# Deliverable D2.2

# Stakeholder Needs

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## Notice

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## List of abbreviations and of *project acronyms*

AB Advisory Board
BGR Bundesanstalt für Geowissenschaften und Rohstoffe (German Geological Survey)
*CWIT - Countering WEEE Illegal Trade (EC, 2007-2013)*
*CRM_InnoNet – Substitution of Critical Raw Materials (EC, 2012-2015)*
DG GROW Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs
DG JRC Directorate-General Joint Research Center
EC European Commission
EFG European Federation of Geologists
EGDI Scope – European Geological Data Infrastructure (EC, 2012-2014)
EGS Association of the European Geological Surveys
EHS Environment, Health and Safety
EIP European Innovation Partnership
EIT European Institute of Innovation and Technology
*EIT KIC Raw Materials – European Institute of Innovation and Technology / Knowledge and Innovation Community Raw Materials (EC, 2014-2022)*
ELV end-of-life vehicles
EoL End of Life
*EO-MINERS – Earth Observation for Monitoring and Observing Environmental and Societal Impacts of Mineral Resources Exploration and Exploitation (EC, 2010-2013)*
ETS Emission Trading Scheme
EU European Union
*EURare – development of a sustainable exploitation scheme for Europe's Rare Earth ore deposits (EC, 2013-2018)*
*EuroGeoSource is a data portal (EC, 2010-2013)*
Fraunhofer ISI Fraunhofer Institute for Systems and Innovation Research
GIS geographic information system
*i2Mine – Innovative Technologies and Concepts for the Intelligent Deep Mine of the Future (EC, 2011-2016)*
*INTRAW – International Raw Materials Observatory (EC, 2015-2018)*
*IRP WG on Global Metal Flows - International Resource Panel Working Group on Global Metal Flows (UN, since 2007)*
ISIE International Society for Industrial Ecology
LCA Life Cycle Assessment
MFN Most Favored Nation (a status or level of treatment accorded by one state to another in international trade)
MICA Mineral Intelligence Capacity Analysis
*Minerals4EU – Minerals Intelligence Network for Europe (EC, 2013-2015)*
*Minventory is a data portal (EC, 2013-2015)*
n (frequency) number
OECD Organisation for Economic Co-operation and Development
OG Operational Group
*ProMine – exploration and the efficient use of mineral resources within Europe. (EC, 2009-2013)*
*ProSUM – Prospecting Secondary raw materials from the Urban Mine and Mining waste (EC, 2015-2017)*
Q Question
REACH Registration, Evaluation, Authorisation of Chemicals
REE Rare Earth Element
RTO Research and Technology Organisation
R&I Research and Innovation
SIP Strategic Implementation Plan
SME Small and Medium-sized Enterprises
STI Science, Technology, Innovation
TRL Technology Readiness Level
WEEE Waste of Electrical and Electronic Equipment
WTO World Trade Organization

# PURPOSE

Deliverable D2.2 of the Mineral Capacity Intelligence Analysis (MICA) project documents the identification & mapping of stakeholders' needs and requirements related to raw material intelligence (RMI). This Stakeholder Needs Report refers to Task 2.3 of the MICA project. The main purpose is to provide a broad synopsis of stakes in RMI expressed by different stakeholders that could be future users of the envisaged MICA online platform.

# EXECUTIVE SUMMARY

The aim and ambition of the MICA project is to contribute to the emerging raw materials knowledge infrastructure in Europe. The objective of WP2 *Needs: Stakeholder identification, appraisal and mapping of stakeholder requirements* is

- to provide a comprehensive inventory of relevant stakeholders, and
- to explore current stakes (interests/questions) in raw material intelligence.

Deliverable D2.2 of the Mineral Capacity Intelligence Analysis (MICA) project documents the identification & mapping of stakeholders' needs and requirements related to raw material intelligence (RMI).[1]

The main target groups of the empirical needs appraisal are definitive, dominant and dependent stakeholders. Definitive stakeholders are formally involved in the MICA project, including geological surveys, other public research institutes, universities, research & technology organizations, intelligence institutes, professional organizations, mining and extraction industry, material production industry, recycling and material recovery industry, innovation initiatives, project management agencies, ministries of economic affairs and ministries of education & research. Dominant stakeholders have legitimacy and power in the raw material intelligence discourse, but are not formally involved in the MICA project. They include the manufacturing industry as a user of materials and the re-manufacturing industry and governments formulating raw material policies. Dependent stakeholders with less power but equal legitimacy are accounted for to put them at a comparative level of consideration compared to dominant stakeholders. They include industry sectors potentially affected by minerals RMI (e.g. the bio-based industry, tourism industry) and civil society organizations (e.g. environmental NGOs and human rights NGOs).

Three empirical appraisal types (surveys, stakeholder workshop and interviews) were designed to collect RMI stakes in a broad and multi-facetted way.
The three online surveys were conducted between June and September 2016 to reach many stakeholders for identification and assessment of RMI needs:

- The EGS Survey is directly targeted at the EGS members, i.e. the national and regional geological surveys in Europe. The raw material information needs of the superior national and regional ministries are asked for, too.
- The EFG Survey is directly targeted at the EFG members, i.e. professional geologists in Europe. They are employed at a wide range of affiliations such as exploration industry, mining industry and consultancies. The raw material information needs of their key clients are gathered, too.

[1] according to the specifications of Task 2.3 of the Description of Work

- The Industry Survey approaches industry associations directly via cold calling. The material production, manufacturing and recycling industries are focused at. Indirectly, the raw material information needs of member companies are collected.

The Stakeholder Workshop held at 27 September 2016 at Eurometaux's premises gathered 25 stakeholders from industry, research and governments clustered in four focus groups: the Mineral Deposit Community, the Mining Community, the Urban Mining Community and the Materials Community. The focus groups refined the interim results and suggested further needs related to RMI from their different institutional backgrounds.
In total, 20 interviews were conducted with representatives from NGOs and industry, EU agencies, ministries, cities, finance, education and consumers. The interviews explored RMI needs in depth and closed major gaps in the targeted stakeholder landscape.

The EGS Survey has reached almost two thirds of the geological surveys organized under the umbrella of EGS. Respondents consider *budget pressure* and *public attitudes towards exploration and mining*, raw material abundance and a European Circular Economy as major strategic issues. The needs for improvement of raw material information are broadly confirmed; *above ground infrastructure stock* and *subsurface infrastructure stock* not yet being an issue for the majority of respondents. Most important clients of geological surveys are – in declining order – national ministries, exploration and mining industry, earth science and regional ministries. The emerging questions raised by the respondents' clients are mainly related to primary and secondary raw material access, local availability of building & construction materials, concessions, specific minerals resource areas/objectives and raw material types, and closed raw material utilization.

