



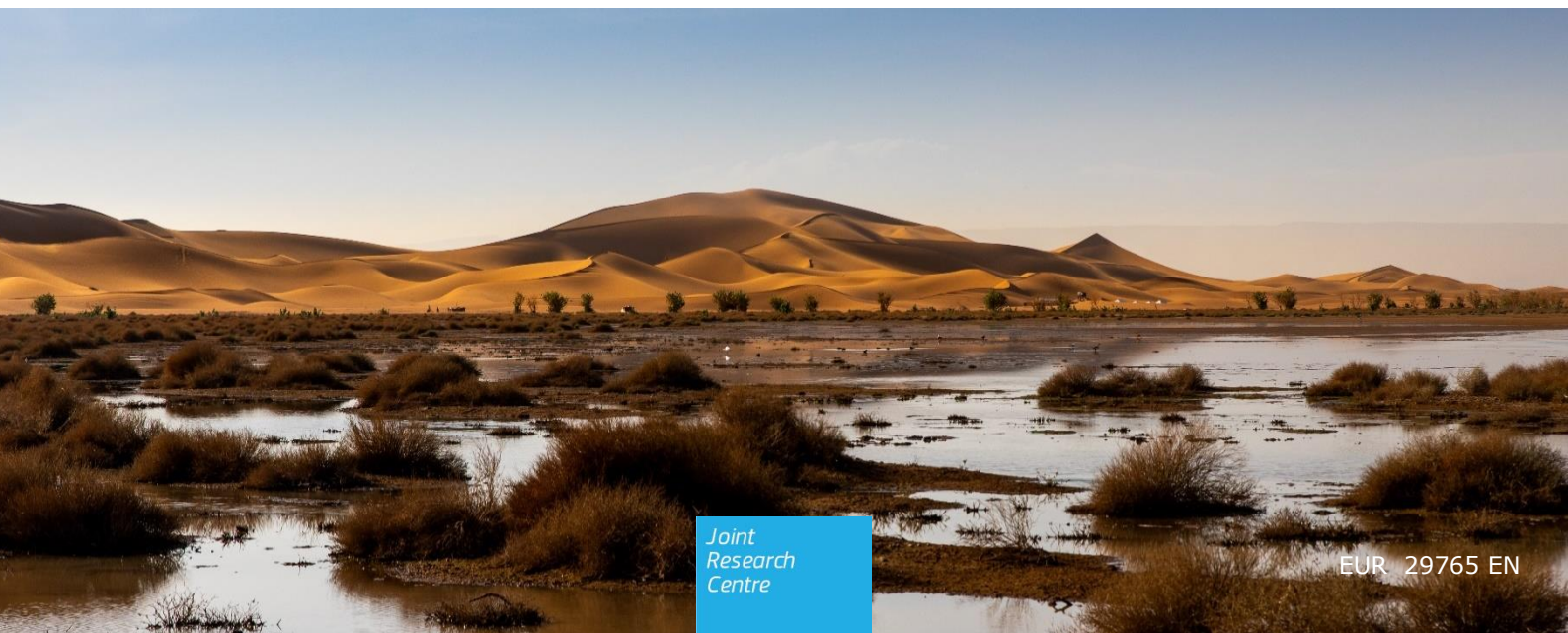
JRC TECHNICAL REPORTS

Raw Materials Information System (RMIS): 2019 Roadmap & Progress Report

Context, content & foreseen priorities

Manfredi, S., Hamor, T., Blengini, G.A., Bonollo, B., Ciupagea, C., Ciuta, T., Eynard, U., Garbossa, E., Georgitzikis, K., Huisman, J., Latunussa, C., Mancini, L., Mathieu, S., Mathieux, F., Nita, V., Pennington, D., Torres de Matos, C., Unguru, M., Vidal Legaz, B., Wittmer, D.

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Contact information

Name: Simone Manfredi
Address: via E. Fermi 2749, 21027 Ispra (Varese), Italy
Email: simone.manfredi@ec.europa.eu
Tel.: +39 0332 78 6046

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Foreword

The Raw Materials Information System (RMIS) is the Commission's reference web-based knowledge platform on non-fuel, non-agriculture raw materials. The first version of the RMIS was released in 2015 as a permanent website under the JRC Science Hub. The markedly upgraded RMIS 2.0 was presented in details in the 2017 "*RMIS Roadmap & Progress Report*".

Two years later, this 2019 "*RMIS Roadmap & Progress Report – Context, content and foreseen priorities*" presents the RMIS in its latest form, highlights the progress made since 2017, identifies most recent policy and knowledge needs related to the European raw materials sectors and provides an overview of the RMIS development goals that could help fill such needs.

Since its conception and first release in 2015, the RMIS has been developed in close cooperation with DG GROW. DG GROW helps the JRC to recognise policy and knowledge needs related to raw materials, and supports the JRC in identifying how the RMIS can best meet these needs. RMIS development is supported by (and should be intended as part of) a well-established and extensive network of knowledge providers in the area of raw materials, which includes – among others – EC-funded projects, European Agencies (EASME, EEA, etc.), academia, European Geological Surveys, industry and business associations. Interactions and knowledge exchanges among the various stakeholders of this network are promoted in the yearly "RMIS Workshop" events, held at the JRC in Ispra, Italy, which attract an increasing number of participants every year.

Acknowledgements

The authors would like to thank all colleagues at DG GROW-C2 for their continuous support in the development of the RMIS and the recognition of the policy and knowledge needs related to raw materials that the RMIS tries to meet.

Authors

Simone Manfredi, Tamas Hamor, Gian Andrea Blengini, Bianca Bonollo, Constantin Ciupagea, Theodor Ciuta, Umberto Eynard, Elisa Garbossa, Konstantinos Georgitzikis, Jaco Huisman, Cynthia Latunussa, Lucia Mancini, Stephanie Mathieu, Fabrice Mathieux, Viorel Nita, David Pennington, Paolo Tecchio, Cristina Torres De Matos, Manuela Unguru, Beatriz Vidal Legaz and Dominic Wittmer.

Summary

The European Commission's (EC) Raw Materials Initiative (RMI) emphasises that raw materials are essential for the sound and sustainable functioning of Europe's industries and, in a broader context, of Europe's economy and society. The EC is committed to promote the competitiveness of industries related to raw materials. These industries play an important role in many downstream sectors in the European Union (EU) such as construction, chemicals, automotive, aerospace, machinery, pharmacy, equipment, renewable energy devices, and defence. These sectors have a combined added-value of around EUR 1,000 billion and provide employment for some 30 million people.

Securing an undistorted supply of raw materials and, in particular, Critical Raw Materials (CRMs) is thus crucial and requires a sound and continuously developed knowledge base, namely the European Union Raw Materials Knowledge Base (EURMKB), as highlighted in the Strategic Implementation Plan (SIP) of the European Innovation Partnership (EIP) on Raw Materials.






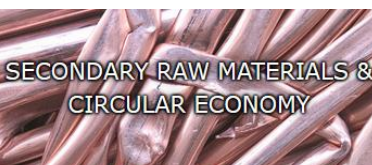

In this context, and responding to a specific action of the 2015 Circular Economy Communication, the JRC is further advancing the EC's Raw Materials Information System (RMIS), which was first released in March 2015. The markedly upgraded second version (hereinafter "RMIS 2.0", or simply "RMIS") was announced in the 2017 JRC *"RMIS Roadmap & Progress Report"* and officially launched during the 2017 "Raw Materials Week", organised by DG GROW in Brussels. RMIS 2.0 broadened goal and scope of the first version, significantly expanded the network of its knowledge providers, and responded – often in quantitative terms – to the latest policy and knowledge needs on raw materials. In particular, important thematic sections such as "raw materials' profiles", "country profiles", "supply chain viewer" and "raw materials knowledge gateway" were included.



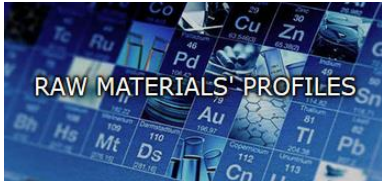

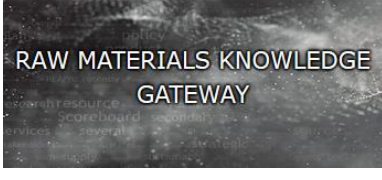
Since its conception and first release in 2015, RMIS has been developed in close cooperation with DG GROW. DG GROW helps the JRC to recognise policy and knowledge needs related to raw materials, and supports the JRC in identifying how RMIS can best meet these needs. RMIS development is supported by (and should be intended as part of) a well-established and extensive network of knowledge providers in the area of raw materials, which includes – among others – EC-funded projects, European Agencies (EASME, EEA, etc.), academia, European Geological Surveys, industry and business associations. Interactions and knowledge exchanges among the various stakeholders of this network are promoted in the yearly "RMIS Workshop" events, held at the JRC in Ispra, Italy, which attracts every year an increasing number of participants.

Today, the RMIS is the EC's reference web-based knowledge platform on non-fuel, non-agriculture raw materials from primary (extracted/harvested) and secondary (recycled/recovered) sources. RMIS responds to the need of strengthening the European Union Raw Materials Knowledge Base (EURMKB) and acts as the core access point to such knowledge and as interface for policy support. The knowledge accessible through RMIS is, to the extent possible, made available for the European Union (from regional, national and EU data), with the ambition of providing it in a harmonized way.

This 2019 *"RMIS Roadmap & Progress Report"* presents RMIS in its latest form, highlights the progress made since 2017, connects this with most recent and relevant policy and knowledge needs on raw materials, and provides an overview of the development goals that could help fulfil such needs (Table 1).

Table 1: Summary of RMIS content in May 2019 and key 2019/2020 development milestones

RMIS main tiles	Current content (as of May 2019)	2019/2020 development milestones
	<ul style="list-style-type: none"> • knowledge needs • news & events • stakeholders • future foresights • funding options 	<ul style="list-style-type: none"> • “terminology” section will be moved to this tile
	<ul style="list-style-type: none"> • european policy • eu legislation • international conventions & initiatives • member states legislation 	<ul style="list-style-type: none"> • Most important content from MIN-GUIDE H2020 project will be added to the MS legislation section
	<ul style="list-style-type: none"> • terminology (glossary) • library 	<ul style="list-style-type: none"> • “Terminology” will be moved to “Overview” • “Library” will become part of “Raw Materials Knowledge Gateway” tile
	<ul style="list-style-type: none"> • what are CRMs • what the EC does • the CRM list • material factsheets • resilience 	<ul style="list-style-type: none"> • Inclusion of the 2020 list of critical raw materials, with circa 80 RM-specific criticality factsheets
	<ul style="list-style-type: none"> • RM Scoreboard: 2016 and 2018 editions and Scoreboard Laboratory • EIP monitoring & evaluation • Circular Economy monitoring • Resource Efficiency Scoreboard 	<ul style="list-style-type: none"> • Update of chapter on the Resource Efficiency Scoreboard • Dynamic application of the next edition of the Raw Materials Scoreboard, whose release is expected at the end of 2020 • Possibly update of the Scoreboard Laboratory, and the EIP monitoring & evaluation
	<ul style="list-style-type: none"> • SRMs in the CE action plan • monitoring SRMs: data, indicators, tools • SRMs in priority areas of the CE AP • SRMs in specific industry sectors 	<ul style="list-style-type: none"> • SRMs in specific industry sectors: an updated listing of H2020 projects related to SRMs will be included • Merging of the Priority areas with the Industry Sectors topics. • Or, a sectoral approach can be presented as a dedicated tile entitled “Raw Materials for Strategic Value Chains”. For (sub)topics, the most visible sector shall initially be the battery/mobility sector data.
	<ul style="list-style-type: none"> • environmental dimension • social dimension • sustainable development goals 	<ul style="list-style-type: none"> • development of chapters on land use, nature protected areas, industrial and natural risks • Possible development of other chapters (best practices, influences to criticality)

		<ul style="list-style-type: none"> • Investigations in view of a possible development of a sustainable sourcing map viewer application that visualizes environmental and social indicators jointly with data on production and trade • Improve the linkages to information at material level
	<ul style="list-style-type: none"> • methodological overview • raw materials trade flows • FDI stocks & flows • pilot country fiches 	<ul style="list-style-type: none"> • Compilation of two separate trade-code lists ("Raw Materials" and "Intermediates and building dedicated databases with data for 2017 • Collection of data and the development of new country-level visualizations for two subsets - "Raw Materials" and "Intermediates"
	<ul style="list-style-type: none"> • supply chain viewer • material flow analysis • material system analysis • batteries value chains • dual use materials 	<ul style="list-style-type: none"> • MFA section will be updated, improved and expanded by the new MSAs • Development of new section on "batteries value chains" • Development of new section on "dual use materials"
	<ul style="list-style-type: none"> • raw materials profiles for 15 materials 	<ul style="list-style-type: none"> • Improvement/expansion of the current structure/content and revision of current 15 profiles • inclusion of circa 20 new profiles
	<ul style="list-style-type: none"> • country profiles for 9 EU countries 	<ul style="list-style-type: none"> • Further development of profiles for the remaining EU countries
	<ul style="list-style-type: none"> • information available for 11 rm-stakeholders and knowledge providers at national and eu levels 	<ul style="list-style-type: none"> • Complete restructuring of the RMKG (towards a more "thematic" focus) • Inclusion of a library with 200+ relevant documents

1 Introduction

1.1 Objectives & structure of this report

Anticipating the launch of version 2.0 of the Raw Materials Information System (RMIS), the 2017 “RMIS Roadmap & Progress Report” provided an overview of the progresses made with the development of the key thematic blocks of the RMIS as of June 2017, as well as the key development milestones foreseen until approximately the end of 2018.

