European Commission

SCIENCE FOR POLICY BRIEF

RMIS Roadmap 2024

Raw Materials Information System (RMIS): current status & 2024 roadmap

HIGHLIGHTS: foreseen actions

- → Support enhanced analyses (including foresight) related to the EU's raw materials supply risk for especially critical & strategic materials – providing prompt responses to the rapidly changing geo-political context.
- → Increase knowledge related to advanced materials and their use in EU's strategic sectors and technologies, taking into consideration current and future demand.
- → Revamp the existing country profiles in RMIS including for selected non-EU countries to further support international partnerships.
- → Further develop existing raw materials' profiles in RMIS to better cover aspects related to e.g. resources & reserves, use, trade, recycling.
- → Enhance existing knowledge related to environmental and social sustainability, including in relation to the Environmental Footprint (PEF) method.
- → Ensure more extensive coverage of key outputs from EU projects on raw materials, e.g. in relation to Horizon Europe projects.
- → Through a range of targeted actions (e.g., workshops, seminars, meetings, reports, newsletters), further strengthen networking & collaboration with key stakeholders to ensure better coherence, quality and accessibility of RMIS knowledge products. Stakeholders includes EC/EU services, geological surveys, leading EU and extra-EU entities and groups.

QUICK GUIDE - The *EC's Raw Materials Information System (RMIS)* is a commitment in the 2015 Circular Economy Action Plan, led and maintained by the JRC. Its latest version (the so-called RMIS 3.0, released in March 2023), introduces major upgrades in terms of web-layout, visual interface and improved search functions.

RMIS covers the entire value chains of raw materials (mostly metals and minerals from primary and secondary sources) and takes into consideration the materials' full life cycle. It provides knowledge on raw materials and associated value chains in the context of sustainability, including supply risks and circularity.

RMIS plays an important role in facilitating knowledge needs identified by EU policy on raw materials, such as the recent *Critical Raw Materials Act (CRMA)*, especially in relations to the Act's chapter 2 (list of critical and strategic materials), chapter 4 (supply risk monitoring and mitigation), chapter 5 (circularity and environmental footprint), chapter 6 (strategic partnerships) and chapter 7 (governance).

Joint Research Centre

1. RMIS SPECIFIC OBJECTIVES & FOCUS AREAS

RMIS acts as a vital interface between European stakeholders and the EU-level policy community. It facilitates the availability, coherence and quality of key data & knowledge. Specific objectives include the support of:

- Existing and emerging priority needs identified by the EC, such as in relation to critical and strategic raw materials (and their value chains), as well as with regards to advanced materials;
- Prompt responses to emerging knowledge needs arising from, for example, the fast-changing geopolitical context, such as in relation to the increased supply risk arising from the short/long-term consequences of the invasion of Ukraine by Russia;
- Identification of areas where further research and investment is needed through foresight analyses on supply and demand;
- Coordinated knowledge dissemination through technical reports, briefs, the biannual RMIS Newsletter and the yearly RMIS Workshop.

Fulfilling these objectives requires a solid network within the EC, with Member States, industry associations, research projects (such as Horizon projects), as well as with other key European and international knowledge providers.

RMIS covers – in an integrated and impactful manner – a broad range of thematic areas, including: policy & legislation; sectorial and technology demand; supply risk and autonomy; criticality and resilience; circular economy and secondary raw materials; economic and trade-related analyses; material flow analyses, environmental and social sustainability. These are addressed in a foresight as well as retroactive manner.

Knowledge can be accessed by material, sector/technology, and country as well as by thematic area.

RMIS currently includes: nearly 100 *raw materials' profiles* (including for critical and strategic raw materials); country profiles for all 27 *EU Member States* and various *extra-EU* regions such as for African, Latin American and Caribbean countries; *trade-related country profiles* for key EU trade partners as well as information on demand for selected *sectors and technologies*: renewable energy, batteries, vehicles, electronic and electrical equipment – among others.