The EFG Survey has enhanced the knowledge and understanding of raw material information needs of professional geologists as potential users of the envisaged online platform. They belong to four major organization types: academia / university / research institute, consultancy / planning office, geological survey and industry. The need for improving access to raw material information as well as support responding to information needs is pointed out broadly in all response categories. Exploration industry and mining industry, followed by the geological surveys and policy makers are the main clients of the respondents. The emerging questions raised by the respondents' clients are mainly related to commodity pricing, financing, tailings operations, permitting, social constraints, environmental restrictions, security constraints, infrastructure, groundwater impact and access to public data.

The Industry Survey has reached the strategic management of industry associations covering large parts of the value chain from material processing to recycling. Industry associations broadly emphasize the strategic relevance of trade and environmental policies and regulations. The need for improving access to specific raw material information as well as support responding to specific information needs is seen depending on the industry associations' positions in the value chain. The industry associations' members and key external stakeholders increasingly ask for life cycle analyses, recycling streams, innovations and conflict mineral due diligence.

Further analysis of the three surveys revealed that the Sustainable Development Goals, and data selection options in the MICA Online Platform are particularly important. Depending on the raw

material knowledge domain, information is non-existent or not exploited sufficiently giving hints for designing the MICA Online Platform.

The Stakeholder Workshop has sharpened the raw material information needs and has brought a number of additional aspects to the fore. Major amendments generated by the four focus groups are related to actors in charge of local raw material availability and waste registers, links to existing data bases and projects, information about by-products, inventory and composition of stocks, mining venture sites, profitability and risks, supply chains / value chains, material fate between primary production and its secondary production, and properties of alternative materials for the design. All in all it was found, that MICA should make clear to the Online Platform user what can be expected of its services.

The 20 interviews have explored raw material information needs in depth. The investment perspective is leveraged asking for area/country comparisons (e.g. exploration project radar, propensity to invest, availability and costs of production factors, financial models for regeneration). A supply chain / value chain view is promoted asking for trade-related, material/design-related, transparency and sustainability issues. A number of consumer organizations, trade unions, environmental NGOs and transparency & democracy NGOs share the need for transparent information of corporate actors / networks and differ with regard to the part of the value chain they are engaged in. Civil society actors strive for being on eye-level with private and public sector actors through better access to raw material information. The interviews on urban mining and cities specify the information needs with regard to stocks and flows, actors, best practices and actors in detail.

As an outlook, avenues for redesigning the MICA Ontology in its version of 29 July 2016 are suggested:

1. *Differentiate existing concepts according to stakeholders' perceptions of the raw material field*
2. *Consider to allow navigating the numerous raw-material related actors, initiatives and projects at EU and other levels*
3. *Unlock the black box of materials fate between virgin raw materials and waste statistics*
4. *Technology/innovation (available/emerging) appears to be a raw-material related need within several domains*
5. *Disentangle raw material supply chains / value chains*
6. *Introduce a material/design perspective on raw materials*
7. *Disclose financial information on mining companies and networks*
8. *Account for trade as a well visible concept*
9. *Sort out, if and how to address procurement, standards, skills, property issues and communication*
10. *Provide orientation according to the Sustainable Development Goals*

The empirical needs appraisal has reached stakeholders in RMI systematically and in large breadth, despite its shortcomings here and there. Taking into account the methodological approach and the research restrictions, the entire picture of needs and requirements related to RMI is considered sufficiently diverse and comprehensive.

# DELIVERABLE REPORT

## 1. Introduction

The aim and ambition of the MICA project is to contribute to the emerging raw materials knowledge infrastructure in Europe. To do so, the project team conducts a careful analysis of stakeholder needs and undertakes a review of existing data, methods and tools that provide intelligence on raw materials. The outcome of this analysis and review will be integrated into a powerful, user-friendly decision-support platform that provides different stakeholders (e.g. policy and decision makers, industry, investors, economic analysts, researchers and others) with answers to their raw materials related questions and proposes options available for addressing associated problems.

The objective of WP2 *Needs: Stakeholder identification, appraisal and mapping of stakeholder requirements* is

- to provide a comprehensive inventory of relevant stakeholders, and
- to explore current stakes (interests/questions) in raw material intelligence.

Task 2.2 has identified and classified stakeholders systematically (Erdmann et al. 2016), to provide a sound basis for a broad and deep appraisal of stakeholder needs in Task 2.3. Task 2.1 has mapped the pre-existing knowledge of the WP2 participants about the stakeholder landscape and stakeholder needs to achieve a shared understanding of key raw material intelligence issues at an early stage of the MICA project.

Deliverable 2.2 provides a consolidated synthesis of the stakeholder needs appraisal. This Stakeholder Needs Report documents Task 2.3 only.

- Section 2 presents the empirical appraisal concept tailored to the principal stakeholder groups identified in Task 2.2.
- Section 3 provides a synthesis of the results of the empirical appraisal activities.
- Section 4 critically reflects the empirical appraisal against and suggests avenues for a redesign of the Main Ontology of the envisaged MICA Online Platform[2].

The Annex contains descriptive information on the empirical appraisal activities.

This Stakeholder Needs Report is complemented by a spreadsheet file that maps some 700 needs and requirements to concepts captured within the eight raw material knowledge domains (down to level 2) of the Main Ontology. A revised Main Ontology is meant to address the stakeholders' needs and requirements to RMI gathered in this empirical appraisal.

[2] Ontology Version of 29 July 2016.

# 2. Appraisal concept

First, the conceptual approach is outlined. Then, it is operationalized in concrete empirical appraisal activities. Finally, the data analysis and mapping procedure is described.

## 2.1 Conceptual approach

The Stakeholder Mapping Report D2.1 (Erdmann et al. 2016) identified four tiers of stakeholders in the MICA project building upon Mitchell and Colleagues' stakeholder typology (Mitchell et al. 1997).

**Tier 1**: *Definitive stakeholders* are formally involved in the MICA project. They have the power, urgency and legitimacy to engage in MICA. Among the stakeholder groups involved are: geological surveys and other public research institutes, universities, research & technology organizations (RTOs), intelligence institutes, professional organizations, mining and extraction industry, material production industry, recycling and material recovery industry, innovation initiatives, project management agencies, ministries of economic affairs and ministries of education & research.