Two years later, this 2019 “RMIS Roadmap & Progress Report” presents RMIS in its latest form, highlights the progress made since 2017, connects this with most recent and relevant policy and knowledge needs and provides an overview of the RMIS development goals that could help fulfil such needs. In particular:

- Chapter 1 “Introduction” provides an overview of the RMIS development background (including its development mandate and the 2015-2018 key development milestones) and of the RMIS goal and scope.
- Chapter 2 “Update on Policy & Knowledge Needs” illustrates the needs identified, for instance, by European raw materials policy that RMIS intends to fulfil, and links such needs to key ongoing and foreseen RMIS development milestones.
- Chapter 3 “RMIS: current structure and key foreseen development steps” goes through each of the RMIS’ 12 main thematic tiles, presents their current content and gives an overview of the identified development priorities.

1.2 Background & context

As stressed in the EU Raw Materials Initiative (RMI) (EC, 2008) and further recognized by the Strategic Implementation Plan of the European Innovation Partnership on raw materials (EIP-SIP) (EC, 2013), raw materials are essential for the sustainable and sound functioning of Europe’s industries (EC, 2008).

In the broad context of the EU’s industrial policy, the European Commission (EC) is committed to promote the competitiveness of industries related to raw materials, represented by non-energy metallic and non-metallic minerals extractive industries, as well as forest-based and manufacturing industries (EC, 2017). These industries play an important role in many downstream sectors in Europe such as construction, chemicals, automotive, defence, aerospace, machinery, equipment, and renewable energy devices. The combined added-value of these sectors reaches EUR 1,000 billion and provides employment for some 30 million people (EC, 2016). Securing undistorted access to raw materials – and, in particular, Critical Raw Materials (CRM) – is crucial to stimulate investment in innovation and new technologies for a European Industrial Renaissance (EC, 2014).

The need for a European Union Raw Materials Knowledge Base (EURMKB) is highlighted in Action area no. II.8 of the 2013 Strategic Implementation Plan (SIP) for the European Innovation Partnership (EIP) on Raw Materials. In addition to the work initiated by DG GROW under the framework of EURMKB¹, and responding to a specific action of the Commission’s Circular Economy Communication (EC, 2015)², the Joint Research Centre (JRC) is continuing to further advance the Raw Materials Information System (RMIS).

¹ European Union Raw Materials Knowledge Base (EURMKB), 2017, http://ec.europa.eu/growth/sectors/raw-materials/specific-interest/knowledge-base/index_en.htm

² European Commission, 2015 Communication from the Commission to the European Parliament, the Council, The European Economic and Social Committee and the Committee of the Regions – Closing the loop: towards a Circular Economy for Europe, COM(2015) 614 final (https://eur-lex.europa.eu/resource.html?uri=cellar:8a8ef5e8-99a0-11e5-b3b7-01aa75ed71a1.0012.02/DOC_1&format=PDF)

The first version of the RMIS (hereinafter "RMIS 1.0") was released in 2015 as a permanent website under the EU Science Hub. The markedly upgraded second version (hereinafter "RMIS 2.0", or simply "RMIS") was announced in the 2017 "*RMIS Roadmap & Progress Report*"³ (Manfredi et al., 2017) and was officially launched during the 2017 "Raw Materials Week" event⁴, organised by DG GROW in Brussels. RMIS 2.0 broadened the goal and scope of RMIS 1.0, significantly expanded the network of its knowledge providers, and responded – often in quantitative terms – to the latest policy and knowledge needs on raw materials. In particular, important thematic sections such as "raw materials' profiles", "country profiles", "supply chain viewer" and "raw materials knowledge gateway" were included.

Further strengthening networking and inflow of knowledge towards RMIS, the EC made it mandatory for Horizon 2020 projects within the call Societal Challenge 5, Raw Materials, 2018-2020 to contribute to the further development of RMIS⁵.

BOX – RMIS development: overview of policy context & key milestones

2008: EU Raw Materials Initiative (RMI)⁶.

2013: Strategic Implementation Plan (SIP)⁷ of European Innovation Partnership (EIP) on raw materials highlights need for European Raw Materials Knowledge Base (EURMKB).

March 2015: JRC launches RMIS 1.0.

December 2015: specific action in Circular Economy Action Plan⁸ focuses on the key role of the RMIS and mandates its further development.

March 2017: 1st International RMIS workshop.

May 2017: RMIS 2.0 Roadmap & Progress report⁹.

November 2017: launch of RMIS 2.0 (as part of the 2017 Raw Materials Week¹⁰).

December 2017: H2020 SC5 2018-2020 shall "contribute to the further development of the EC RMIS".

May 2018: 2nd International RMIS workshop.

June 2018: meeting with selected H2020-SC5 projects to discuss how their work could support RMIS development, organized by the "Executive Agency for Small and Medium sized Enterprises" (EASME), DG GROW and the JRC.

November 2018: during the 2018 Raw Materials Week, the progress made with RMIS development since its launch in 2017 were presented.

June 2019: 3rd International RMIS workshop

³ Available on line at this address:
http://publications.jrc.ec.europa.eu/repository/bitstream/JRC106005/rmis_roadmap_progress_report_-_final_-_final_-_online.pdf

⁴ https://ec.europa.eu/growth/content/raw-materials-week-2017_en

⁵ http://ec.europa.eu/research/participants/data/ref/h2020/wp/2018-2020/main/h2020-wp1820-climate_en.pdf

⁶ <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0699:FIN:en:PDF>

⁷ <https://ec.europa.eu/growth/tools-databases/eip-raw-materials/en/content/strategic-implementation-plan-sip-0>

⁸ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52015DC0614>

⁹ http://publications.jrc.ec.europa.eu/repository/bitstream/JRC106005/rmis_roadmap_progress_report_-_final_-_final_-_online.pdf

¹⁰ <http://eurawmaterialsweek.eu/>

1.3 RMIS goal & scope

The RMIS is the EC's reference web-based knowledge platform on non-fuel, non-agriculture raw materials from primary (extracted/harvested) and secondary (recycled/recovered) sources. The RMIS responds to the need of strengthening the European Union Raw Materials Knowledge Base (EURMKB)¹¹ and acts as the core access point to such knowledge and as interface for policy support. The knowledge accessible through RMIS is, to the extent possible, made available for the European Union (from regional, national and EU data), with the ambition of providing it in a harmonized way.

The RMIS aims at facilitating:

- The availability, coherence, and quality of knowledge required by specific EU raw materials policies and EC services;
- The knowledge needs of the EU criticality assessment¹², the Raw Materials Scoreboard¹³, trade, defence, Circular Economy¹⁴, due diligence/conflict minerals and other raw materials specific policies;
- Access to key raw materials information from the EURMKB¹⁵, within and beyond Europe, which complements the knowledge currently essential for policy support.

Fulfilling these objectives requires establishing networks with Member States' experts and industry associations, but also bilateral agreements with other key European and international knowledge providers. Continuous efforts are being made to strengthen networking, cooperation and knowledge exchange with most relevant stakeholders within and beyond the European raw materials sector.

As presented in this report, key features of the RMIS facilitate the provision of structured knowledge on material flows & stocks, social & environmental sustainability and trade & economic considerations. These contribute to developing e.g. country & material specific profiles that are available in the RMIS.

¹¹ http://ec.europa.eu/growth/sectors/raw-materials/specific-interest/knowledge-base/index_en.htm

¹² http://ec.europa.eu/growth/sectors/raw-materials/specific-interest/critical_en

¹³ <http://rmis.jrc.ec.europa.eu/Scoreboard/>

¹⁴ <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52015DC0614>

¹⁵ http://ec.europa.eu/growth/sectors/raw-materials/specific-interest/knowledge-base/index_en.htm

2 Knowledge needs & providers: an update

In order to facilitate a secure and sustainable supply of raw materials and to better manage resource use, the EU requires – among others – comprehensive knowledge related to entire raw materials value chains, comprising exploration, extraction, processing, refining (including by-product management), production (including product eco-design), use (e.g. consumption), and end-of-life treatment (re-use and recycling, including waste collection, separation, recovery). 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.

The RMIS intends to continue supporting the knowledge needs identified by the Commission in the area of raw materials. Towards this end, RMIS has established extensive synergies with a wide network of knowledge providers. Sub-chapter 2.2 provides an overview of key knowledge providers and, in particular, shows how knowledge from EC-funded projects (such as Horizon 2020) is linked to RMIS and integrated in its thematic tiles.

2.1 Knowledge needs

2.1.1 EU Raw Materials Policy

- Facilitate information and monitoring related to the objectives of the EIP on Raw Materials¹⁶, with a particular emphasis on collection of underlying data and information required for the indicators of the Raw Materials Scoreboard¹⁷.
- In line with the Strategic Implementation Plan (SIP) of the EIP on Raw Materials¹⁸, support information related to the security of supply of raw materials, including advancements in the analysis of raw materials criticality, updates of the list of Critical Raw Materials (CRMs), and related methodology development.
- The RMIS has the role to facilitate the provision of data for policy support needs, with a strong linkage to the criticality assessment exercise in view of the 2020 list of CRMs for the EU.
- Gather and provide information on material stocks and flows in the EU economy and globally for both primary and secondary raw materials, as re-iterated in the Circular Economy Action Plan¹⁹.
- Serving information in the context of the EU regulation on conflict minerals^{20, 21} and its implementation, with regard to mineral resources, production, trade flow and policy on global scale.
- Functioning as the hosting information system to accommodate information and knowledge on raw materials generated in the frame of the H2020 programme Societal Challenge 5, "12. Climate action, environment, resource efficiency and

¹⁶ The European Innovation Partnership (EIP) on Raw Materials is a stakeholder platform that brings together representatives from industry, public services, academia and NGOs <https://ec.europa.eu/growth/tools-databases/eip-raw-materials/en/content/european-innovation-partnership-eip-raw-materials>

¹⁷ <https://publications.europa.eu/en/publication-detail/-/publication/117c8d9b-e3d3-11e8-b690-01aa75ed71a1>

¹⁸ The Strategic Implementation Plan (SIP) is the EIP's action plan <https://ec.europa.eu/growth/tools-databases/eip-raw-materials/en/content/strategic-implementation-plan-sip-0>

¹⁹ <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018DC0029&rid=3>

²⁰ <http://ec.europa.eu/trade/policy/in-focus/conflict-minerals-regulation/regulation-explained/>

²¹ <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017R0821&from=EN>

raw materials”, as published in numerous calls in the Work Programme 2018-2020²².