Box 1: The CRM Act

In March 2023, the EC proposed the Critical Raw Materials Act. The Act was officially adopted in November of the same year. This Act emphasises specific groups of materials that the EC considers fundamental for sustainable, circular and solid societal development. These include not only Critical Raw Materials (CRM), but also Strategic and Advanced materials. The Act highlights – among others – the necessity for knowledge in relation to CRM demand, as well as supply associated with value chains, supply risks, foresight, circularity, substitution, sustainability and the Product Environmental Footprint (PEF).

2. KNOWLEDGE NEEDS & PROVIDERS

In order to facilitate a secure, circular and sustainable supply of raw materials, the EU requires comprehensive knowledge related to entire raw materials value chains, comprising exploration, extraction, processing, refining, production, use, and end-of-life options. Knowledge needs relate to both high-quality data and information. Fulfilling identified knowledge needs is critical to support factual decision- and policy-making in the field of raw materials.

Knowledge is also increasingly needed in terms of foresight/predictive analyses related to emerging issues, such as supply risk forecasts related to the rapidly changing geopolitical context, and concerning emerging strategic sectors (e.g. e-mobility, renewables, ICT, aerospace & defence) and technologies (e.g. batteries, fuel cells, wind turbines, solar photovoltaics, heat pumps). The CRM Act equally points out knowledge needs related to CRM substitution and foresees the need to reinforce monitoring and stress-tests.

RMIS attempts to support knowledge needs identified by the Commission by establishing synergies and knowledge exchanges across its broad stakeholder network. Such a network includes a wide variety of identified knowledge providers, e.g.:

- Documents and studies from the JRC and various EC Directorates (GROW, TRADE, ENV, INTPA, RTD, DEFIS, ESTAT), such as the *2023 list of Critical and Strategic materials*, the *2023 Foresight study* on "Supply chain analysis and material demand forecast in strategic technologies and sectors" – as well European Agencies (e.g. HaDEA and EEA);
- EU-funded projects, in particular projects under the Horizon Europe scheme working closely with the DG RTD and with HaDEA;
- European and Member State level institutions providing data at European level (e.g., EIT RawMaterials, OFREMI, DERA, EuroGeoSurveys (EGS), Bureau de Recherches Geologiques et Minieres (BRGM)) and with support of the national/regional geological surveys, and other relevant entities collecting raw materials related data and information;
- Stakeholders along the value chain, e.g. industry associations, companies, research institutes, research programs;
- Non-EU country entities, e.g. the United States Geological Survey (USGS), US COMTRADE;
- International bodies (e.g. UNEP International Resource Panel (IRP), OECD, UNECE);
- Commercial services (e.g. SNL).

Representatives from these organisations and entities are active part of the broad RMIS Knowledge Network. Equally, the RMIS increasingly feeds into these organisations and their activities; creating mutually beneficial interactions.

In addition to bilateral discussions, the yearly RMIS workshop continues the well-established dialogue amongst key stakeholders. The event aims at identifying most relevant knowledge outputs, with a particular emphasis on EU-level projects that can help fulfil key knowledge needs. It also aims at facilitating the integration of such outputs into the RMIS, as well as towards increasing their visibility and relevance for policy support.

A specific section in RMIS gives access to a general overview of 40+ *European projects* and links to the projects' specific web resources. In addition, results from many of these projects are further elaborated and used to develop content for RMIS, such as the apps on *battery value chains* and *raw materials in vehicles*.

Box 2: Moving towards Artificial Intelligence

Modern cutting-edge Artificial Intelligence (AI) has proven highly successful in many applications such as intelligent automation, pattern recognition, generating creative content or predicting complex trends. AI technologies, particularly natural language processing, computer vision, Boltzmann machines and recurrent neural networks are now capable of achieving unprecedented results, surpassing both human and classical computing abilities.