**Tier 2**: *Dominant stakeholders* and *dependent stakeholders*, it is argued, should be considered in this comprehensive survey of raw material information needs. Dominant stakeholders are important because they have legitimacy and power in the RMI discourse. Dependent stakeholders with less power but equal legitimacy need to be accounted for urgently to put them at a similar level of consideration compared to dominant stakeholders.

Among the dominant stakeholders are in particular the manufacturing industry as a user of materials and the re-manufacturing industry as key actors to mobilize material in stock for the purposes of recycling and material recovery. Governments formulating raw material policies also count among the dominant stakeholders.

Dependent stakeholders include in particular industry sectors potentially affected by minerals raw material intelligence (e.g. the bio-based industry, tourism industry) and civil society organizations (e.g. environmental NGOs and human rights NGOs).

**Tier 3**: *Discretionary stakeholders* may have legitimate claims in RMI. They are not in the focus of the MICA project, but they have been considered upon their request.

**Tier 4**: *Dormant stakeholders* and *dangerous stakeholders* might have limited legitimacy to benefit from MICA. Both stakeholder groups have not been targeted in the empirical appraisal, but they have to be dealt with to ensure that the MICA services will be exploited in the intended ways. Dormant stakeholders were considered case by case.

⇨ Main **target groups** of the empirical needs appraisal are definitive, dominant and dependent stakeholders.

The main aim of the empirical appraisal is to contribute to the design of the Main Ontology of the Envisaged MICA Online Platform. The empirical appraisal is one approach to uncover stakeholders' needs and requirements to RMI among others.

Figure 1 displays the empirical appraisal and other MICA related sources for the identification of raw material information needs that are to be considered when rebuilding the Main Ontology.

| Sources | Subjects | Documentation |
|---|---|---|
| Task 2.1: Inception | • supposed stakeholder questions formulated by MICA partners<br>• compilation of key projects responding to information needs | M1 |
| Task 2.2: Stakeholder Mapping | • topics of importance identified through analysis and mapping of R&I activities, consultations, industry associations, civil society organisations, conferences and country perspectives | D2.1 |
| **Task 2.3** | **Empirical appraisal** | |
| surveys | • topics and questions of the respondents and their external stakeholders | D2.2 |
| interviews | • topics and questions of the affiliation | D2.2 |
| stakeholder workshop | • focus groups on knowledge domains identifying and refining topics and questions | D2.2 |
| Advisory Board | • topics and questions from an AB member perspective (February 2016, September 2016) | AB minutes |
| EIP Raw Materials | • OG meeting (April 2016), SIP, Raw Material Committments<br>• material submitted by DG GROW and DG JRC | SIP<br>D2.1 |

*Figure 1: MICA-related sources for the detection of raw material information needs*

The Inception (Task 2.1) had yielded a MICA-internal milestone document (M1) that contributed to building the Main Ontology of the envisaged MICA Online Platform in its version 29 July 2016. It covers supposed stakeholder questions formulated by MICA partners and a compilation of key projects responding to raw material information needs.

The stakeholder mapping documented in Deliverable D2.1 (Task 2.2) reveals a broad range of topics addressed in R&I programmes and projects, consultations for raw material policy-making, mapping of industry associations and of civil society organizations, raw material related conferences and country perspectives on raw material information needs.

The two Advisory Board (AB) meetings gathered topics and questions from an AB-member perspective and sharpened the potential user spectrum of the envisaged MICA Online Platform.

The MICA project was presented at an EIP Raw Materials OG Meeting accompanied by its Strategic Implementation Plan (SIP), Raw Material Commitments and material submitted by DG GROW and DG JRC in the aftermath of this meeting.

Three empirical appraisal types have been employed in Task 2.3:

- 3 online **surveys** to capture distributed stakeholders' positions broadly. The surveys mainly gathered topics and some questions, raised by the respondents and by their external stakeholders.
- 20 **interviews** (including other individual statements) to elicit key stakeholders' positions in depth. Both, specific topics and detailed questions were raised.

- 1 **multi-stakeholder workshop** to identify non-apparent stakeholder positions and to identify joint interest of a broad range of stakeholders. Participants explored raw material information needs in focus groups on certain raw material knowledge domains.

The main focus on the appraisal was on stakeholder needs, i.e. on the topics and questions they want to get information from the MICA Online Platform. In addition, functional requirements to the MICA Online Platform were asked for in the surveys and they popped up here and there during the stakeholder workshop and the interviews.

Figure 1 shows a morphological box for the three appraisal types and their characteristics. The three different approaches are pursued to generate raw material information needs from different perspectives in different contexts.

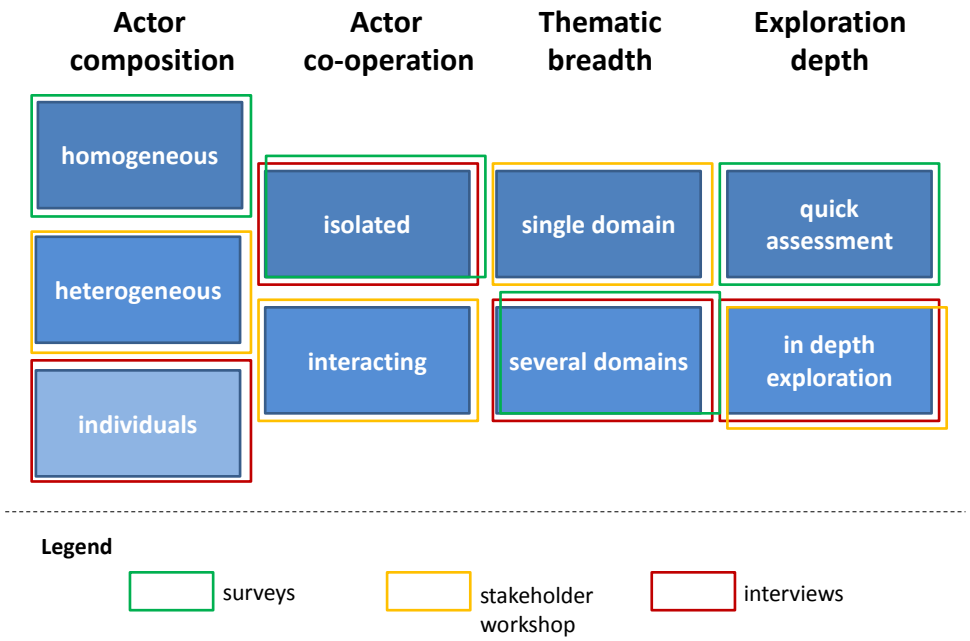


*Figure 2: Morphological box for the three appraisal types and their characteristics*

We refrain from prioritizing the stakeholders' positions according to any of the three empirical appraisal types.