2.1.2 Raw Materials Trade

- Strong need to build-up knowledge on trade of raw materials, including monitoring of trade flows, tariff and non-tariff measures, trade agreements, and calculation of trade performance indicators.
- Country-specific data and information on trade flows by product cluster (i.e., raw materials, intermediate goods, consumer goods and capital goods) by both value and weight, tariffs and export restrictions; physical and monetary trade balances; trade commitments; foreign direct investments in raw-material relevant sectors; competitiveness indicators.
- Commodity-level data and information, including market analysis with emphasis on market reach of EU producers in the global value chains.
- Analyses of trends in investments and trade in raw materials induced by recent phenomena such as trade measures.
- Information related to due diligence and conflict minerals, as well as on environmental considerations (see 2.1.4).

2.1.3 Material efficiency, stocks & flows, recycling

- Information on circularity, including secondary raw materials inventories, stocks and flows.
- Information, including trends, on raw materials content in selected waste flows, such as WEEE, batteries, end-of-life vehicles and other product categories as well as in mining waste and old landfill sites.
- Expansion and update of existing knowledge on stocks and flows, for example through Materials Flow Analysis (e.g. MSA study).
- Information on recycling potentials and actual recovery rates and quality of battery raw materials.

2.1.4 Social and Environmental Sustainability

- Information is needed to assess the environmental sustainability of raw materials production in the EU and sourced from other regions. RMIS will provide information on the emission of pollutants and greenhouse gases to the environment, the use of resources such as land or water, and the framework environmental conditions (e.g. water scarcity, nature protection areas) in which extractive and processing facilities operate. This should cover, whenever information and data availability allows for that, all relevant raw materials sectors (primary and secondary production, all relevant supply chain stages). The main environmental impacts of the sector, and best practices will be also highlighted.
- Social and environmental considerations are geographically and raw materials-specific. Since possible analyses of these data are countless, RMIS will include an application where country- and material-related information can be assessed “on demand” by the user. In addition, the environmental sustainability section in RMIS will establish clear gateways to sections in the RMIS providing material and

²² http://ec.europa.eu/research/participants/data/ref/h2020/wp/2018-2020/main/h2020-wp1820-climate_en.pdf

country-related information (e.g. raw materials profiles, country profiles) and to relevant external data sources.

- With respect to social considerations related to raw materials, the RMIS has the potential of supporting due diligence and responsible sourcing as it provides a wide range of information on materials sourcing to the EU, country risk (in terms of governance, conflict risk, occupational safety, etc.) and international initiatives on natural resource governance.
- The RMIS content on Sustainable Development Goals (SDGs) responds to the need of mapping the contribution of raw materials production and consumption towards sustainable development, highlighting relevant indicators from the UN and ESTAT frameworks. This preliminary analysis on the relevant goals, targets and indicators can guide companies and policy makers to assess the contribution of their activity to SDGs, and to a first identification of trade-offs and synergies.

2.2 Knowledge providers

2.2.1 Overview

Raw materials' knowledge – in terms of both original and re-processed data and information – is being collected and analysed from various sources and by various stakeholders. Knowledge providers include:

- EU documents and studies, e.g. EURMKB²³, KBA²⁴, MSA²⁵ & Minventory²⁶, Raw Materials Scoreboard²⁷, Criticality analysis²⁸,
- EC-funded projects (such as Horizon 2020 projects), e.g. Minerals4EU, MICA, PROSUM, ERECON / EURARE, CRM_Innonet, ERAMIN, SMART GROUND, SCREEN, INTRAW, New Mine, MINATURA2020, MINLEX, MIN-GUIDE, VERAM, STRADE.²⁹
- Institutions providing data at European level (e.g., EIT Raw Materials, EuroGeoSurveys (EGS), Bureau de Recherches Géologiques et Minières (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.
- EU Member States and their competent entities.
- Non-EU country entities, e.g. the United States Geological Survey - USGS, US COMTRADE.
- EC services such as the JRC³⁰ and DG ESTAT³¹, DG GROWTH³², DG ENV³³, DG TRADE³⁴, DG DEVCO³⁵, EU Agencies (e.g. European Environment Agency (EEA)³⁶, EASME³⁷).

²³ European Union Raw Materials Knowledge Base (EURMKB), 2017, http://ec.europa.eu/growth/sectors/raw-materials/specific-interest/knowledge-base/index_en.htm

²⁴ DG for Internal Market, Industry, Entrepreneurship and SMEs, 2015, KBA - European Raw Material Knowledge Base Architecture, Final Report, Brussels, 322 p.

²⁵ European Commission Raw Material System Analysis, <https://ec.europa.eu/jrc/en/scientific-tool/msa>

²⁶ European Commission, 2016, Minventory, <https://ec.europa.eu/jrc/en/scientific-tool/minventory>

²⁷ European Commission, 2016, Raw Materials Scoreboard, <http://bookshop.europa.eu/en/raw-materials-scoreboard-pbET0215541/>

²⁸ European Commission, 2015, 'Critical Raw Materials', https://ec.europa.eu/growth/sectors/raw-materials/specific-interest/critical_en

²⁹ A comprehensive overview of Horizon 2020 projects relevant in the context of raw materials is provided in the "Bi-annual report, 1st semester 2017" by the Executive Agency for Small and Medium-sized Enterprises (EASME). (Not available on line at the time of writing).

- International bodies (e.g. UNEP Resource Panel, OECD) are also key sources of data and analyses, and commercial services (e.g. SNL).

2.2.2 Examples of integration of H2020 projects' outputs into RMIS

In the Horizon 2020 Work Programme 2018-2020, "12. Climate action, environment, resource efficiency and raw materials" (European Commission Decision C(2018)4708 of 24 July 2018)³⁸, numerous calls in frame of "Greening the economy in line with the Sustainable Development Goals (SDGs)", stress that actions shall contribute to building the EU knowledge base of primary and secondary raw materials for solid decision making, and particularly to the further development of the EC Raw Materials Information System (H2020 SC5 2018-2020).

In general, knowledge exchanges with selected H2020 projects are taking place through four types of information supply:

1. By default, the basic information of selected projects shall be uploaded into the Raw Materials Knowledge Gateway (The "Gateway"). In order to display the information with a uniform logic on the projects, a template is recommended for use (Annex 1).
2. Provision of specific "stand-alone" thematic information (where the project produced outstanding new information on a specific topic/material), as direct additions to RMIS tiles (or sub-sections).
3. Provision of data (original or reprocessed) "typically requiring integration" to tiles such as the Country Profiles, Critical Raw Materials, Raw Materials' Profiles, etc. These contributions can be aligned and integrated in discussion with the JRC on case-by-case basis.
4. Framework support, i.e. projects with significant and sustainable network, and/or at international scale are welcome to provide Knowledge Base support via providing information on events, expert clusters and other types of knowledge base development tools.

Table 2 provides an overview of targeted H2020 projects and the type of connection with RMIS.

Table 2. Overview of targeted H2020 projects and the type of connection with RMIS

<p>Example H2020 projects of interest to RMIS</p>	<p>MIN-GUIDE, ProSUM, BATRe ARES, COLLECTORS, INTRAW, MinLAND, MIREU, ROSEWOOD, STRADE, SCALE, SMART GROUND, VERAM, SCREEN, ORAMA, REPAIR, PANORAMA, CHROMIC, HISER, LEFAPO, MINATURA2020, Platirus, ReCrew, REE Value Chain, REMAGHIC, ROBUST, Smart Exploration, VAMOS, INTERIM, MSP-REFRAM, ImpactPaperRec, CEWASTE, WoodCirus</p>
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³⁰ https://ec.europa.eu/info/departments/joint-research-centre_en

³¹ https://ec.europa.eu/info/departments/eurostat-european-statistics_en

³² https://ec.europa.eu/info/departments/internal-market-industry-entrepreneurship-and-smes_en

³³ https://ec.europa.eu/info/departments/environment_en

³⁴ https://ec.europa.eu/info/departments/trade_en

³⁵ https://ec.europa.eu/info/departments/international-cooperation-and-development_en

³⁶ <https://www.eea.europa.eu/>

³⁷ <https://ec.europa.eu/easme/en>

³⁸ http://ec.europa.eu/research/participants/data/ref/h2020/wp/2018-2020/main/h2020-wp1820-climate_en.pdf

JRC is currently partner of	SCREEN, ORAMA, REPAIR
Projects (partly) integrated in RMIS and/or visible through its <i>Raw Materials Knowledge Gateway</i> (RMKG)	MIN-GUIDE, ProSUM, MICA, ORAMA Forthcoming: FORAM, MinFuture

2.2.3 The way forward

The JRC-led Task 5.2 of the ORAMA project on mapping of the relevant EU funded projects and initiatives³⁹ concluded that there are ca. 500 such projects financed by different EU funds and supervised by a number of EU agencies (EASME, INEA, RFCS, ERC). At the time of mapping no detailed information was publicly available on the 200+ EIT Raw Materials projects, and on the national projects funded by Member States. A subsequent thematic screening of the full H2020 database⁴⁰ by the JRC, and the inclusion of the 100+ EIP SIP commitment groups⁴¹, lead to the conclusion that the overall number of relevant projects can be close to 1000. The current capacity of the RMIS team does not make it feasible to archive and serve all the knowledge generated by these projects. Nevertheless, the RMIS' Thematic Library is a good candidate to host such an enormous volume of information in a structured way, and enables RMIS users to search for the required information in an easy manner.

The annual RMIS workshops are designed to mediate the networking of these projects. In addition, the enhanced co-operation with the managing agencies shall be reinforced, also with the involvement of the policy DG(s) supervising this field.

³⁹ <https://orama-h2020.eu/downloads>

⁴⁰ <https://data.europa.eu/euodp/en/data/dataset/cordisH2020projects>

⁴¹ <https://ec.europa.eu/growth/tools-databases/eip-raw-materials/en/call-commitments>

3 RMIS: current structure, foreseen developments, news & events

This section provides an overview of the current content and structure of the RMIS website⁴², and highlights the foreseen most important development priorities and milestones in the short term (e.g. by the end of 2019) and in the mid/long term (e.g. 2020+). Such priorities and milestones should be sufficiently flexible to allow for adjustments that enable meeting the continuously changing policy and knowledge needs on raw materials.

3.1 Overarching design concepts

The RMIS is an information system related to raw materials in the wider sense. The RMIS structure supports the collection, organization, storage and communication of information on raw materials, and components and products made of them. The RMIS website is the dedicated web-based interface that communicates the RMIS content.

The content and some of the functional elements of the website menu at its different levels are going to correspond implicitly with the major EU policy-related drivers (and their implementing priority actions), such as:

- Raw Material Initiative (RMI),
- European Innovation Partnership on Raw Materials (EIP-RM),
- Resource Efficiency (e.g. EU Resource Efficiency Roadmap),
- Circular Economy, and
- Sustainable Development,
- Common Security and Defence.

Policy documents do have overlapping, synergetic objectives and implementation priorities. On the contrary, potential customers (website users) and stakeholder groups (EU and Member States decision makers, industry representatives, international and domestic investors, academia (research and education entities)) and interested public may have differing interests and foci.

To properly address such differing interests, RMIS established a flexible system architecture (and, thus, data architecture) in order to provide the potential functional links among the website's menu entries, the elements of the policy action areas, the stages of the value chain and the information set modules. This requires the planning to be set in a matrix system with the indication of multiple interlinkages and tagging (labelling or indexing) of the individual elements. This multiple interlinking, by intention, leads to virtual redundancy that helps non-professional visitors finding the information they are interested in.

The front-end layout of the RMIS website is based on a modern semi-flat design. This design helps the visitor understand the content more quickly and logically. Inside this layout, the content elements are displayed using a "tile design" (Figure 1). Individual tiles help distribute information in a visual way so the visitors can easily consume bite-sized pieces of content without being overwhelmed.