In *A European approach to artificial intelligence* the European Commission states that "the way we approach AI will define the world we live in the future" and "fostering excellence in AI will strengthen Europe's potential to compete globally". RMIS is subsequently seeking to grasp this game-changing opportunity and enhance its knowledge and analytical capabilities by leveraging the power of AI, thereby expanding into this new dimension of technology.

The RMIS team is exploring feasible methods for implementing the latest advancements in AI to the domain of raw materials. The implementation of AI technology for predictive analysis in the areas of raw materials value chains, raw materials economics forecasts and circular economy optimisations is currently being envisioned. RMIS will further conduct analysis of additional raw materials related areas to identify opportunities for AI integration.

3. 2024 DEVELOPMENT OUTLOOK

3.1 Raw Materials' Profiles

Knowledge on individual raw materials in relation to security-of-supply and sustainability for a range of policy and community interests. *Raw Materials' profiles* in RMIS provide quantitative summaries at EU-level of a wide range of indicators and relevant aspects for nearly 100 materials, including critical and strategic ones.

RMIS profiles complement the "*Critical and Strategic raw materials factsheets*" that are associated to the *triennial list of CRMs for the EU* and other key sources of information such as *Material Flow/System Analyses*.

They also facilitate knowledge needs identified in the CRM Act, in relation to supply risk/monitoring and circular/sustainable use of critical and strategic materials and in relation to CRM substitution.

Once entered the material-specific profile, a dashboard is provided. It gives an overview of 20+ indicators covering aspects related to reserves, production, EU trade, recycling, use, as well as sustainability.

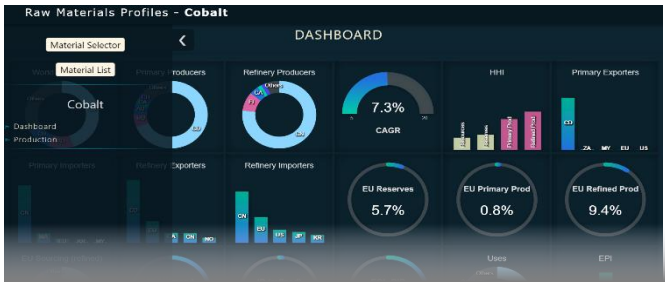
In addition to the dashboard, a module on "Production" covers long production trends and insights for mining/extraction and processed/refined products for each raw material. Methodological notes associated to each indicator can also be accessed.

In relation to raw materials' profiles, but transversally serving various thematic sections in RMIS, a technical report has been recently published that presents the analysis of trade codes and their correspondence to each raw material and their products according to international and European nomenclatures.

Upcoming actions:

- Development of a new module on resources & reserves;
- Development of a new module on recycling indicators;
- Development of a new module on trade;
- Development of a new module on applications and demand for each raw material;
- Complementing and linking to existing knowledge provided by the *Energy and Industry Geography Lab (EIGL)*, development of the database and the corresponding GIS-based application with a comprehensive overview of the EU operating sites and installations across the whole value chain for each raw material. Work already done for a series of raw materials (e.g. Al, PGMs) will be extended to additional materials. In the second phase, the module will also present an all-inclusive mapping of mine projects and refining plants planned to operate in the EU for Critical Raw Materials.

Figure 1 – Raw Materials' Profiles – Cobalt

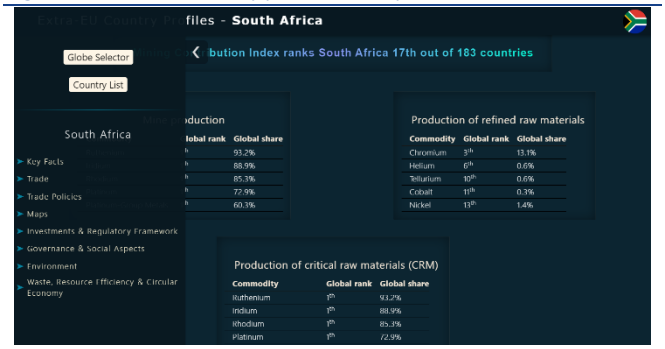


3.2 Country Profiles

Knowledge is essential at EU and country levels, including in the contexts of trade, to facilitate the strengthening of international partnerships and in the rapidly changing geo-political context.