⇨ The three empirical appraisal types (surveys, stakeholder workshop and interviews) **collect raw material intelligence stakes in a broad and multi-facetted way**.

## 2.2 Operationalization

The various stakeholder groups are targeted in different ways. Figure 3 provides an overview how stakeholder positions are gathered.

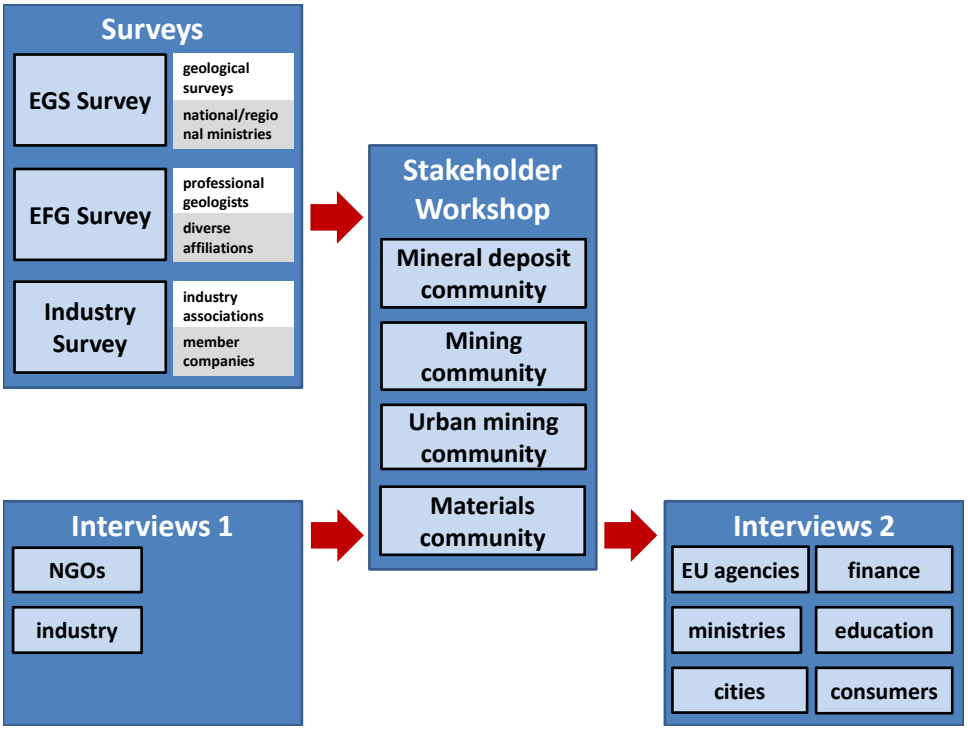


*Figure 3: Phasing of empirical appraisal type to collect stakeholder needs and requirements to the envisaged MICA Online Platform. white-/grey-shaded boxes – direct/indirect approach.*

At first, three online surveys were designed and conducted between June and September 2016.

- The EGS[3] Survey is directly targeted at the EGS members, i.e. the national and regional geological surveys in Europe. The raw material information needs of the superior national and regional ministries are asked for, too.
- Likewise, the EFG[4] Survey is directly targeted at the EFG members, i.e. professional geologists in Europe. They are employed at a wide range of affiliations such as exploration industry, mining industry and consultancies. The raw material information needs of their key clients are gathered, too.
- The Industry Survey approaches industry associations directly via cold calling. The main target groups are raw material processing and recycling industries, because they are not reached adequately via the EFG Survey. Indirectly, the raw material information needs of the member companies are collected.

Questionnaire development built upon the first Advisory Board Meeting and the first Consortium Meeting in February 2016 as well as the MICA-internal Inception Report (M1).
The three surveys center at the identification of topics and on emerging questions that should be addressed by the MICA Online Platform. The EGS Survey and the Industry Survey also ask for current and future strategic issues. The EGS and EFG Surveys gather functional requirements to the envisaged MICA Online Platform. The three survey drafts were pre-tested by various persons.

[3] MICA project partner
[4] MICA project partner

The EGS Survey and Industry Survey were launched via the EFS online survey tool by Fraunhofer ISI, the EFG Survey via Google Surveys by EFG.

The first interview phase, taking place between June and September 2016, aims to explore raw material information needs in depth:

- Interviews with industry include in particular a recycling company, industry associations dedicated to certain materials and trade associations with a broader remit.
- Interviews with NGOs include an interview with an environmental NGO, with a trade union and with a responsible mining initiative.

The interviews ask for raw-material related topics and questions of relevance, how information needs are met at the moment and what is needed additionally.

The multi-stakeholder workshop was held on 27 September 2016 at Eurometeaux's premises in Brussels. It gathered 25 participants that were assigned to four focus groups:[5]

- The Mineral Deposit Community is mainly composed of geological surveys and geological information providers & promoters.
- The Mining Community includes actors involved in the exploitation of mineral deposits such as consultancies advising investors to invest in mining ventures.
- The Urban Mining Community is made up of – among others – recycling companies, recycling initiatives and applied sustainability research institutes.
- The Materials Community predominantly consists of the material production industry converting raw materials into materials for industrial use and the manufacturing industry using these materials.

The four focus groups were informed by topics and questions already raised and had the task to cast a multi-actor perspective on the selected four raw material knowledge domains. In addition, individual participants took the opportunity provided to express raw material information needs on the raw material knowledge domains not selected for collective discussion.

The second interview phase, from October to November 2016, has the purpose to close the raw material information gaps that were identified at the multi-stakeholder workshop and along the second Advisory Board Meeting and the second Consortium Meeting that took place by the end of September 2016. It covers interviews with

- EU agencies on the environment, research and investment
- a national ministry engaged in the development of a mining region
- umbrella organizations for cities
- financial actors such as investment organizations and consultants advising investors[6]
- a secondary school teacher
- a consumer organization and a prosumer community organisation

The basic interview design was like in the first interview phase (see above).