Regarding the interaction experience, the website layout adapts the Responsive Web Design (RWD) approach. RWD provides an optimal viewing and interaction experience—easy reading and navigation with a minimum of resizing, panning, and scrolling—across a wide range of devices (desktops, tablets, phones). RWD relies on CSS3 and HTML5 to

⁴² As of May 2019

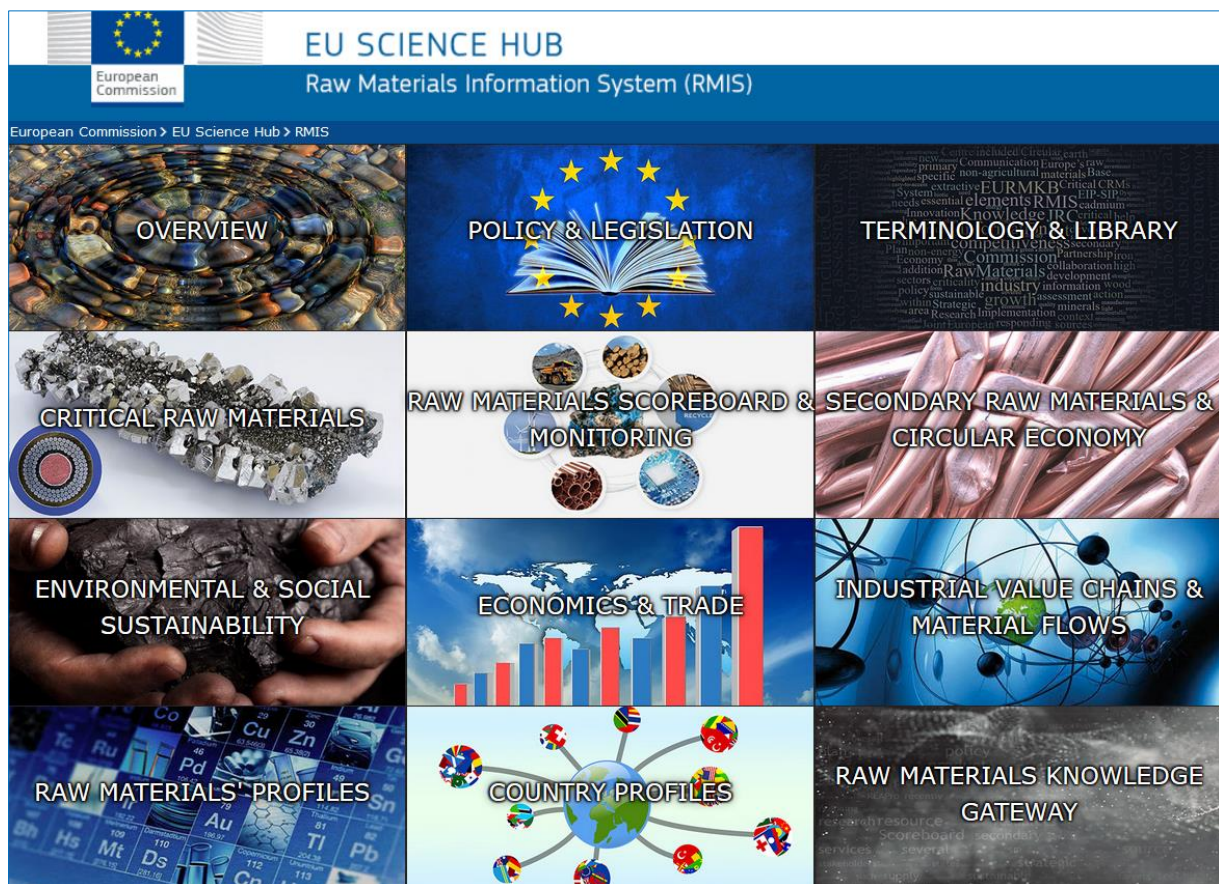
auto resize, hide, shrink, enlarge, or move the content to make it look good on any screen of any device.

3.2 Overarching structure & home-page

The RMIS' home page allows for straightforward and intuitive access to the RMIS' content through twelve (12) overarching thematic tiles (Figure 1). Each of these tiles provides access to RM-knowledge related to a certain main topic. By clicking on a given tile, users access to the second and third menu levels within the tile.

Beyond the third level, the fourth level is the broad set of further pages that are mentioned and hyperlinked internally in the first three menu levels. The following sub-chapters present the content each of the 12 main thematic tiles (as of May 2019) and the foreseen development steps in the short term (by roughly the end of 2019) and in the medium-long term (2020+).

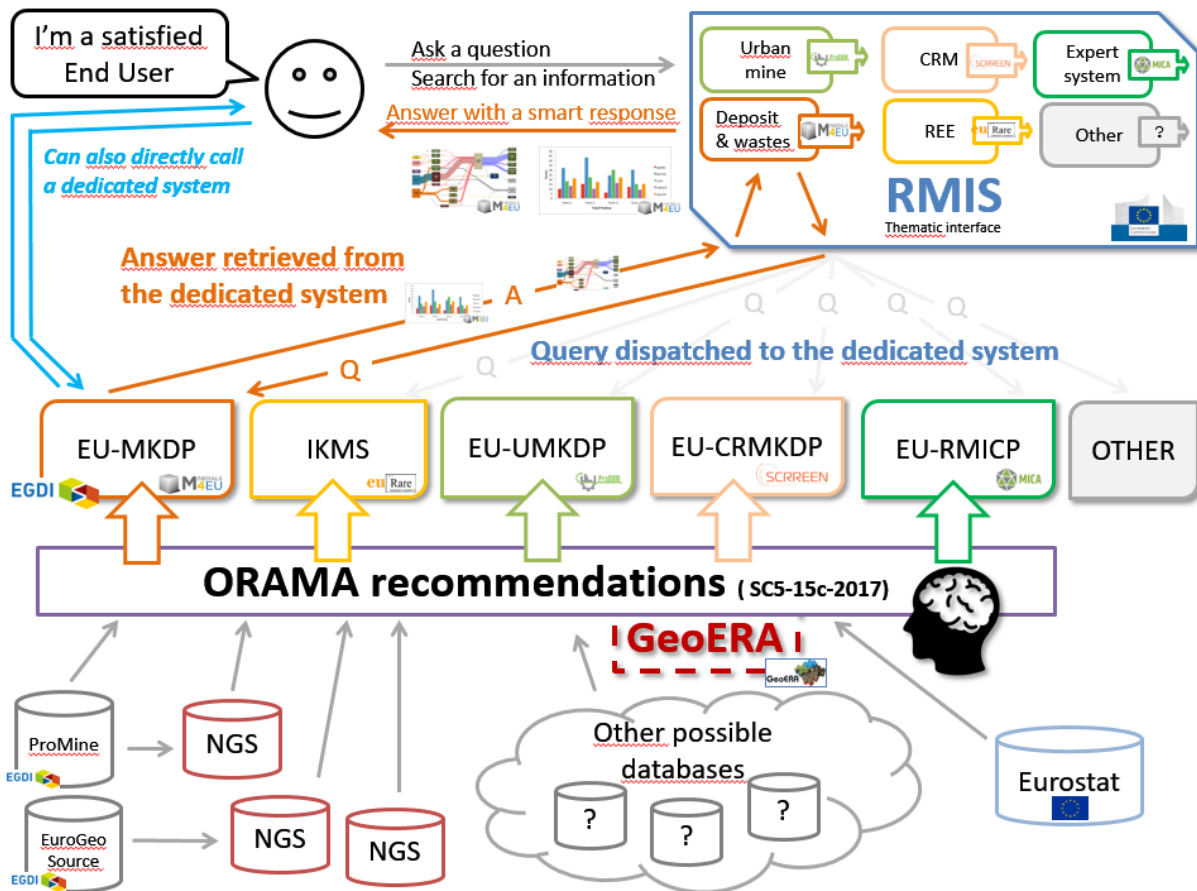
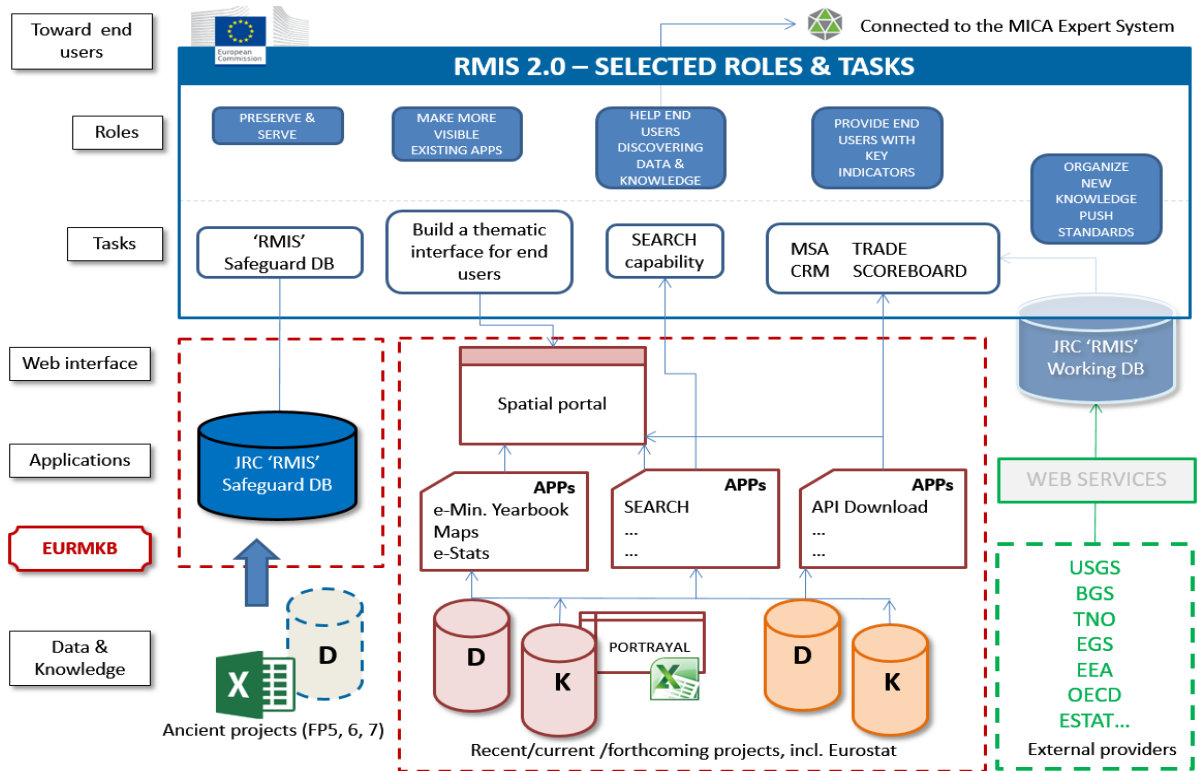
Figure 1. RMIS home page



3.3 RMIS data management & underlying database

The establishment of an RMIS database development started in 2016 in preparation for the launch of RMIS version 2.0 in line with the overall JRC knowledge management strategy (Figure 2). The JRC, in general, does not generate original new data, its primary mission is to collect, organize, structure, interpret data and serve tailor made information and knowledge to Community and Member States decision makers, as well

Figure 3. Schematic figures presenting how the RMIS database links data providers (sources) to the RMIS website (Cassard, 2017; ORAMA, 2018)



In the period of 2016-2018 earlier datasets of the MINVENTORY and MSA projects were migrated to RMIS, and a robust and raw material specific international trade database

was developed covering primary raw minerals and intermediates. The traditional Scoreboard and CRM applications' database modules progressed significantly, and separate datasets were established for the raw materials profiles and the country profiles. The valuable output datasets of the PROSUM project, and the MIN-GUIDE project was imported and planned to be transferred, respectively. In general, there is an emphasis on the preferred use of European data sources. In this regard, further attempts were made to establish a collaboration framework with distinguished entities, such as ESTAT, EGS, EEA, WMD and selected industry associations. The annual RMIS stakeholders workshops are major communication means in this direction.

In 2019, the assessment of the feasibility of linking the above presented database modules has started. Co-operation links to the EIT Raw Materials project PANORAMA were set because it has a high potential of meeting RMIS needs in the fields of materials flows combined with economic and socio-environmental accounting, developing data harmonization standards and correlation tables between major datasets, etc. The development of basic GIS capabilities and functions at RMIS database management and website visualization is also a concern in the short and mid-term. The opening of the direct interfaces, APIs, to the above listed major European databases shall be speeded up in course of 2019 and beyond.

