EU Raw Materials Information System and Raw Materials Scoreboard: addressing the data needs in support of the EU policies – an example for water use in mining

Beatriz Vidal-Legaz; Cynthia Latunussa; Gian Andrea Blengini; Tamas Hamor; Simone Manfredi, David Pennington

[1]*European Commission – Joint Research Centre, Directorate D – Sustainable Resources, Unit D3 – Land Resources, Via E. Fermi 2749, 21027 Ispra (VA) Italy, beatriz.vidal-legaz@ec.europa.eu*

Abstract The European Commission is developing the Raw Materials Information System (RMIS) and Scoreboard to count on a sound knowledge base for the support of the EU raw materials policy, covering the extraction of non-food, non-energy materials. Water is among the sustainability aspects that those developments will cover, given its paramount importance in the operation of mining and processing activities. This study surveyed water (use and pollution) data available at national/sub-national level to monitor the EU sector performance. Valuable, yet limited sources were found, which illustrates the challenges faced to provide sound data to support the EU raw materials policies.

Key words EU raw materials policy, sustainability, environmental performance, water use, water pollution

The EU Raw materials policy

Following the 2008 Raw Materials Initiative (RMI) (EC, 2008), the European Commission (EC) is committed to promoting the competitiveness of industries related to raw materials and securing their undistorted supply. This embraces the extraction and production of non-food, non-energy raw materials: abiotic materials such as metals, non-metallic minerals, and industrial minerals, and biotic materials such as wood or natural rubber. Of particular importance are materials considered as 'critical' (EC, 2014), i.e. they are very relevant to the economy while at the same time they show risk of supply disruption due to the conditions in supplying countries. Apart from securing materials supply, the RMI also promotes the 'fair and sustainable supply of raw materials from global markets', which embraces also social and environmental considerations, and the boosting of recycling.

Further, the Circular Economy Action Plan (EC, 2015) promotes the transition towards a circular economy, through the fostering of reuse and recycling, which will boost EU competitiveness and jobs generation, as well as fostering sustainability. This ambitious plan includes measures and reviewed targets to increase recycling and prevent landfilling all along the production and consumption chain and until waste management and the market for secondary raw materials.

These policy actions to secure supply and boost sustainability require a solid and continuously updated knowledge base (data and information), covering the entire raw materials value chain. The environmental performance of all production stages becomes essential information, where water plays a key role. To cover these needs, the EC is developing the Raw Materials Information System and the Raw Materials Scoreboard.

The Raw Materials Information System and the Raw Materials Scoreboard

The Raw Materials Information System (RMIS, version 2.0) is being developed by the EC-Joint Research Centre (JRC), and intends to become the reference web-based knowledge platform for non-energy, non-food materials. It responds to a specific action of the EU Circular Economy, and will be based on the 2015 RMIS version (JRC, 2015), but with a much more ambitious scope.

The RMIS 2.0 shall have a stronger focus on providing material-specific, and quantitative and spatio-temporal data and information. This includes extensive content (Fig. 1, left) related to the entire raw materials value chain from reference data providers (Fig. 1, right). It will also include dynamic applications to visualize material supply chains and material and country factsheets, as well as the content of the Raw Materials Scoreboard, and that of the assessment of materials critical to the EU (EC, 2014), etc. In addition to satisfying the knowledge needs for the EU raw materials policy support, the RMIS 2.0 shall target a wide range of stakeholders including the extractive and manufacturing industry, trade sector, material scientists, economists, academia and education, and other decision makers.

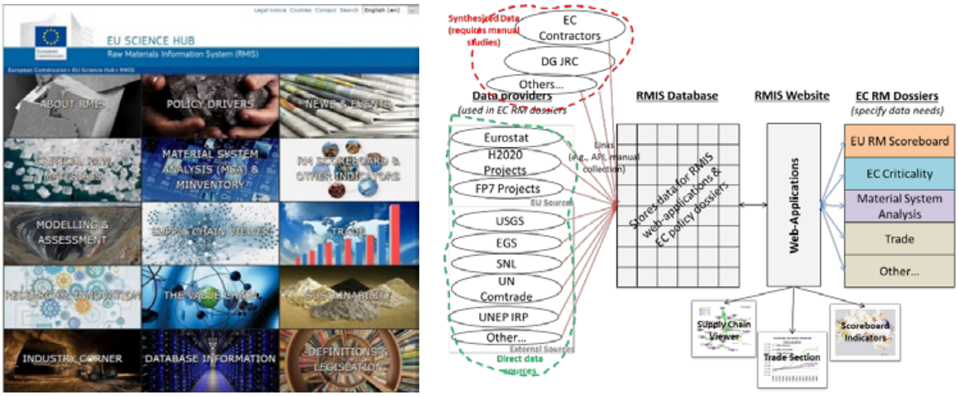

Fig. 1 *RMIS 2.0 content overview (left) and schematic figure of links to RMIS data providers (right).*