The Ethics Deliverable D1.5 (Keulen et al. 2016) guided the involvement of people in the empirical needs appraisal as well as data processing and analysis. All contacted persons were informed about

[5] The last three communities have been slightly relabeled for this Synthesis Report.
[6] In addition, a mining investment conference was attended by one MICA partner.

the goals and background of the MICA project, and that they would not face any consequences from rejection to engage in the empirical appraisal. All statements are therefore voluntary and in the context of the MICA project.
The three online surveys are anonymous so that no single statement could be assigned to a natural person. The contact data of the invitees are kept separate from the survey responses. In the case of the EGS Survey and of the EFG Survey the respective associations used their membership databases. In the case of the Industry Survey, the interviewees and the stakeholder workshop participants, publicly available contact data retrieved from the internet was used, stored for invitation purposes only, and finally deleted. Again, no single statement can be assigned to a natural person or single affiliation by displaying the results in this report for 'industry' (survey), 'communities' (stakeholder workshop) and 'clusters' (interviews) respectively.

The survey questionnaires, interview guidelines and multi-stakeholder workshop material are provided in the Annex.

## 2.3 Data analysis and mapping

The outcomes of the empirical appraisal are processed, analyzed, classified and mapped. A draft report was discussed in a virtual meeting on 20 October 2016 by the Workshop 2 participants, which was then further elaborated by Fraunhofer ISI and finally validated by the WP2 participants giving written comments.

The **data processing** includes the following activities:

- Capture: The survey tools collect response data automatically. The stakeholder workshop statements were written on post-its by the participants themselves, complemented by taking minutes of the oral discussions. The interviews were captured during conduct by taking notes. The stakeholder workshop and interview statements both were then digitized.
- Cleaning: The survey responses were cleaned by elimination of participants who did not respond to at least half of the questions posed. Those stakeholder workshop statements that do not fall under the scope of WP2 were eliminated. The same applies to interview statements that do not express needs or requirements to RMI.
- Coding of appraisal data: All statements are given a code that assigns them to the empirical appraisal type, the concrete appraisal activity and which distinguishes the statements from one another by a suffix.
- Recoding of the Main Ontology (WP6): The Main Ontology (Version of 29 July 2016) is recoded including the domain, level 1 and level 2 to reduce the number of characters that are needed for a tagging of statements.
- Mapping of coded appraisal data to the Main Ontology (WP6): The coded data, i.e. the statements, are mapped to a recoded Main Ontology of WP6 down to level 2. It was searched for Main Ontology terms in the appraisal data and it was searched for appraisal data terms in the Main Ontology. Up to four mappings of a single statement to the Main Ontology are made.

The data processing results are stored in a spreadsheet file that contains over 700 statements.[7]

A large amount of qualitative and quantitative data is collected and analyzed.
The **basic analysis of quantitative data** is carried out in two major steps:[8]

- Frequency analysis: All quantitative data from the three online surveys are first analyzed through frequency analysis, question by question.
- Aggregate analysis: Questions that are part of several surveys are analyzed by aggregation of the respective data sets, and designation of the respective response shares in the surveys.

The core of the data analysis is about stakeholders' raw material information needs (Q3, Q4).
In addition, there are three **special analyses of quantitative data**:

- Context analysis: In the EGS Survey and the Industry Survey, current strategic issues (Q1) and future developments relevant for strategy development are collected (Q5). The analysis reveals with which mindsets the respondents actually see or will see RMI.
- Gap analysis: The need for improving access to raw material information (Q3) was mirrored against the usage of existing online platforms (Q2) to allow for a rough assessment if there are rather availability problems or navigation problems.
- Relevance analysis: The priorisations of the functional requirements to the envisaged MICA Online Platform are considered through weighting of their positions on a linear scale across respondents of the EGS Survey and EFG Survey.

The **analysis of qualitative data** incorporates the items for quantitative data:

- Content analysis: The individual statements are read in the context they were uttered and compared to other statements in the same or in another context.
- Cluster formation: In the process of mapping the single statements to the Main Ontology, semantic clusters have been built intuitively bottom-up as first-order concepts (cf. Miles et al. 2014). Some semantic clusters do not have an adequate expression in the Main Ontology pointing at a need for revision.

The treatment of quantitative data items also as qualitative data can be justified by the non-weighting of different statements and that sometimes respondents repeated qualitatively what was asked quantitatively.

As a summary, the data processing and analysis yields three **qualities of data**:

- direct statements on needs (three surveys, workshop, interviews)
- indirect statements on others' needs (three surveys)
- derived needs (interpretation of the MICA WP2 team)

It could be argued that a direct raw material information need, which is empirically confirmed, ranks higher than a single indirect interest stated only once. However, it is not within the remit of the empirical needs appraisal to undertake such weightings. We acknowledge the three data qualities as epistemic categories, but not as a guide for normative choices. In the following, we therefore do not distinguish these data qualities any more.

[7] includes double counting to allow for different stakeholders and different contexts in which a statement is uttered
[8] It is refrained from a filter analysis or bi-variant analysis because of limited response numbers within each survey.

# 3. Synthesis of results

This section presents the results of the three surveys, the stakeholder workshop and the interviews one after another in an interpretative form. Here, frequently occurring issues and novel issues are singled out accounting for the phasing of the three empirical appraisal types.
The descriptive results of the appraisal activities are displayed comprehensively in the Annex. The full set of empirical data gathered is also stored in a spreadsheet file. The extensive Annex is complementary to this section 3 *Synthesis of results* in order to document the full range of raw material information needs.

**A note on style**

- Domains are denoted in capital letters: e.g. Mineral Deposits (survey), Mineral Deposit Community (stakeholder workshop), Investment Cluster (interviews).
- Information gathered is denoted in italics in the plain text: e.g. *onshore resource potential* or *Where do we find the next megadeposit?* as qualitative data gathered or it is encapsulated in a tinted box without further formatting.
- Response options are put into quotation marks: e.g. 'improve access'.

## 3.1 Surveys

Three online surveys (EGS Survey, EFG Survey and Industry Survey) were conducted between June and September 2016. The questionnaires were co-designed by Fraunhofer ISI and other WP2 partners.

- The core of the raw material information need appraisals are questions 3 and 4. Each survey gathered raw material information needs from different target groups directly (Question 3) and also asked for raw material information needs of the respondents' key stakeholders (Question 4). Table 1 shows the direct and indirect target groups in more detail.
- Question 2 explores the usefulness (EGS Survey, Industry Survey) and frequency of use (EFG Survey) of existing raw material information platforms.
- Questions 1 and 5 of the EGS Survey and Industry Survey are about current strategic issues and future developments that could become strategically relevant by 2020.[9]
- Question 6 of the EGS Survey and EFG Survey is about functional requirements to the envisaged MICA Online Platform.

The Annex provides a comparative overview of the set of questions in the three surveys.

[9] Question 1 of the EFG Survey has been analyzed EFG internally only.