3.4 RMIS' thematic tiles: content & foreseen developments

3.4.1 Overview

Figure 4. The "Overview" tile in RMIS



The "Overview" tile of the RMIS provides an introduction on the policy context, mandate, goal and scope of the RMIS 2.0, as well as a presentation of key knowledge needs (i.e. the knowledge-gaps that the RMIS is expected to fill) through identified knowledge providers (i.e. the groups, projects, organisations that will help gather such knowledge). The "Overview" tile also includes an 'RMIS news & events' section, as well as information on "stakeholders" and industry associations along the raw materials value chain. It also includes knowledge related to the "funding options", intended as a first aid kit for access of funding information.

No major changes are foreseen for this tile in addition to keeping up-to-date its content.

3.4.2 Policy & Legislation

Figure 5. The “Policy & Legislation” tile in RMIS



This thematic tile includes an overview of European policy and legislation on raw materials, as well as of international conventions & initiatives and Member State (MS) level legislation.

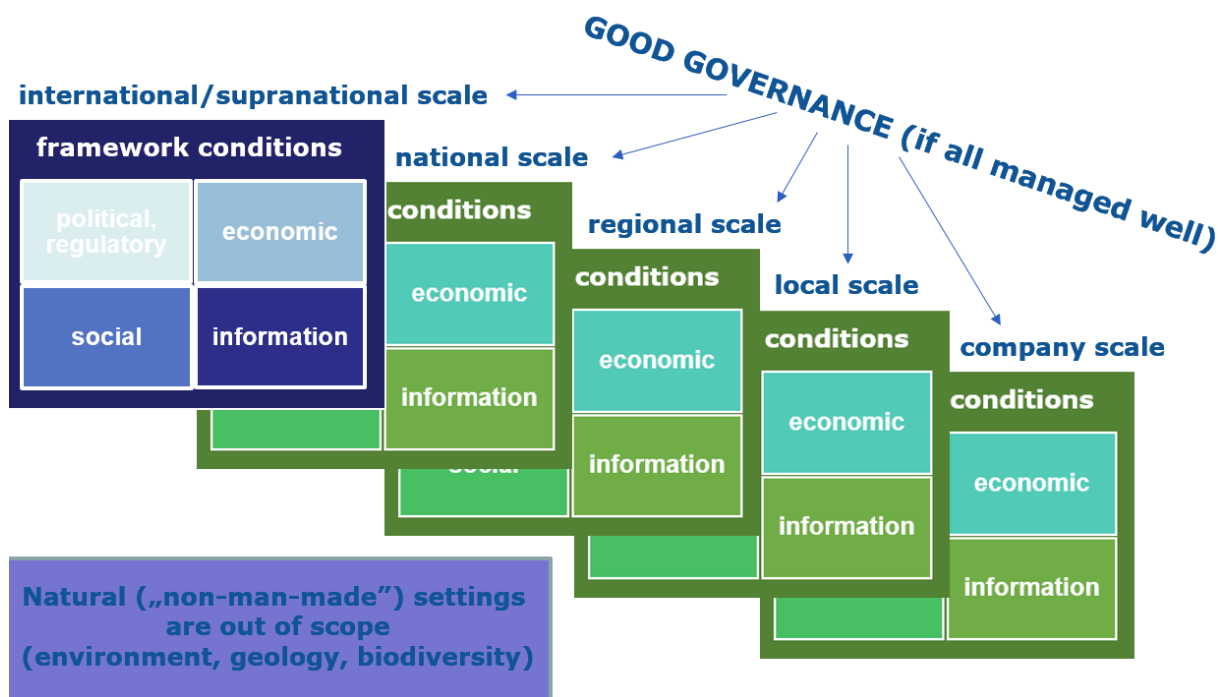
Policy & Legislation is an important segment of a broader concept called “Governance”, or “Good governance” (Figure 6). Sectoral policies and national (federal) legislation have overarching importance and effect on all but the three other components can be also highlighted as core elements of good governance. These are the economics, such as financial instruments (incentives, specific funds, favourable loans, etc.), fiscal tools (tax waiver, smart royalty, trade customs duties, etc.), the overall economic attractiveness (easy company registration, innovative environment, etc.).

The social dimension covers the labour market conditions, occupational health, gender balance, education, elimination of child labour, to mention a few. As a horizontal aspect, the public, open access to information with regard to the above mentioned aspects, as well as to the geological and environmental data, are of crucial importance in the good governance⁴⁵. The natural baseline conditions over which the governance has no supervision is usually considered as out of the scope of the governance. The three other core elements of this concept are presented at other chapters of RMIS, respectively.

⁴⁵ IRP 2019: Mineral Resource Governance in the 21st Century: Gearing extractive industries towards sustainable development. Ayuk, E. T., Pedro, A. M., Ekins, P., Gatune, J., Milligan, B., Oberle B., Christmann, P., Ali, S., Kumar, S. V, Bringezu, S., Acquatella, J., Bernaudat, L., Bodouoglou, C., Brooks, S., Burgii Bonanomi, E., Clement, J., Collins, N., Davis, K., Davy, A., Dawkins, K., Dom, A., Eslamishoar, F., Franks, D., Hamor, T., Jensen, D., Lahiri-Dutt, K., Petersen, I., Sanders, A. R. D. A Report by the International Resource Panel. United Nations Environment Programme, Nairobi, Kenya. 60 p.

<http://www.resourcepanel.org/reports/mineral-resource-governance-21st-century>

Figure 6. The “Good governance”, its major components and scales⁴⁶



During 2019/2020, major foreseen developments include:

- Continuous updates will be carried out of the sub-chapters on EU policies, legislation, documents and international treaties.
- At Member States Legislation the third-level sub-chapter will be re-installed based on the *MINLEX* report (DG GROW & MINPOL, 2017) and its coming updates. A possible cross-link to Country Profiles section shall be provided in order that the user can access to the national reviews via the geographic visualization tool.
- It is also foreseen that most relevant outputs from the Horizon2020 project Min-Guide, namely the content of its online 'mineral policy guide' will be integrated into RMIS. This online guide provides in-depth understanding over national legislation on primary raw materials (country profiles), as well as direct access to most important national legislation documents.

3.4.3 Terminology & Library

Figure 7. The “Terminology & Library” tile in RMIS



⁴⁶ Hámor, T. 2019: Framework conditions in RMIS – 3rd International RMIS workshop presentation, Ispra

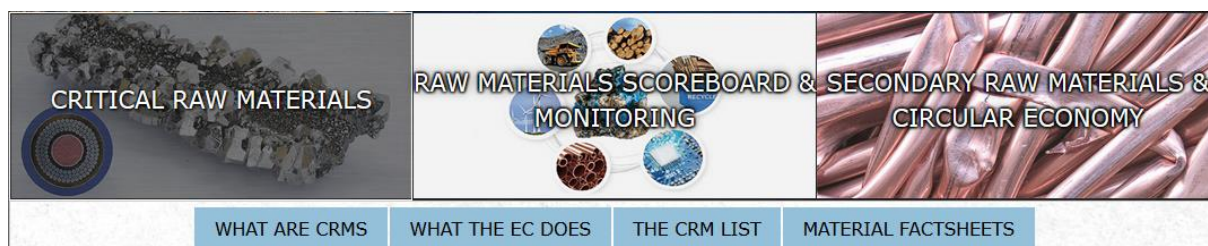
At present, this tile of RMIS includes a 'terminology' section, as well as the first version of the 'RMIS Library', which collects all most important reports and documents that are linked to RMIS and/or relevant in the broader raw materials context. During 2019/2020, major foreseen developments include:

- The legal glossary will be updated with the new entries and changes of the last two years. As a new subchapter, the *Technical Glossary* will be commissioned, a collection of definitions derived from H2020 reports and international sources.
- The Library section will be most likely allocated to the new *Thematic Knowledge Gateway* (as part of the tile 'Raw Materials Knowledge Gateway', subchapter 3.3.12).

Since the sub-chapter on *Harmonization* was already removed in the last year, this chapter is lacking more content. Its future shall be re-assessed also in the context of emerging new priorities at the policy field and the corresponding RMIS functionalities.

3.4.4 Critical Raw Materials

Figure 8. The "Critical Raw Materials" tile in RMIS



The "critical raw materials" tile provides insights on the present and past lists of CRMs for the EU. The CRM section also provides structured and facilitated access to policy relevant and detailed information on critical and non-critical raw materials in the form of factsheets. It furthermore presents information on criticality-related aspects such as resilience and sector-specific analyses.

Various sub-sections within this tile and other inter-linked RMIS sections are targeted to highlight the bi-directional flow of information:

- (1) RMIS as a «showroom» to highlight which are the CRMs in the latest list, the linkage with the previous lists, what the EC does and why;
- (2) RMIS as a source of «pre-digested» information and data to efficiently feed the next criticality assessment, via various sections of RMIS.

During 2020/2021, the following developments are expected:

- A new section will be added for the 2020 list of CRMs for the EU (the criticality assessment will be run by the JRC in 2019). Candidate CRMs are the same 78 raw materials already assessed in 2016 (2017 list of CRMs), plus 5 new candidates. The next list is expected to be published any time in 2020, depending on the political agenda and priorities of the next Commission.
- A new report will be included: Report on the critical raw materials 2020, similar, as appropriate, to the CRM study 2017. This report will contain:
 - 2-3 page executive summary of the main findings and conclusions for the general public with infographics (interactive maps, graphs, charts, tables)

etc.) (to be provided in English, French, German, Italian, Spanish and Polish)

- content and purpose of the report, objectives of the report, importance and challenge of critical raw materials in Europe, criticality assessment approach and methodology, scope & materials covered, data collection and sources, information on data validation/check, stakeholder consultation, criticality assessment outcome and results, proposed list of 2020 Critical Raw Materials, brief comparison with the previous criticality assessment results, key findings of the criticality assessments, limitations of criticality assessments and of the algorithms used, details of any revisions to the methodology for the 2020 assessment, conclusions and recommendations.
 - annexes: overview of EU and international assessments and initiatives on critical raw materials, data sources used in criticality assessments one full example of calculations (to be selected after the stakeholders' workshops), additional details on the criticality assessment results, summary report of the stakeholder validation workshops, key contributors.
 - All screened raw materials factsheets.
-
- The final report and the final version of the raw materials factsheets generated for the 2020 review of the list of CRMs will be transferred into RMIS after the publication of the list of CRMs in 2020.
 - A new section will be added to incorporate an upcoming JRC report focused on forecasts of supply and demand trends of critical raw materials for strategic sectors, including renewable energies, batteries, other aspects of mobility, defense, and space.

This tile of RMIS also provides an overview of the worked planned (2019/2020) related to raw materials **resilience**. The EC communication "For a European Industrial Renaissance" set the target to stop industrial decline and reach a share of 20 % of GDP for manufacturing. The competitiveness of the EU industrial production within a worldwide market is a key condition to maintain a strong global player. A major weakness potentially hampering industrial growth are difficulties to access basic inputs such as raw materials, qualified labour and capital in affordable conditions.

To assess these difficulties, the EC publishes regularly updates on the list of critical raw materials (CRMs). However, the uncertainty when and whether bottlenecks appear requires advanced preparedness in order to minimise the negative impacts on the performance of the supply chain of the industrial sector. In this respect, supply chains do not only need to be efficient and stable, but also be able to recover quickly from potential difficulties (systemic shocks or persistent structural changes) whose incidence cannot be excluded. In other words, the industrial system requires *resilience*.

This section "Resilience and Raw Materials" will provide information on the application of the resilience concept on raw material supply chain issues. Bottlenecks of a secure raw material supply will be identified, serving as basis to develop strategies to cope with and reacting to shocks or persistent structural changes. The approach builds on and connects to the JRC transversal project "JRC work towards a more resilient EU society".

3.4.5 Raw Materials Scoreboard & Monitoring

Figure 9. The “Raw Materials Scoreboard & Monitoring” tile in RMIS



This section includes the entry points to the information contained in the Raw Materials Scoreboard and to the monitoring and evaluation scheme of the EIP on Raw Materials. The Scoreboard is a bi-annual publication, core to the monitoring and evaluation of the EIP on Raw Materials. Both 2016 and 2018 editions of the Raw Materials Scoreboard can be accessed from this tile.

