99%	211413	76565	2108	136957	98%
Synthetic graphite															
UNITED KINGDOM	35511	5994	35074	-66551	9518	11%	-415%	5%	143%	-254%	70377	208686	157854	19545	-708%
GERMANY	4317	-24397	-1918	-9944	-24590	-456%	179%	1145%	287%	168%	271276	426226	98419	-56531	274%
Gypsum															
UNITED KINGDOM	1072227	1595997	2525248	3186655	2814364	35%	31%	29%	50%	54%	4722726	28235	6500000	11194491	42%
GERMANY	1353964	3667909	3674855	3358035	3823009	-31%	-12%	-14%	-18%	-16%	101017	2711246	18488000	15877771	-16%
Lithium compounds															
UNITED KINGDOM	127	146	35	168	246	100%	100%	100%	100%	100%	1200	477	0	723	100%
GERMANY	597	566	753	691	464	100%	100%	100%	100%	100%	5897	2827	0	3070	100%