*Table 1: Three surveys for direct and indirect appraisal of raw material information needs*

| | **EGS Survey** | **EFG Survey** | **Industry Survey** |
|---|---|---|---|
| direct target groups | • national and regional geological surveys (EGS members) | • professional geologists (EFG members from a wide range of affiliations) | • industry associations |
| indirect target groups | • national and regional ministries<br>• other stakeholders | • key clients of professional geologists | • member companies<br>• external stakeholders |

The EGS Survey and the Industry Survey intended to approach institutions with strategic interests in raw material intelligence, while the EFG Survey targeted at individuals, presumably with rather operative than strategic raw material intelligence interests.

The EGS Survey and EFG Survey were facilitated by the MICA consortium partner EGS and EFG respectively, whereas the Industry Survey approached industry associations via cold calling by Fraunhofer ISI.

*Table 2: Responsivity of the three surveys' target audiences*

| | **EGS Survey** | **EFG Survey** | **Industry Survey** |
|---|---|---|---|
| sample number | 41 | 1.100 | 92 |
| number of respondents | 26 | 60 | 10 |
| response rate | 63,4 % | 5,45 % | 10,9 % |

The EGS Survey got a very high response rate (Table 2) reflecting also the high level of engagement of geological surveys in the MICA project. The EFG Survey reached out to a wide range of professional geologists, only some of which occupied with mineral raw materials. The Industry Survey has achieved a satisfactory percentage for cold calling. All in all 96 questionnaires have been filled-in (almost) completely, yielding a remarkably broad picture of raw material information needs, especially when indirectly expressed needs of respondents' stakeholders are taken into account.

### 3.1.1 EGS Survey

Out of the 26 respondents in the EGS Survey, 9 respondents refer to themselves as *strategic management*, while 17 others rather see themselves under *geological data, information and knowledge*, *research* and *public relations* respectively.

At least 15 respondents consider the suggested Current Strategic Issues (Q1) as important or very important, *budget pressure* and *public attitudes towards exploration and mining* most frequently quoted as very important.
Among the most salient Current Strategic Issues raised additionally by the respondents are:

**Additional Current Strategic Issues (Q1)**

- renewal of mineral resources experts (e.g. replenishment of staff, staff training and specialization, information platform dedicated staff)
- development of geological information system and e-commerce (e.g. form central archive of geological research, digitalization, information technologies in geology, standards for the interaction of geological information systems)

Most suggested Future Strategic Issues (Q5) are agreed upon broadly. Some items receive comparatively low levels of agreement: A *European bio-based economy* is considered important or very important only by 8 respondents, *Europe under threat* by 10 respondents and *regional economies in Europe* and a *global digital economy* by 15 respondents respectively. At the same time *social conflicts over mining*, *raw material abundance* and a *European Circular Economy* are most frequently assessed as important or very important.
Additional Future Strategic Issues, not covered elsewhere, are not raised.

Question 3 explores Needs for Improvement of Raw Material Information, namely which of the two options, 'improve access to information' and 'support responding to information needs', are considered particularly important to the respondents' work:

- For most topics in the realm of Mineral Deposits (Q3a), 20 or more respondents consider 'improve access', 'support responding' or 'both' particularly important. *Offshore resource potential* (n=17) and *investors and investment levels* (n=18) rate slightly below.
- *Above ground infrastructure* and *subsurface infrastructure* do not count among the particularly important topics for the majority of respondents (10 and 11 positive mentions respectively), whereas the other topics related to Anthropogenic Stocks (Q3b) would be clearly welcomed by 16 or more respondents.
- All suggested topics for Raw Material Supply and Demand (Q3c) and Other Fields (Q3d) are approved at least by 16 respondents.

The respondents also raise a number of issues qualitatively, some salient examples displayed below:

| | |
|---|---|
| **Mineral Deposits (Q3a)**<br>• reports of geological exploration works (geological structures and formations, mineral endowment, minerals quality, historical information, deposit information such as access etc.)<br>• innovation in Greenfield exploration techniques | **Anthropogenic Stocks (Q3b)**<br>• abandoned mine tailings chemical information, contamination<br>• electronic waste - collection rate, share of real and potential recovery |
| **Raw Material Supply and Demand (Q3c)**<br>• awareness in the major trends of European raw material development<br>• historical production data | **Other Fields (Q3d)**<br>• mineral policies at global, EU, national and regional level<br>• resource classification and inventory (licensed and proven reserves of a commodity, registered mineral resources/reserves) |

Weighting of the respondents clients by their significance (Q4a) brings *national ministries*, *exploration and mining industry*, *earth science* and *regional ministries* (in declining order) to the fore. Emerging key questions relevant to the geological surveys by 2020 (Q4b) include:

| | |
|---|---|
| **National and regional ministries (Q4b)**<br>• access to primary and secondary raw materials (e.g. land use, protected areas, infrastructure plans)<br>• information about a specific mineral resources objective and mineral resources from a specific area (e.g. prospectivity and safety of uranium in Greenland)<br>• transparent information related to concession: on license holders / exploration permits; social license to operate (exploration and mining) | **Other key clients (Q4b)**<br>• availability of building & construction materials<br>• information about a specific raw material type / commodity (e.g. location of Titanium-bearing minerals, CRM substitution issues)<br>• circular (closed) raw materials utilization: new, effective and economic technologies for secondary metals; secondary raw materials inventory and data harmonization |

Summary: The EGS Survey has reached almost two thirds of the geological surveys organized under the umbrella of EGS. Respondents consider budget pressure and public attitudes towards exploration and mining, raw material abundance and a European Circular Economy as major strategic issues. The needs for improvement of raw material information were broadly confirmed; above ground infrastructure stock and subsurface infrastructure stock not yet being an issue for the majority of respondents. Most important clients of geological surveys are – in declining order – national ministries, exploration and mining industry, earth science and regional ministries. The emerging questions raised by the respondents' clients are mainly related to primary and secondary raw material access, local availability of building & construction materials, concessions, specific minerals resource areas/objectives and raw material types, and closed raw material utilization.

### 3.1.2 EFG Survey

Out of the 60 respondents in the EFG Survey, 31 respondents state their affiliation as *consultancy/planning office* and 22 as *industry* (multiple answers possible). The most frequently mentioned principal thematic areas of work are *mineral exploration* (n=41), *earth sciences / applied geological sciences* (n=30) and *regional reconnaissance and prospection* (n=26).