The section also presents the content from other monitoring schemes that relate to the EU raw materials sector (Circular Economy, Resource Efficiency). Figure 9 shows the structure of the section and Figure 10 the structure of the sub-section dedicated to the Raw Materials Scoreboard.

Figure 10. Content of the section 'Raw Materials Scoreboard'



As of May 2019, the following developments have been completed:

- Update of the structure of the whole section (tile, see Figure 9 above) and the sub-section dedicated to the 'Raw Materials Scoreboard' (**Error! Reference source not found.**). Within the latter sub-section, the following content has been developed:
 - Dynamic application of the Raw Materials Scoreboard 2018 (**Figure 11**). The application provides a summarized version of the Scoreboard indicators, classified by thematic cluster, and gives the possibility to download the introductory texts and the full version of the indicators.

3.4.6 Secondary Raw Materials & Circular Economy

Figure 12. The “Secondary Raw Materials & Circular Economy” tile in RMIS



The present version of the RMIS includes four topics related to the Secondary Raw Materials and Circular Economy. They contain qualitative and quantitative information on the following subjects:

- SRMs in the Circular Economy Action plan
- Monitoring of SRMs: Data indicators and tools
- SRMs in Priority areas of the Circular Economy Action plan
- SRMs in specific industry sectors.

Under these four main topics, there are a number of duplicate information links to e.g. H2020 projects, Eurostat data, reports, the CE action plan, critical raw materials. It is considered to re-order this slightly to have a more intuitive access to the relevant information. For example, C&D waste is present in the CE priority areas, whereas the next topic is the SRMs in specific Industry sectors.

To populate the SRM tile further with readily available information, the RMIS network and projects will be contacted. In general, data will be updated and web-links to relevant recent (JRC) publications included.

During 2019/2020 some updates are considered for the following pages:

- SRMs in the CE action plan: No new developments foreseen. It may make sense to add a page on the Strategic Action Plan on Batteries and its implications for battery raw materials here. In addition, new content should be ready to update quickly in case a new CE package is released;
- Monitoring SRMs: The focus of this topic can be improved, in particular for the Recycling Input Rates/ Recycling Output Rates in the MFA section. A stronger connection between the MFA work is possible with better documented recycling rates for specific materials, like the 2019/2020 data for battery raw materials. The hyperlink to the Raw Material Scoreboard should be improved (focusing only on Circular Economy cluster, and probably only on Scoreboard 2018);
- Possibly under this topic a new sub-topic Harmonisation of data is planned: inputs from EC-funded projects like ORAMA, PANORAMA, the COST-MINEA/ UNFC-AR work and others, improved classifications and data models will be proposed here (externally developed, but disseminated here, either with or without implementation comments).
- SRMs in specific industry sectors: an updated listing of H2020 projects related to SRMs will be included. The ORAMA WP5.3 final list of relevant projects will be updated in 2019. A small number of most relevant projects could be approached again to fill in the RMKG template. This obviously has a close link to the RMKG tile.

- It is considered to merge the Priority areas with the Industry Sectors topics. Or, more far reaching: a sectoral approach can be presented as a dedicated tile entitled: "Raw Materials for Strategic Value Chains". For (sub)topics, the most visible sector shall initially be the battery/mobility sector data, which would include a specific application to visualise all battery (secondary) raw materials data from the ProSUM project and from experts of UNU and TUB. The goal is to visualise battery data (SRM) that will be provided by the external organisations in an appropriate format, and find a mechanism to update (regularly in the future) via an extraction from the UMP platform (e.g. using APIs, see www.urbanmineplatform.eu). The following steps for this work are envisaged:
 - Expert contacts with UNU, TUB, BRGM and RECHARGE.
 - Participation to meetings with external partners (United Nations University, TU Berlin, BRGM).
 - Follow-up meeting and review of results of external partners.
 - Visualisation of some .XLS datasets on batteries (Goal 1) in a new RMIS application.

Other sectors will include electric and electronic equipment (also with some links with UMP Platform), and sectors such as mining waste, landfill, defence, dual-use (upcoming MDU report), etc., using in particular the structure of the JRC report "Critical Raw Materials and the Circular Economy". Construction and demolition subtopic (currently empty) shall be linked to Indicator 19 of RM Scoreboard, and might be further developed, depending on the RM Scoreboard 2020 and cooperation with JRC.E.4.

3.4.7 Environmental & Social Sustainability

Figure 13. The "Environmental & Social Sustainability" tile in RMIS



3.4.7.1 Environmental dimension

This section intends to provide an overview of the main environmental considerations linked to raw materials, as well as their links to the Sustainable Developments Goals. Next, the section intends to describe from a general point of view the main environmental impacts of the sectors along the supply chain, and the main environmental policies and regulations at EU level. In addition, the section aims to give dedicated information, and links to related data sources, for the main environmental media, namely air, water and soils/land. The latter intends to cover the main challenges of the sector (e.g. environmental pressures and impacts) and opportunities (e.g. contribution of raw materials to low-carbon technologies). Then, the section intends to include information on hazards to humans and ecosystems as well as information on sound environmental practices and management schemes. In addition, the JRC intends to provide material-specific environmental information, which will be linked to the Raw Materials profiles, to support analysis of responsible sourcing. Some sections are still under development. See details on current status and planned developments in the following.

As of May 2019, the following has been completed:

- Update of the structure of this section as:

Figure 14. The “Environmental dimension” sub-tile in RMIS

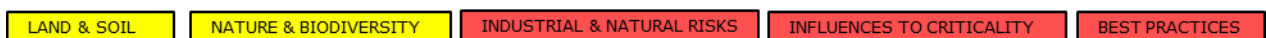


- Development of all content, with sections on climate and water particularly comprehensive, including drop-down menus:

Climate & Low-Carbon	Water
Climate change and decarbonisation	Water – a precious input to the economy
Direct GHG emissions from raw materials production	Use of water by the raw materials sector
Additional GHG emissions from raw materials production	Direct water use and water intensity
GHG emissions from consumption	Water stress and climate change
Climate change mitigation – potential of the sector	Emissions to water
Raw materials contribution to low-carbon technologies	Seabed mining and dredging
Challenges for climate mitigation	Water data sources
The EU Emissions Trading System and carbon leakage	Policies safeguarding water
Innovation and financing	Additional references
Climate change adaptation and risk to raw materials supply	
GHG emissions data	
Additional references	

For the period 2019-2020, the following developments are planned:

- Chapters that respond to information needs related to sustainable sourcing and production of materials (in yellow colour, already ongoing developments):



- Improve the linkages to information at material level.
- Investigation of how to build a sustainable sourcing map viewer application. The intended application under research aims at providing information relevant for responsible sourcing and the sustainable supply of raw materials from domestic and non-EU sources, therefore serving also to complete the information of the Raw Materials profiles. It will do so by allowing users to visualize environmental and social indicators jointly data on production and trade. Optimally, policy-relevant data will be displayed such as:
 - Related to the supply of Critical Raw Materials:
 - Data used for determining supply risk in the criticality study (e.g. production, imports, World Governance Index)

- Environmental and social aspects considered as additional influences to criticality (nature protection sites, land use, water risk, natural hazards, etc.).
- Socio-environmental variables considered for the SureBatt project.
- Indicators used for the monitoring of the Sustainable Development Goals (those found relevant for the raw materials sector by Mancini et al., 2018⁴⁷).
- Data on Artisanal Small-scale Mining.

3.4.7.2 Social dimension

Figure 15. The “Social dimension” sub-tile in RMIS



The present version of the RMIS includes eight tiles within the social sustainability part. They contain qualitative and quantitative information on the following topics:

- Artisanal and small scale mining
- Conflict minerals and conflict diamonds
- Employment
- Social licence to operate
- Occupational safety and health
- Sustainable management of Secondary Raw Materials
- Good governance and integrity
- International initiatives.

During 2019/2020 the following pages will be updated:

- **Conflict minerals and conflict diamonds:** the scope of this page will be broaden to “Responsible Sourcing” in order to reflect critical issues regarding the supply of a wider range of materials. Indeed, conflict minerals include Gold, Tin, Tungsten and Tantalum only, but the supply chain of other materials can show similar risks or be characterized by human rights abuses, undignified working conditions, etc. The Responsible Sourcing page will also include information on timber, for which due diligence is foreseen since the 2013 Timber Regulation, and Cobalt, which is a strategic material for batteries. In addition, this page will resume the results of the SureBatt project (JRC institutional project) “Analysis of responsible and sustainable sourcing opportunities for key raw materials for batteries: the example of Cobalt”. The JRC report on this topic is expected by end

⁴⁷ Mapping the role of Raw Materials in Sustainable Development Goals. A preliminary analysis of links, monitoring indicators and related policy initiatives.

of 2019. The review of this page will also take into account feedback received by experts in the field, both within and outside of the JRC.

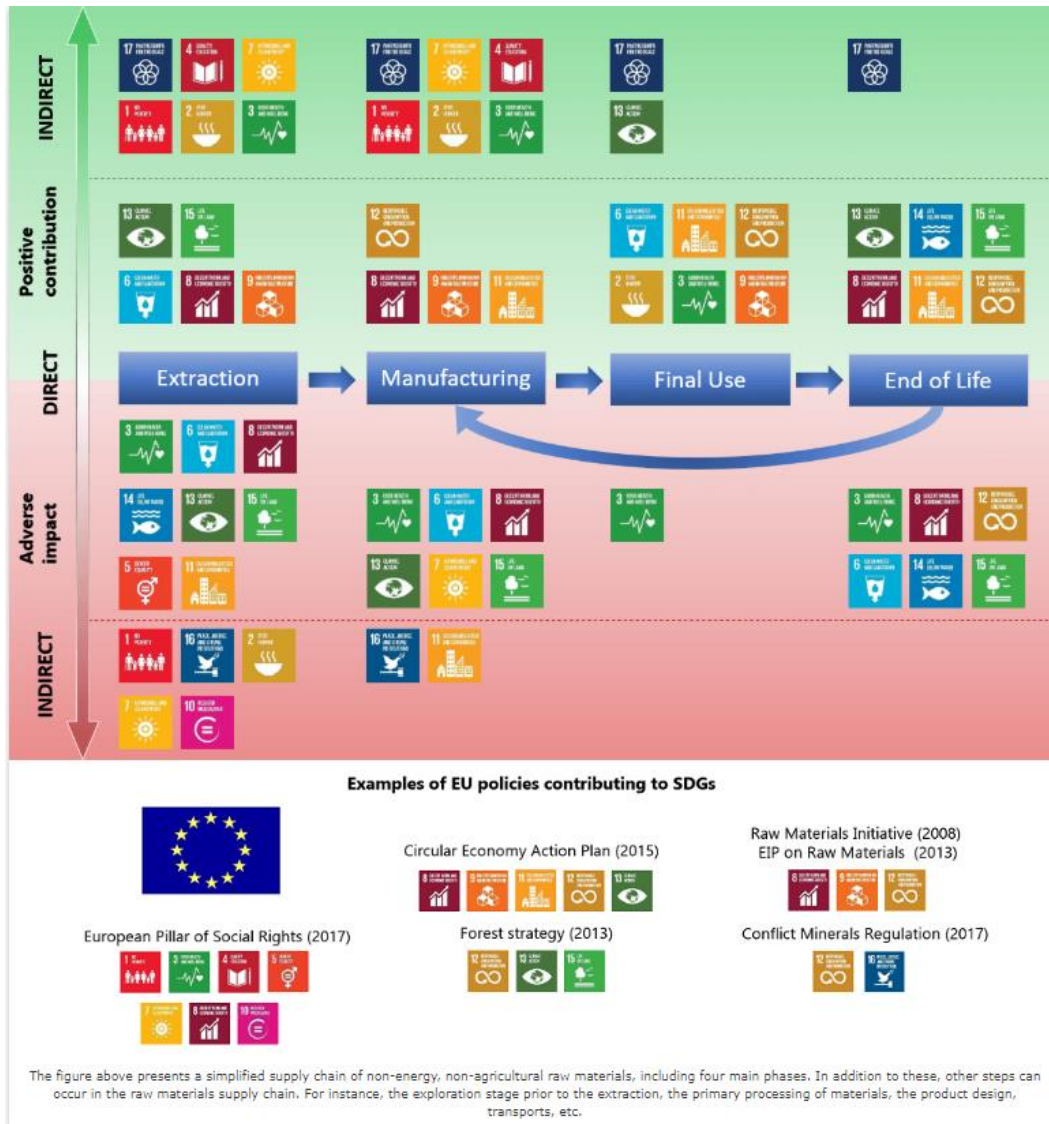
- **International Initiatives:** this page contains a table with relevant resource governance initiatives worldwide. During 2019-2020 the list of initiatives will be systematised (clustering them by topic/aspect addressed) and updated, including the initiatives shown in the social sustainability section of the raw materials profiles.
- **Occupational safety and employment:** these pages contain figures from the 2018 Raw Materials Scoreboard, which will be updated with the 2020 Scoreboard edition.
- **Artisanal and small-scale mining:** this page will be slightly reviewed taking into account feedback from experts in the field. This page will probably link with a Map Viewer application, that is planned to be developed this year and that will match geographical data with information on social and environmental aspects.