The **EU Raw Materials Scoreboard** is a cornerstone of the EU's knowledge base on raw materials. It is developed by DG GROWTH and the JRC, as initiative of the European Innovation Partnership (EIP) on Raw Materials, which implements the RMI. The Scoreboard presents relevant and reliable, quantitative data that follow up on the challenges related to the EU raw materials sector at macro-level (e.g. mining activity and exploration, importance of raw materials to the economy, sustainability of production, etc.). The Scoreboard, first published in 2016 (EC, 2016; Fig. 2), will be updated every two years, and is developed in close interaction with an *ad hoc* working group of public and private stakeholders and policy makers.

The ongoing update for year 2018 will include the widening of specific analysis. In particular, it shall present quantitative data to monitor the use of water by the industry, an essen-

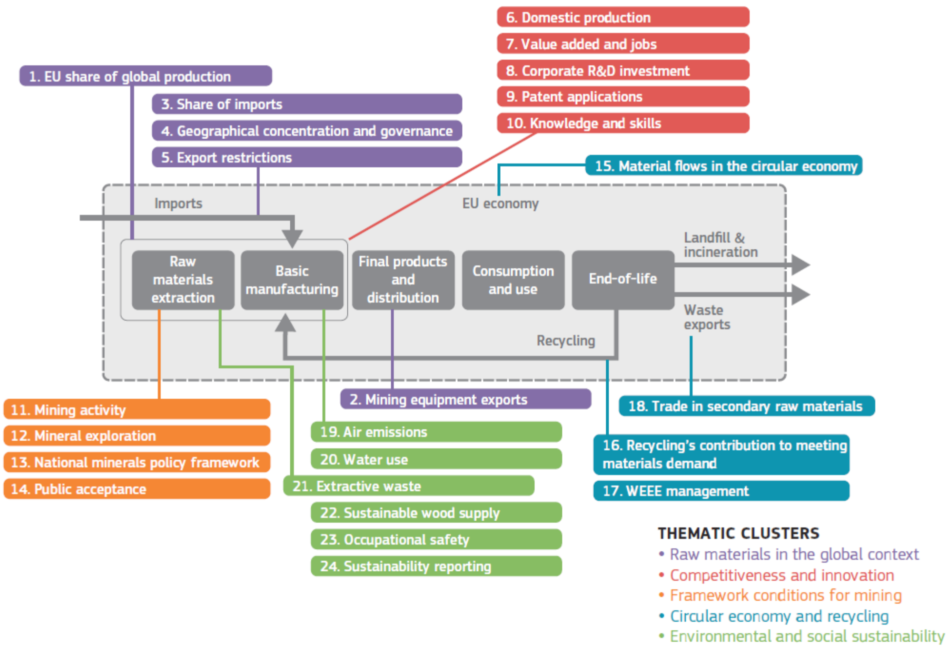

Fig. 2 *Overview of the 2016 Raw Materials Scoreboard content.*

tial and complex topic which was missing in the first version due to the lack of data fitting the Scoreboard requirements. The analysis shall provide a comparison of water use across countries and economic sectors, and over time.

Raw materials production: water use and impact on water

Water is an essential production factor for raw materials production, being used in multiple ways, from ore processing to dust suppression, cooling processes and as material input for industrial processes. On the other hand, water from de-watering of mine spaces often contributes to local infrastructure development and potable water supply; and renewable energy can be produced from water flooded into closed underground mines.

Although the mining and processing industries are relatively small water consumers, some of them are among the most water-intense economic activities (OECD/Eurostat, 2010), and can have a significant relevance on the local water balance regarding both quantity and quality. Water extraction by the sector might drop groundwater levels and change groundwater flow patterns – yet recovery to original conditions upon termination is observed in most cases.

Mining might also have negative impacts on surface and groundwater quality either by the emissions from chemicals used during mineral processing, operational exhausts from fuels, lubricants, etc., or the oxidation products of the exposed mineral deposits themselves.

Safeguarding water is specifically mentioned in the EU industry regulation and policy drivers. First, the deployment of the Industrial Emissions Directive (2010/75/EU), which covers the largest installations producing metals and minerals, and requires the adoption of the so-called Best Available Techniques (BATs), has contributed to the improvement of water performance in the EU. BATs, specified in the BREFs (BATs reference documents), which are further promoted by the Circular Economy Action Plan, provide also standards for water use and water discharges of industrial processes. Several BREFs have been adopted by the EC, e.g. iron and steel (EC, 2012) and mining waste (EC, 2009). In addition, the mining waste directive (2006/21/EC) establishes requirements to promote safe operating sites (during exploration and operation, and after closure) which prevent/minimise leachate and water contamination, and also refers to the adoption of BAT technologies. Thus, the prevention and control of surface and groundwater contamination has become an important component of mine operation and closure.