Question 3 about improvement needs for raw material information yields these patterns:

- For all topics in the realms of Identification and Assessment of Mineral Deposits (Q3a) and of Exploitation of Mineral Deposits (Q3b), more than half of the respondents consider 'improve access', 'support responding' or 'both' particularly important. 28 respondents say that *offshore resource potential* is not relevant to their work.
- The responses for Anthropogenic Stocks and Recycling (Q3c) give a mixed picture: *Abandoned mining waste deposits and tailings* and *abandoned mines for future land use* are a particularly important topic for 47 and 43 respondents, *landfill mining* and the *material flows for the recovery of commodities* for 37 and 35 respondents and *subsurface infrastructure* and *above ground infrastructure* for 34 and 29 respondents.
- All suggested topics in Other Fields (Q3d) are approved at least by 39 respondents, *mineral policies* and *other policies affecting mineral extraction* receiving most answers, n=52 and n=48, with regard to being particularly important.

Some salient examples of issues raised qualitatively, are displayed below:

| **Identification and Assessment of Mineral Deposits (Q3a)** | **Anthropogenic Stocks and Recycling (Q3c)** |
|---|---|
| • exploration works (e.g. mining industry, companies involved in research for mineral deposits, university research projects for selected commodities)<br>• expertise available for selected countries | • environmental impact plans<br>• European research and innovation into treating tailings<br>• legal aspects of mine waste ownership |

Among the key clients (Q4a) most frequently mentioned are *exploration industry* (n=42), *mining industry* (n=38) and *geological surveys* (n=22).

Emerging key questions and topics raised by the professional geologists' key clients include:

**Emerging information needs of key clients (Q4b)**

Questions:

- Where could we possibly find the next "mega deposit"? (size and location)
- Where are the most suitable tailings? (size and location)
- What commodities will do best in the coming years?
- Are the countries to be invested "mining pro"?
- What is the likely timeframe for permitting a new mine?
- What is the likely timeframe for re-opening an old mine?
- Are there more cost effective exploration techniques?
- What help is available to set up a tailings reprocessing operation?

Topics:

- exploration and mining activities (e.g. in Europe)
- possibilities and outlook of financing of exploration projects
- property issues (e.g. security of tenement ownership)
- constraints to exploration and mining (social / environmental, land use, infrastructure, issues relating to water and groundwater, regulation)
- costs of extraction
- prediction of pricing of commodities
- raw material clients (e.g. European battery and electric vehicle producers)
- raw material economies (e.g. Nickel and Uranium)

Summary: The EFG Survey has enhanced the knowledge and understanding of raw material information needs of professional geologists as potential users of the envisaged online platform. They belong to four major organization types: academia / university / research institute, consultancy / planning office, geological survey and industry. The need for improving access to raw material information as well as support responding to information needs is pointed out broadly in all response categories. Exploration industry and mining industry, followed by the geological surveys and policy makers are the main clients of the respondents. The emerging questions raised by the respondents' clients are mainly related to commodity pricing, financing, tailings operations, permitting, social constraints, environmental restrictions, security constraints, infrastructure, groundwater impact and access to public data.

### 3.1.3 Industry Survey

Out of the 10 respondents in the Industry Survey, 9 respondents refer to themselves as *strategic management*. Industry associations typically cover various parts of the value chain: *component and part manufacturing* (n=8) and *primary processing*, *secondary processing*, *material production* and *semi-finished goods* (n=7, each) most frequently mentioned.

At least 6 respondents consider the suggested Current Strategic Issues (Q1) as important or very important; *competitiveness* and then *circular economy*, *chemicals regulation*, *conflict minerals*, *ethical requirements* and *Sustainable Development Goals* most frequently quoted as very important.
Among the salient current strategic issues raised by the respondents are:

**Additional Current Strategic Issues (Q1)**

- Trade regulation and policy (e.g. WTO, EU trade tariffs, anti-dumping issues, MFN decisions, China dumping, Chinese trade policy, shipment of Waste)
- Environmental regulation and policy (e.g. energy and climate; $CO_2$ emission; reform of the electricity markets, with a link to the revision of the EU Emission Trading Scheme)
- Revision of regulation schemes (e.g. anti-slavery and child labour legislation may develop into something very important, similar to conflict minerals; the impact of over-regulation, particularly on SMEs)

Most suggested Future Developments relevant for the industry associations' strategy (Q5) are widely agreed upon. All topics, but a *European bio-based economy,* are considered important or very important by at least 6 respondents. Nobody assessed the topics *raw material competition* and *raw material abundance* and *instable economies and societies* and *environment- and health-driven global raw material use* as unimportant.
Additional future developments of strategic importance not covered elsewhere include:

**Additional Future Developments of strategic importance (Q5)**

- renewal of manufacturing experts (loss of manufacturing in Europe - future skills deficits)
- design/materials (use recycled material instead of primary material)

Question 3 asks, which of the two options, 'improve access to raw material information' and 'support responding to raw material information queries', are considered particularly important to the respondents work on topics in four knowledge domains:

- For all topics in the realms of Raw Material Supply and Demand (a) and of Material Production and Manufacturing (b), 7 or more respondents consider 'improve access', 'support responding' or 'both' particularly important.
- *Subsurface infrastructure* does not count among the important topics for the majority of respondents (4 positive mentions), whereas the other topics related to Anthropogenic Stocks and Recycling (c), in particular *recycling*, *moveable product stock*, *material flows for recovery* and *agile remanufacturing* would be clearly welcomed by the respondents.
- All Other Topics suggested (d) are approved by at least by 7 respondents; but *investment cycles in exploration and mining* yields only 5 positive assessments.

The respondents also raised three major specifications qualitatively:

| **Specification of topics (Q3)** |
|---|
| • emerging technologies: global future raw material demand<br>• intermediate products (e.g. glass fibre, carbon fibre, resins)<br>• minor metals (material flows, recycling rates, life cycle analysis) |

Emerging key questions and topics relevant to the industry associations by 2020 include:

| **Members (Q4a)** | **Key external stakeholders (Q4b)** |
|---|---|
| • Life Cycle Analysis<br>• detailed information on the different recycling streams<br>• class 7 (radioactive material) port and shipping requirements | • innovation<br>• conflict mineral due diligence |

Summary: The Industry Survey has reached the strategic management of industry associations covering large parts of the value chain from material processing to recycling. Industry associations broadly emphasize the strategic relevance of trade and environmental policies and regulations. The need for improving access to specific raw material information as well as support responding to specific information needs is seen depending on the industry associations' positions in the value chain. The industry associations' members and key external stakeholders increasingly ask for life cycle analyses, recycling streams, innovations and conflict mineral due diligence.