3.4.7.3 Sustainable Development Goals (SDGs)

During 2018, this second-level menu entry on SDGs was included in RMIS. It presents the outcomes of an analysis of the raw materials contribution to the SDGs, published in the JRC Report "Mapping the role of Raw Materials in Sustainable Development Goals. A preliminary analysis of links, monitoring indicators and related policy initiatives"⁴⁸. The content of this page, developed by the raw materials team of the Land Resources Unit (D3) in cooperation with the Bio-Economy Unit (D1) of the JRC, scrutinizes how raw materials can hinder or contribute to the Sustainable Development Goals (SDGs), adopted by the United Nations in the 2030 Agenda for Sustainable Development. Based on literature review and experts' opinion, the study takes into consideration the whole value chain (extraction, manufacturing, use, end-of-life) of biotic and abiotic materials, looking at potential positive contributions and adverse impacts.

⁴⁸ Mancini L., Vidal Legaz B., Vizzarri M., Wittmer D., Grassi G. Pennington D. Mapping the role of Raw Materials in Sustainable Development Goals. A preliminary analysis of links, monitoring indicators and related policy initiatives. EUR 29595 EN, Publications Office of the European Union, Luxembourg, 2018 ISBN 978-92-79-98482-2, doi:10.2760/933605, JRC112892.

Figure 16. Screenshot of the Sustainable Development Goals page in the RMIS



3.4.8 Economics & Trade

Figure 17. The “Economics & Trade” tile in RMIS



The “Economics & Trade” tile of the RMIS allows users to access information relative to trade performance (e.g. import/export of raw materials at country level), global production of primary and secondary raw materials, as well as knowledge on foreign investments, trade promotion and restrictiveness. Key data and information from the Economics & Trade feed the “Trade” section of the “Country profiles” in RMIS.

Ongoing work includes the compilation of two separate trade-code lists (“Raw Materials” and “Intermediates”) for non-food, non-energy raw materials and building dedicated databases. In the longer period (2019/2020), efforts will be put on the collection of data and the development of new country-level visualizations for two subsets - “Raw Materials” and “Intermediates” - similar to the existing one for raw material commodities, in the “Raw Materials Trade Flows” section.

3.4.9 Industrial Value Chains & Material flows

Figure 18. The “Industrial Value Chains & Material Flows” tile in RMIS



3.4.9.1 Supply Chain Viewer

The raw materials Supply Chain Viewer (SCV) was included in RMIS in 2018 Q4. It provides a powerful, dynamic overview of networks of selected raw materials supply chains, consisting of supplying countries, material products, product applications, and economic sectors using such products and materials.

Conceptually, this type of data representation is forming a *directed graph*, i.e. a network consisting of *nodes*⁴⁹ or *vertices* (four different types, namely countries, materials, applications and sectors) connected together. These connections (named either *links*⁵⁰ or *edges*) are representing the flows associated to a specific material.



Data for the linkages among countries, materials, product applications and sectors were selected mainly from the EC criticality assessment (CRM 2017)⁵¹. Such underlying data refer to the period 2010-2014. For several cases, where data were not reported in the CRM 2017, missing data were collected from BGS⁵² or Eurostat⁵³. On each link, a detailing popup displays the data source.

From the perspective of a single material node, the sum of country supply shares equals 100%. The countries can produce multiple materials and the shares reported always equal 100% for a single material. The country-to-material supply shares are representing the EU-28 supply (EU imports + domestic production) for most of the supply chains. On

⁴⁹ The size of a node is proportional to its “*degree centrality*” in the current graph view. From the perspective of a material supply chain, the degree centrality, and so the node size, represents the importance of the node within the supply chain and can give a measure of the impact (chain disruption) in case of removal of a certain “important” node (Nuss & Ciuta, 2018).

⁵⁰ The links, representing the material flows, have thicknesses proportional to the link’s share (in terms of mass share). An ending arrow indicates the flow direction. Along the link, a text shows its value (share). The colours of these links are either dark grey for flows related to raw materials production, or light grey for flows related to raw materials use.

⁵¹ European Commission, 2017a, 2017b, 2017c
⁵² <https://www.bgs.ac.uk/mineralsuk/statistics/wms.cfc?method=searchWMS>
⁵³ <http://epp.eurostat.ec.europa.eu/newxtweb/>

the other hand, where EU data were not available, the shares refer to the global production. This aspect is specified on the left side panel for each supply chain. Also on the left side panel, the user will find external hyper-links to the corresponding country and material profiles in RMIS, when available.

Subsequently, the links from material products to product applications represent the shares of materials “used in” different product applications. In this case, the underlying data come exclusively from the CRM 2017 data set provides.

Finally, and similarly to the material to application flow links, the links from product applications to economic sectors represent the flows corresponding the use of product (shares) in different NACE-2 economic sectors.

The SCV application is divided into four distinctive views or modules:

- **Material Supply Chains** view as described above
- Individual nodes views for **Countries, Applications** and **Sectors**
- **Overlaid** view
- **Whole Supply Chain Network** view

The individual node views section contains three sub-modules (**Countries, Applications, Sectors**) that present a view to the whole supply chain network from the perspective of singular country, application or sector node, highlighting the interlinkages among different raw materials supplies or uses, but does not look at any material supply chain individually. Instead, each view includes the supply chain membership on the links. Each view shows the chosen node and the nodes directly connected to it.

The **Overlaid** view provides interconnection information among combined multiple supply chains. It can help to highlight the fact that materials are interlinked at various stages of their supply chain and that certain countries, materials, products, and sectors might be of greater importance for a defined set of materials, simply because of their increased interlinkage in the network, or large share in contributing to material flows⁵⁴.

The **Whole Supply Chain Network** view serves as the main entry point of the application and visualizes the entire graph with all its members: countries, materials, end-use applications, and sectors involved in raw material supply chains that are shown as nodes and the relationships among them as links (edges) among the nodes. The degree centrality is applied as nodes’ sizes to visualize the interconnectedness of each supply chain actor (node) in the raw materials network. Increasing node size indicates more interconnected nodes (“key players”) in the production and use of raw materials captured by the Commission’s CRM 2017 data set⁵⁵. The view can be interactively used to directly jump to a material supply chain view or individual node view.

3.4.9.2 Material flows

The material flows and stock information is hitherto presented by two subtiles:

1. The subtitle “EU Material System Analysis (MSA)” (in the following referred to shortened “MSA subtitle”) presents information specific for the Material System Analyses carried out for the Commission. This includes:
 - a. Scope and Methodology of the MSA (intro).
 - b. Links to MSA reports.

⁵⁴ As described in Nuss & Ciuta, 2018

⁵⁵ European Commission, 2017a, 2017b, 2017c

- c. Summary of the MSA study⁵⁶ describing the study procedure, with reference to published and non-published results.
2. The general subtitle “Material Flow Analysis (MFA)” (in the following referred to shortened “MFA subtitle”) that exploits the MSA and the UNEP live dataset in parallel:
 - a. The MFA inventory, providing (a) the MSA results on the original 28 MSAs and the additional new 3 MSAs (in total 31 MSAs), using the structure of the published report, and (b) accessory compiled data on country/region level from the JRC “Sankey report”⁵⁷, the country factsheets of the EEA study “More from less”⁵⁸, and selected Economy-wide MFA (EW-MFA) indicators from the UNEP Live database⁵⁹. The UNEP Live database provides data for all countries, while the EEA study covers 32 European countries, and the Sankey report for 8 selected EU member states.
 - b. Methodological notes providing links to methodological background.

The objective is to advance the MFA and MSA subtitles by a profound revision in two steps: firstly, consolidation of existing content, secondly, modular extension by new content.

Step 1: Present the existing content more structured and more complete by adapting the existing two subtitles to the degree necessary.

- A more user-oriented presentation of the contents, less driven by the procedure of the MSA study.

The upgrade of the MSA reports section by adding context and key results from the hitherto reports.

Step 2: Upgrade the existing MFA/MSA subtitles by extending the current content.

- Regarding the MSA section of the “MFA Inventory”, the list of materials providing MSA results (cf. Figure 1) shall be extended. This comprises 5 “battery materials” and 9 further new materials.
- A presentation of the past, ongoing and planned activities on the MSA study, potentially with a long-term vision.
- Information on the status quo on MFA studies on country/member state level.
- An extension of the presentation of the methodology, providing sufficient detail to understand the complementary character of EW-MFA and MFA, and sketching further MFA variants.

Possibly, the country-level data can be updated and/or extended due to ongoing advancements of the “Global Material Flow and Resource Productivity Database” provided by the UNEP IRP Work Stream for Metrics and Data for Sustainable Resource Use. Where applicable, also results from the EIT Raw Materials project “PANORAMA” will be included into this tile. In the midterm, it is foreseen to extend the methodology section thematically, providing insights on uncertainty and standardization processes. This work on MSAs is closely aligned with data collection and analysis within the scope of the CRM Assessment, and with the data collection and compilation of the Raw Material Profiles.

⁵⁶ This summary reflects a slightly updated version of the “MSA website”, which was formerly hosted by DG GROW and transferred to the RMIS. A slightly outdated version is currently also available at the EU Science Hub as “Scientific Tool: MSA” (<https://ec.europa.eu/jrc/en/scientific-tool/msa>).

⁵⁷ <https://ec.europa.eu/jrc/en/publication/development-sankey-diagram-material-flows-eu-economy-based-eurostat-data>

⁵⁸ EEA Report No 10/2016: <https://www.eea.europa.eu/publications/more-from-less>

⁵⁹ <https://environmentlive.unep.org/>

Figure 19. Screenshot of the Materials section of the MFA inventory sub-tile

Materials

Countries and Regions

Materials

Materials shown are based on the publicly available data and information from the EU Material System Analysis (see the full MSA studies (including confidential data) in the [MSA Inventory](#) (only available with ECAS login).

In the future, the MFA inventory below aims to also provide data and linkages to external MFA studies in the EU (e.g., public studies from academia and industry associations).

Please select a material from the table to obtain its MFA information.

Aggregates	Aluminium	Antimony	Beryllium	Borate	Chromium
Cobalt	Coking Coal	Copper	Dysprosium	Erbium	Europium
Fluorspar	Gallium	Germanium	Indium	Iron	Lithium
Magnesite	Magnesium	Natural Graphite	Neodymium	Niobium	Palladium
Phosphate Rock	Platinum	Rhodium	Silicon	Terbium	Tungsten
Yttrium					

3.4.9.3 Batteries Value Chains

Raw materials for batteries as well as a wider analysis of the fate of materials in the battery value chain is a key topic under the pillar 1 and pillar 5 of the Commission Strategic Action Plan on Batteries.

Providing more up to data and sector specific battery raw materials information, the development of this specific (sub)tile should support EU policies and strategies with relevant data for industrial value chains that are crucial for the future. In this tile, it is foreseen to highlight key data from many other places in the RMIS dedicated to the battery sector including:

- Supply of raw materials in particular for cobalt, lithium, natural graphite, nickel and other CRMs present in batteries.
- Past and forecasted demand for battery raw materials in electronics, e-mobility and industrial applications.
- Reuse, remanufacturing and repurposing of batteries and the effects on reduced raw materials demand as well as extension of material residence times in the EU economy.
- Stocks and flows available for collection and recycling.
- Recycling of battery raw materials, material recovery rates and availability of secondary raw materials from and towards the EU.