Apart from the impact of the regulation on the water use and protection at mining sites, increasing water costs and limited water resources availability in e.g. dry environments have fostered the adoption of water saving technologies, e.g. wastewater reuse and recycling.

However, challenges persist. The potential of modern and old abandoned sites to pollute water can be high. Also, in a context of climate change, availability of water resources might threaten future mining water supply needs. Decreasing ore grades, which the subsequent increase of water demand, might further challenge improvements in mining water performance.

In this context, it becomes essential to count on sound data to monitor the EU sector water performance from both a quantitative and qualitative point of view. However, availability of industry water accounting data and official, comparable data records is limited. For instance, no data were found for a fair and accurate comparison of water use in the raw materials sector that could be presented in the 2016 Raw Materials Scoreboard. This is partly due to the fact that the assessment of water use is very complex. First, water use is very industry-specific, and it rather differs among operation sites. For instance, the extraction of precious metals, or the manufacturing of iron, steel, and paper are typically water-intensive activities. While the manufacturing of wood and non-metallic minerals are usually less demanding. Then, water supply and distribution networks are complex, often with both public authorities and private stakeholders involved. Water use is also very country-specific, with heterogeneous water availability conditions, and with different regulatory frameworks for water pricing, environmental fees, scarcity issues, etc., which differently drive changes in water use efficiency. Particularly challenging is the sound assessment of water use by mining activities, where water use and water production, which can be used to cover self and other sectors' demand, often co-exits (INE, 2013); where water consumption might strongly differ from water withdrawal and where several water sources with different quality levels might be used.

Methods

We underwent an assessment of available water-related data to improve the EU knowledge base, which included data provided at EU national or sub-national level on water withdrawals, water use, water consumption, water intensity and water discharges. The scope covered the extraction and processing of non-food, non-energy raw materials. We first revisited the sources listed for potential future use in the 2016 Scoreboard (EC, 2016) and contacted experts on the diverse approaches. Based on that, we expanded the review of scientific and grey literature.

Results

This study identified valuable data sources which provide estimates following different methodologies, scales of analysis and water aspects (Tab.1).

Tab. 1 *Overview of the most valuable data sources identified.*

Option	Description	Indicators	Coverage
Eurostat	Harmonizes data by EU country and sector following Eurostat/ OCDE (2010). Those are also used to estimate water intensity (related to the economic output). Poor data completeness.	Water withdrawal, water use and wastewater dis-charges.	- Countries: EU-28+ - Time: 1970-2014 - Sectors: B, C24 (only water use)
Member State data (competent authorities and state agencies identified by Reynaud et al. 2016)	Data obtained directly from the EU Member States, generally more detailed and complete than those reported to Eurostat. No harmonization among countries, and in some cases indicators and methodologies differ. Data can be based on industry surveys or even measurements (from e.g. withdrawal permits, etc), but in most cases estimated from e.g. production volume.	Water withdrawal, water supply or water use (varying among countries).	- Countries: AU, BG, HR, DK, EE, DE, MT, PL, ES - Time: Ranging from 1991 and 2015 (varying among countries) - Sectors: B, B07, B08, C16, C17, C23, C24 (varying among countries)
Industry water disclosures	Water data from industry disclosures such as the Global Reporting Initiative (GRI) and CDP water (which comes from the Climate Disclosures Project). GRI data has been used in several studies of water embodied in mineral commodities (e.g. Northey et al. 2013).	Water withdrawal by source, water discharge by quality and destination, water recycled and reused, and in some cases water intensity (GRI); water intensity (CDP).	- Countries: worldwide - Time: 1999-2015 (GRI); 2010-2017 (CDP water) - Sectors: construction materials, forest and paper products, metals products, mining

Life Cycle Assessment (LCA)	It considers not only direct water use onsite but all water used along the production chain (from extraction to transport, smelting, refining, etc). While focussing on the analysis of potential impacts of end-use products, it can also provide water estimates for commodities production.	Water inflows (water intake from different sources), pollutant and wastewater discharges.	- Countries: data from production process in specific countries (e.g. US, Switzerland, etc) - Time: specific reference years - Sectors: broad set of commodities
EE-IO (e.g EXIOBASE)	They follow the flows of materials through the economy and estimate the inputs to production (e.g. water) as well as emissions associated to the production of a given sector, accounting also, as LCA does, for all the upstream value chains.	Water withdrawal, water consumption.	- Countries: EU-28 plus broad non-EU country coverage - Time: 1995-2011 - Sectors: minerals and metals mining and production, metals re-processing
European Pollutant Release and Transfer Register (E-PRTR)	Europe-wide register that provides data on emissions of a complete set of substances to water of a relevant share of EU industrial facilities. Limited data completeness.	Emission of pollutants to water.	- Countries: EU-28 + - Time: 2007-2016 -Sectors: all NACE