Existing country profiles in RMIS cover *EU27 countries*, as well as many *extra-EU regions* such as the recently released profiles for Latin American & Caribbean (LAC) countries and African countries. These profiles complement and link to other sources of information available at EC-level, such as the overarching JRC's *Africa Knowledge Platform* (AKP) and *trade flows* for 200+ countries – including additional *in-depth trade-related country profiles* for most important EU trade partners.

Figure 2 – Extra-EU country profiles' example – South Africa



Upcoming actions:

In line with the design of recently released extra-EU country profiles, existing EU27 profiles will be re-designed to align their content and layout to most recent web design trends. The architecture will be modular, consisting of modules, namely:

- Quick Facts
- Investment and Regulatory Framework
- Competitiveness
- Trade and Trade Policy
- Circular Economy and Resource Efficiency
- Governance and Social Sustainability
- Environmental Sustainability
- Competitiveness

Each section will have a set of core indicators - available for all country groups - and more in-depth indicators for specific groups of countries (EU and extra-EU country groups). Geographical coverage of RMIS country profiles will be enlarged to cover additional countries and provide better support to existing/future EU partnerships.

Forthcoming country profiles in RMIS will include new aggregation level for the Trade module (e.g. Material level or CRM/Strategic materials, instead of individual trade codes or chapters of the Harmonised System). Additional indicators will also be included (e.g. the four components of the Mining Contribution Index and MFA Sankey diagram at national level (for the EU) and circularity rates). Also, GIS-based maps for mining locations and other environmental indicators (e.g. forest loss, protected and conservation areas, water risk index, flood hazard) will be included.

3.3 Sectors & Technologies Profiles

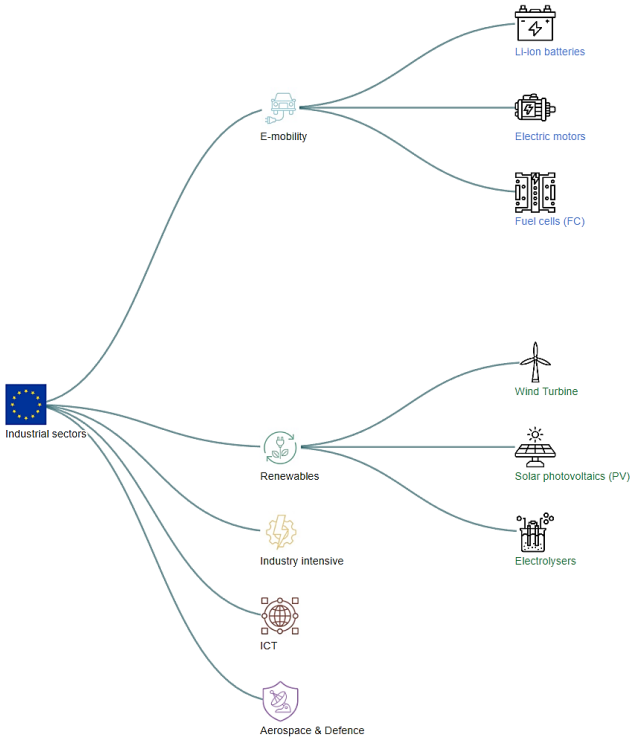
The *Sectors and Technologies Profiles'* page provides a comprehensive overview of the raw materials that are vital to Europe's strategic technologies and industries. Identifying and harnessing these materials is crucial for Europe to enhance its competitiveness and achieve sustainable economic growth.

This section focuses on the materials that drive innovation and contribute to Europe's strategic advantage by conducting a comprehensive review of the following EU sectors:

- Renewables,
- E-mobility,
- the Energy Industry,
- ICT (Information and Communication Technology),
- Aerospace & Defence.