3.4.9.4 Dual Use Materials

The development of technologies depends on inputs of raw materials in adequate quantities and qualities. While access to these inputs is crucial for the competitiveness of the civil sector, there are in addition strategic challenges to be addressed in the military sector. Certain technologies are not solely attributable to the civil nor the military sector.

Such technologies applied in both sectors are called "dual-use technologies". To support the EU civil and defence industry, the Commission investigates potential bottlenecks

linked to the supply of materials needed for the development of emerging dual use technologies.

The Commission has launched an analysis of material bottlenecks for five selected dual-use technologies, namely batteries, fuel cells, robotics, drones, and additive manufacturing. The study identifies and assesses potential material supply bottlenecks. Results are expected in 2019.

3.4.10 Raw Materials' Profiles

The "Raw materials' profiles" tile of the RMIS 2.0 main menu provides access to quantitative and qualitative information relative to the supply chains of raw materials on the following topics:

- General description of the supply chain
- (Geological) Occurrence, Resources and Reserves
- World and EU Primary production (extraction)
- World and EU Production of refined/processed materials
- EU-extra Imports and Exports by tonnage and trade balance
- EU consumption
- Global and EU end uses
- Evolution of prices
- Export restrictions
- Research and development projects funded by the EU
- Available Material Flow Analysis
- Major world importing and exporting countries
- Circular Economy aspects and recycling indicators
- Environmental aspects
- Social sustainability aspects

The current objective is to develop in total 20 profiles by the end of 2019, in addition to the 14 published in 2018.

The Raw Materials' profiles have a solid connection to other on-going work as they share common developments with parts of the various other developments, in particular with the following:

- Criticality calculations,
- Raw materials factsheets,
- Material System Analyses updates and advancements.

The interlinkage is bidirectional, meaning that data collection and processing performed during the development of RM profiles can feed the above developments and vice versa.

In the longer period (2019 to 2020), it is envisaged that the structure and content of the Raw Materials' Profiles is improved and extended with the aim to provide more visually attractive information and additional insights into the in the EU and world supply chains of Raw Materials.

Figure 20. The "Raw Materials' Profiles" tile in RMIS

Raw Materials' Profiles

Alphabetically By groups

Aggregates	Aluminium	Antimony	Baryte	Bentonite	Beryllium	Bismuth
Borates	Cerium	Chromium	Cobalt	Coking coal	Copper	Diatomite
Dysprosium	Erbium	Europium	Feldspar	Fluorspar	Gadolinium	Gallium
Germanium	Gold	Gypsum	Hafnium	Helium	Holmium	Indium
Iridium	Iron	Kaolin clay	Lanthanum	Lead	Limestone	Lithium
Lutetium	Magnesite	Magnesium	Manganese	Molybdenum	Natural cork	Natural graphite
Natural Rubber	Natural Teak wood	Neodymium	Nickel	Niobium	Palladium	Perlite
Phosphate rock	Phosphorus	Platinum	Potash	Praseodymium	Rhenium	Rhodium
Ruthenium	Samarium	Sapele wood	Scandium	Selenium	Silica sand	Silicon metal
Silver	Sulphur	Talc	Tantalum	Tellurium	Terbium	Thulium
Tin	Titanium	Tungsten	Vanadium	Ytterbium	Yttrium	Zinc

3.4.11 Country Profiles

Figure 21. The "Country Profiles" tile in RMIS

Country Profiles

Select a country from the drop-down list or use the map to obtain information.

Ongoing work / developments - After the conceptual and methodological design, elaboration and publication of 6 country profiles in 2018, another 10-12 country profiles will be elaborated in 2019. Country profiles are structured along the following sections:

- Key indicators
- Investment and regulatory framework
- Research, development and innovation
- Resources and reserves
- Supply
- Raw material use
- Trade
- Environment
- Social and policy
- References and methodological notes

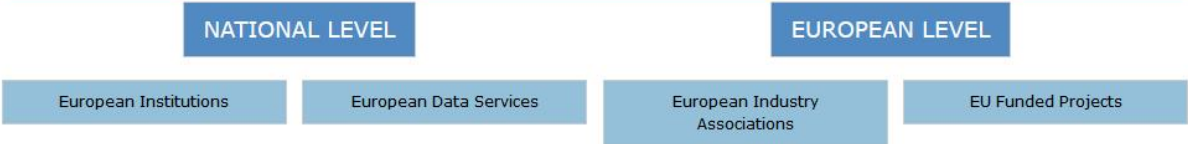
Expected outcomes/outputs in the longer period (2020/2021): work on country profile development will continue by the end of 2020 (according to the presentation of RMIS project in Project Browser).

3.4.12 Raw Materials Knowledge Gateway

Figure 22. The “Raw Materials Knowledge Gateway / European level” tile in RMIS



Raw Materials Knowledge Gateway



Plans 2019-20: Populating of this database shall be speeded up in the coming year. The function of sub-chapters *European Institutions*, *European Data Services*, *European Industry Associations* shall be re-evaluated. It is proposed to provide rather an inventory type of meta-database of these than detailed profiles. It is noteworthy that the content of the former *Industry & Innovation* chapter, which were moved to the *Overview* chapter, such as *National entities*, *Industry Associations*, *Certified professional experts*, would fit the above Gateway functions perfectly. The *Funding Options* section can also be considered for the translocation to the Gateway.

Figure 23. The “Stakeholders” sub-tile in RMIS



Instead, the focus shall be on the introduction of the most relevant EU funded projects, as well as the major EU member States entities. The international dimension was deleted in 2018.

The *Knowledge Gateway* shall provide assistance in access to technical knowledge too, besides entities. The introduction of a new *Thematic Knowledge Gateway*, as a second-level subchapter, would strengthen this character and function of RMIS services. The re-positioned *Library*, and the new entries on *MICA ontology* (as a kind of steered value chain insight), and the *ORAMA inventory* of R&I projects.

3.5 Upcoming events: 3rd RMIS workshop & joint ORAMA-JRC workshop

Following the success of the 2017 and 2018 editions, the 3rd International RMIS workshop (June 11-12, 2019) brings together key RMIS knowledge providers, targeting the most recent developments in the field of primary and secondary raw materials value chains. It provides insights on how RMIS addresses knowledge and policy needs related to e.g. social and environmental assessment of raw materials supply chains, national legislation, specific Secondary Raw Materials (SRMs) and Critical Raw Materials (CRMs), and material efficient end-of-life processes.

Figure 24: group photo taken at the 2nd RMIS Workshop, May 2018



The 2019 RMIS workshop includes ample time for discussion with participants, with a view of strengthening the networking and knowledge sharing with key stakeholders and further advancing key thematic areas in RMIS.

The sessions of this 3rd workshop will focus on:

- Social challenges and responsible sourcing aspects associated with supply chains of non-energy, non-agricultural raw materials, with a view to identifying key knowledge needs, availability, and gaps that could be filled.
- How RMIS provides knowledge on raw materials related legislation at EU Community and Member States levels, with a view of identifying further needs, gaps and recent national legislation updates in the EU Member States.
- The current and potential roles of RMIS in increasing the availability of knowledge on secondary raw materials, zooming in on the knowledge on specific secondary (critical) raw materials.

Immediately after the 3rd RMIS workshop, a joint JRC-ORAMA workshop will be held (June 13th) at the JRC-Ispra. The Horizon2020 ORAMA project (Optimizing quality of information in RAW MAterial data collection across Europe) focuses on improving data collection for primary and secondary raw materials in the Member States of the EU.

The project is now nearing its end and wishes to share its results and present to key stakeholders the methodologies it has developed around raw material enhancing data across Europe, using such tools as the United Nations Framework Classification system (UNFC). The ORAMA project has close ties with the Joint Research Centre's Raw Materials Information System (RMIS). This workshop will focus on sharing the outcomes of the ORAMA project.

3.6 Upcoming initiatives: RMIS Newsletter

With a view of informing a broader audience on the key RMIS developments, as well as related news & events, the JRC raw materials team is currently working on a bi-annual "RMIS Newsletter. This newsletter is also intended to help further consolidate and facilitate knowledge sharing between RMIS and the broad network of stakeholders and knowledge providers on raw materials.

The first number of the RMIS Newsletter will be released in Q2 or Q3 of 2019 and will roughly include:

- An update on the European policy documents relevant to RMIS
- A series of highlights related to e.g. circular use of raw materials, value added and jobs, raw materials trade flows, environmentally and socially sustainable use of raw materials, use of raw materials in batteries and electro-mobility.
- Upcoming RMIS developments, publications, news & events

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List of abbreviations and definitions

CE	Circular Economy
CEAP	Circular Economy Action Plan
CRM	Critical Raw Material
EC	European Commission
EGS	European Geological Survey
EIP-RM	European Innovation Partnership on Raw Materials
EU	European Union
EURMKB	European Raw Materials Knowledge Base
H2020	Horizon 2020
MFA	Material Flow Analysis
MSA	Material System Analysis
RMI	Raw Materials Initiative
RMIS	Raw Materials Information System
RMKG	Raw Materials Knowledge Gateway
SIP	Strategic implementation Plan (of the EIP-SIP)
SRM	Secondary Raw Material
UNFC	United Nations Framework Classification system

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Name of the knowledge provider

Flag, Picture, logo
(preferable in SVG format, if image is provided please send it as large as possible)

Include also the link to your homepage

Overview

Short description of your entity or project (4 to 6 lines).

Activities on raw materials
Include here a description and/or list of activities on raw materials. Please include hyperlink(s) to the correspondent website and/or database.

Raw materials of interest
List or description of the raw materials and of the related sectors under consideration (directly and/or indirectly) in your activities.

Statutory, IPR issues
Legal and statutory basis of your service, rules of procedures of data access and use, waivers, contacts etc.

Raw materials knowledge

This section can include data, figures, GIS maps or information on raw materials that you have available, or simply a hyperlink to the corresponding information, independent of the geographical scope.

Raw materials value Chain
This should be an indication of your knowledge coverage of the raw materials value chain. For instance, aspects of interest include:

Resources and reserves

Production

Consumption

Waste flows

Secondary raw materials

Materials flows and Stocks

Environmental and Social sustainability

Here you can highlight, for instance, any assessments made by your entity on impacts associated with raw materials sectors, you can also make reference to data/information on e.g. air emissions, water pollution, water use associated with the sectors.

Regarding social sustainability, this may include data/information on employment, occupational safety, gender balance, accidents associated with the raw materials sectors.

Economics and trade

Here you can include your knowledge on raw materials trade flows. This may for instance include a small description on the trade flows coverage you have available (e.g. regional, national, European and global) and a hyperlink to your website / data repository. It may also include data on investments on raw materials sectors.

Secondary Raw Materials & Circular Economy

Here you can include, for instance, any initiative related to the reuse, the recycling or the recovery of materials from products and waste. Data on recycling flows. Indicate whether specific sectors are interested to your entity (e.g. electric and electronic equipment, transports, etc.) and the level of detail, recovery efficiency statistics and future trends, and whether specific substances are targeted.

Critical raw materials

Indicate here or make reference to any assessment made to by your entity to identify critical raw materials.

Monitoring raw materials sectors

Please indicate monitoring activities or indicators used to assess the situation of raw materials within the EU or worldwide. This may also include information on technology progress or substantial investments foreseen in the raw materials sectors.

For each of the topics covered please include time coverage, the name and the link of the organisation responsible for data collection, if it is not your entity. Additionally, please specify what classifications are applied for the individual data sets, for example if the data collected complies with any recognised standard code.

Data accessibility

Rules on procedures related to data access and use. Please specify if data are available to the public and who are the holders/owners of the data.

Research and Innovation

Description of existing activities of research and innovation on raw materials sectors developed by and/or funded by your entity. Co-operation partners, contacts, etc.

Links and contacts

Please include here links and contacts of your entity and of any other relevant raw materials knowledge providers, connected with your entity (e.g. organisations collecting, analysing raw materials data/information).

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