Water indicators: Water withdrawal=water removed from any source, either permanently or temporarily. Mine water and drainage water are included. Water use=water actually used by end users, excluding returned water. Water consumption=water use minus water discharged. Water intensity=water withdrawal or water use related to the output of the sector. Water discharges=water discharged after being used in, or produced by, industrial production processes (cooling water and surface runoff is excluded). **Countries**: BG=Bulgaria, DE=Germany, DK=Denmark, EE=Estonia, ES=Spain, PL=Poland. EU-28+=EU-28 plus other European countries (e.g. Norway, Serbia or Switzerland). **Sectors** (following the NACE Rev.2 classification): B=mining and quarrying, B07=mining of metal ores, B08=other mining and quarrying, C16=manufacture of wood and wood products, C17=manufacture of paper and paper products, C23=manufacture of non-metallic minerals and C24=manufacture of basic metals.

EU countries official statistics on water use by sector resulted the most comprehensive data source to monitor trends over time and across countries and sectors. However, country and mining activities' coverage were limited, and data harmonization among countries lacked. According to these data, focusing on the German dataset (Fig. 3, left), it can be noticed that total volumes of water used by the raw materials sector have been decreasing overall (yet patterns and trends are very heterogeneous when compared to other countries). Besides, significant decreasing trends in water intensity (Fig. 3, right) have been observed for basic metals manufacturing, while mining (including also energy carriers) showed increasing trends.

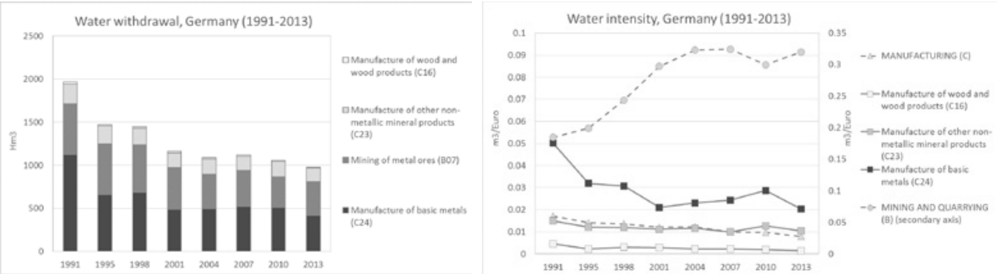

Fig. 3 *Water withdrawal (left) and water intensity (right) by economic sector in Germany (Environmental-economic accounting, Destatis – Federal Statistical Office of Germany).*

As for the remaining data sources, while Eurostat provided data by sector harmonized among countries, data completeness was poor. Data disclosed by mining industries had been increasing but still they were heterogeneously reported. LCA data did not allow for an analysis over time and cross-country comparison, and water estimates from EE-IO tables showed high levels of uncertainty since they are based on models with little source data. E-PRTR, covered pollutants discharged to water for a significant share of the industry, yet it did not provide data on pollutant concentration on water discharges and data completeness was often limited.

Discussion and conclusion

The data sources identified may contribute to developing the EU knowledge base related to water use in raw materials production. However, data sources were limited and heterogeneous. While more complete facility-scale data might be available (not easily accessible) at local or regional level, national and EU accounts that provide comprehensive data to monitor sectors and countries were limited, and very often provided with a high level of aggregation, which often did neither allow to discriminate non-energy mining activities, nor comparing primary and secondary (e.g. recycling) raw materials production. This information could be very relevant for the monitoring of the impact of the Circular Economy Action Plan deployment. The high level of aggregation might also hide trends in specific industries (e.g. cement, aluminium, iron and steel, etc.) and processes inside, providing a limited basis for understanding the underlying drivers.

Data on water use coming from national authorities and agencies was found the most valuable source for our scope. However, conclusions based on them should be drawn with caution due to limited comparability among countries, and since, the full coverage of the EU countries was not ensured.

Complete datasets on contaminated water were much more limited. It is also important to bear in mind that leakages from dams or mining sites run off was not covered by the identified data.

This example on the search for suitable data for water for the RMIS and the Raw Materials Scoreboard illustrates some of the challenges faced to provide sound data to policy making that allows meaningful assessments.

Acknowledgements

The authors thank the experts interviewed during this study, who provided very valuable insight into the water-related data presented here: Arnaud Reynaud, Jeroen Bernhard, and Alberto Pistocchi (JRC Water and Marines Resources Unit); Stephan Pfister (ETH Zürich), Stefan Giljum (WU Vienna); Alexis Morgan and Susanne Schmitt (WWF), Elisa Vargas (DG Env), and Kevin Harding (Wits University). This work has been financed by the Administrative Arrangement SI2.738536 between DG GROWTH and DG JRC.

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