Within these sectors, 15 different technologies are presented and analysed, largely based on various EC studies, such as the *2023 Foresight study* on "Supply chain analysis and material demand forecast in strategic technologies and sectors". These analyses ocus on the supply chain and identify the relevant materials, potential bottlenecks, supply risks, future demand, and circularity aspects (see Figure 3).

Figure 3 – Sector and Technologies profiles' entry point



Upcoming actions:

Planned actions include creating one-page infographics for each technology and sector, which can effectively present key information in a visually appealing and concise manner. Additional sectors and related technologies will also be included, adding to the overall coverage of this section.

3.4 Security and sustainability analyses on EU's raw materials supply

To support knowledge/intelligence needs related to the fast-changing geo-political contexts and to help increase EU competitiveness, analyses (including forward looking) are needed for various value chains in relation to EU security of supply, twin transition, etc.

Towards this end, RMIS already includes a series of *forward looking analyses that depict EU supply risk* in the context of the invasion of Ukraine by Russia. These are conducted for specific raw materials (including potash, titanium, coking coal, rare gases, platinum, palladium) and for specific countries (Russia, Ukraine, Belarus). Analyses have also been conducted for specific sectors and materials based on policy priorities.

Upcoming actions:

While the impact of the ongoing material supply crisis is being largely assessed from an economic perspective, the evaluation of social and environmental effects remains largely uncertain. At the same time, sustainability is essential for the sourcing of materials within the EU and elsewhere, as reflected in e.g. *the EU Principles for sustainable raw materials* and the 2020 CRM Action Plan and the 2023 CRM Act. Analyses of supply, including forecasts, must increasingly account for sustainability as well as security-of-supply risks. Initial forecasts consider implications of shifts in suppliers using e.g. the World Governance Indices, but more in-depth analyses may be justified. Analyses should account for e.g. environmental footprints including in relation to future supply requiring increased processing, wastes, and possibly from existing tailings. These analyses will be conducted in collaboration with the European Environment Agency (EEA).

3.5 RMIS Networking and cooperation

Knowledge in RMIS comes from many sources and organisations. The RMIS team interacts on needs/inputs with policy DGs, Member States and associated bodies, business associations, and key European/international organisations. Initiatives within the JRC will be covered, such as in the context of the JRC's Portfolios that are explicitly supported by RMIS, as well as in connection to e.g. the "Clean Energy Technology Observatory" (CETO) and the "EU Observatory of Critical Technologies".

In a policy context, RMIS and the associated team will continue to interact and support a broad range of activities. This will increasingly include needs foreseen in several policy contexts in relation to the CRM Act proposal.

Box 3: Integration of knowledge from EU-projects into the RMIS – examples

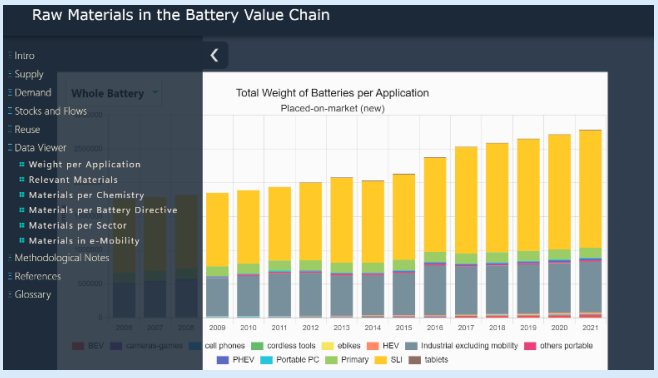
Datasets and information produced from 3rd parties – such as EU funded projects – can be integrated in RMIS in various ways:

- through the RMIS *Raw Materials Knowledge Gateway, which* provides concise overviews of each project,
- or through in-depth pages that delve into specific topics through project outputs (e.g., *Mineral Inventory* by the GeoERA project *Mineral Intelligence for Europe* and *Responsible sourcing in the renewable energy sector* by the RE-SOURCING project),
- or through applications based on databases co-developed with JRC.

An example of the latter option is represented by the apps *Raw Materials in Vehicles* and *Raw Materials in Battery Value Chains*, which are built upon the findings of the Horizon 2020 project "ProSUM", and related published analyses (e.g., *Huisman et al. (2017)* and *Løvik et al. (2021)*).

Forthcoming actions include incorporating the outcomes of the Horizon Europe project "Future Availability of Secondary Raw Materials" (FutuRaM). FutuRaM aims to enrich the knowledge base on secondary raw materials (SRMs) inside the EU, focusing particularly on Critical Raw Materials (CRMs) and their availability and recoverability.

The project's findings will facilitate updates to the datasets of the *Raw Materials in Vehicles* and *Raw Materials in Battery Value Chains* apps, enabling the integration of data related to a new set of secondary raw materials available in strategic value chains, including construction and demolition waste, mining waste, slags and ashes, and WEEE (Waste Electrical and Electronic Equipment).



Upcoming actions:

The team will continue to organise the annual RMIS workshop in the context of EU-level projects, as well as to publish a series of documents such us the biannual RMIS Newsletter and the biennial RMIS Roadmaps, like this one.

Following the increasing interest of EU funded projects in the RMIS, the section *EU funded projects* will be updated and will include new features such as filtering options, and new search functions.

Finally, interactions on knowledge at key events, such as the EC's Raw Materials Week, will remain essential.

Box 4: 2023 RMIS Workshop – November 23rd + 24th

In the context of the revamped RMIS, the 2023 RMIS workshop continued the well-established and essential annual dialogue between the EC, HaDEA, EIT Raw Materials and EU-level projects in relation to outputs and future knowledge developments of mutual interest.

The workshop will brought together key stakeholders and contributors to help identify the most relevant knowledge outputs, with a specific focus on knowledge on critical, strategic and advanced materials.

The workshop aimed to facilitate the integration of such outputs into the RMIS, towards increasing their visibility and relevance for policy and community support, while equally considering the needs of such projects from the RMIS.

Participants discussed:

- How to facilitate technical dialogue (both IT and content-wise) for efficient knowledge transfer;
- How to increase awareness of project outputs and how best these can support identified policy priorities through RMIS;
- How knowledge developed by the EC and its knowledge network support the strengthening of the underlying raw materials knowledge.

4. CONCLUSIONS AND PERSPECTIVES

The EC's Raw Materials Information System (RMIS) is a commitment in the 2015 CEAP and has a key knowledge support role in relation to CRM Act. With respect to non-energy/food raw materials – especially metals and minerals – RMIS facilitates knowledge needs identified by EC policy on raw materials. In particular, RMIS supports the coherent provision of knowledge at EU-level on raw materials and associated value chains in the context of sustainability, supply risk, circularity and governance.

As a result of the continuous interaction with the RMIS knowledge/stakeholders network – and in particular with selected Directorate Generals of the EC – this roadmap defines shared objectives and milestones for RMIS until roughly the end of 2024. This is an important period in relation to the CRM Act implementation as well as many ongoing EC activities.

2024 main foreseen RMIS developments include:

- Further strengthen RMIS networking and collaboration with key stakeholders to ensure better coherence, quality and accessibility of RMIS knowledge outputs.
- Ensure more extensive coverage of key outputs from EU projects on raw materials, e.g. in relation to Horizon Europe projects.
- Enhance forecast analyses, e.g. related to the EU's raw materials supply risk, which provide prompt responses to the rapidly changing geo-political context.
- Increase knowledge related to EU's strategic sectors and technologies, through e.g. inputs to RMIS on current and future demand.
- Expand information on supply from recycling for selected sectors.
- Improve and expand existing country profiles (including for non-EU countries), raw materials' profiles and profiles for strategic sectors and technologies.
- Enhance existing knowledge related to environmental and social sustainability, including in the context of Product Environmental Footprint (PEF).

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