### 3.1.4 Further analysis of survey data

The three surveys contain questions and topics that were posed to several different target groups. We have aggregated these responses to look for additional patterns in raw material needs which are presented below.

Four Current Strategic Issues (Q1) are shared by the EGS Survey (n=26) and by the Industry Survey (n=10). While *competitiveness*, *price volatility* and the *circular economy* are considered 'important' or 'very important' by 16-18 respondents, the *Sustainable Development* Goals (SDGs) stand out in combining 16 votes 'very important' compared to 8-10 respective votes for the other three strategic issues. The aggregate analysis of Future Developments relevant to strategy (Q5) does not unveil significant new insights.

The EGS Survey (n=26) and EFG Survey (n=60) participants were both asked to select three out of nine technical requirements to the envisaged MICA Online Platform (Q6). The *data selection opportunities* (n=50) and *free download of tools* (n=46) were quoted most often. 69 % of EGS Survey respondents count *usability* among the most important technical requirements compared to 23 % of the EFG Survey respondents only. Response patterns are almost reversed for *methodological guidance*, the EGS Survey respondents accounting for 23 % and the EFG Survey respondents for 48 %.

While the professional geologists, addressed as practitioners, were asked for frequency of use of existing raw material information platforms (EFG survey), geological surveys (EGS Survey) and industry associations (Industry Survey), addressed as strategic institutions, were asked to assess the platform's usefulness (Q2).[10]

- A clear majority of EGS Survey respondents finds a number of platforms *useful* or *very useful,* in particular Minerals4EU (n=25), national platforms (n=24), EGDI (n=22) and EuroGeoSource (n=22). On the other hand, several platforms are largely unknown: IRP Global Metal Flows (by n=12), CRM_InnoNet (by n=11) and the Raw Material Information System of JRC (by n=10).
- EFG Survey respondents tend not to use the suggested platforms *daily to weekly*. Adding *monthly to quarterly* usage of platforms brings national (n=31) and regional (n=20) platforms to the fore. Minerals4EU (n=25), EGDI (n=19), CRM_InnoNet (n=17) and the Raw Material Information System of JRC (n=16) show a tendency to be consulted at least quarterly.
- More than half of the Industry Survey respondents finds the CRM_InnoNet and INTRAW platforms *useful* or *very useful* (n=6 each), the remaining respondents (n=4) don't know the platforms.

EGS Survey and EFG Survey respondents both appreciate a number of geological platforms such as Minerals4EU, EGDI and national platforms. While the JRC's Raw Material Information System is often used by the EFG Survey respondents, it is largely unknown to EGS Survey respondents. On the other hand, CRM_InnoNet is often used by the mostly professional users of the EFG Survey and of the Industry Survey.

[10] The composition of the respondent structures shows that this distinction is not so easy to make. 18 out of 36 respondents of the EGS Survey and Industry Survey see themselves as *strategic management*. The same item was not collected in the EFG Survey.

One can explore what has been assessed as 'improve access' and/or 'support responding' problems by the respondents (Q3). All in all it can be stated, that respondents mostly wanted 'both, improve access and support responding'.[11]

- Mineral Deposits: 'Improve access' alone is a need for roughly a quarter to a third of EGS Survey and EFG Survey respondents taken together (n=86). Throughout all topics, EFG respondents state more frequently that they need better access to mineral deposit information than EGS Survey respondents. 'Both, improve access and support responding' is more often an issue of EGS respondents than for EFG respondents.
- Mine Development and Mining: 'Improve access' alone is a need for roughly a quarter to almost half of EFG Survey respondents (n=60). *Land use constraints*, *financing options for mining ventures*, *mining operations*, *existing and planned mining ventures* and *licensing procedures* all account for more than one third of respondents needs specifying 'improve access' alone. 'Both, improve access and support responding' are all between a quarter and a third of respondents needs.
- Anthropogenic Stocks and Recycling: 'Improve access' alone is a need for roughly a sixth to a third of EGS Survey, EFG Survey and Industry Survey respondents taken together (n=96). More than proportionately, EFG respondents state that they need better access to information for all topics, except *abandoned mining sites for future land use* which is rather an issue for EGS Survey respondents. Again, 'both, improve access and support responding' is more often an issue of EGS respondents than for EFG respondents.
- Raw Material Supply and Demand: 'Improve access' alone is a need for roughly a fifth to a third of EGS Survey and Industry Survey respondents taken together (n=36). 'Both, improve access and support responding' exceeds 50 % for *demand trends*, *supply trends* and *future criticality*. Industry Survey figures are too low to single out proportionalities in relation to the EGS Survey.

Finally, we can compare these insights into raw material information needs (Q3) to what the platforms (Q2) have to offer.

- Mineral Deposit information is mainly provided by EGDI, EuroGeosource, EURare, Minerals4EU, Minventory (also INTRAW, IRP WG Metals, ProMine, RMIS)
- Mine Development and Mining information is mainly provided by EO-Miners, i2Mine, INTRAW, Minerals4EU, ProMine (also EIT KIC, Minventory, RMIS)
- Anthropogenic Stocks and Recycling information is mainly provided by Minventory, ProSUM, IRP WG Metals (also EIT KIC, INTRAW)
- Raw Material Supply and Demand information is mainly provided by CRM_InnoNet, EIT KIC, RMIS (also EURare, INTRAW, IRP WG Metals)

Matching the services of these existing platforms with the improvements needs of the survey respondents leads to the following assessments:

**Mineral Deposits**: EGS Survey and EFG Survey respondents find especially the Minerals4EU, EGDI and national platforms useful or use them frequently. Also EuroGeosource, EURare,

[11] which is a convenient answer when answering in a hurry.

INTRAW, Minventory and ProMine are widely known. The lesser known IRP WG Metals and RMIS could fill in – at most – specific raw material information gaps. It can be concluded, that EGS Survey and EFG Survey respondents need additional information on minerals deposits that is not contained in these platforms.

**Mine Development and Mining**: A significant share of EFG Survey respondents does not use at all the platforms suggested. More than 50 % do not use EO-Miners, i2Mine, INTRAW, IRP WG Metals and commercial platforms and more than 40 % refrain from using EuroGeoSource, CRM_InnoNet, EGDI, EURare, ProMine and RMIS. In combination with the high level of 'improve access' needs that the EFG respondents stated, one can conclude first, that professional geologists do not exploit what is already there and that they need smarter and faster gateways to what get they need.

**Anthropogenic Stocks and Recycling**: Almost a third of EGS Survey and Industry Survey respondents do not know the Minventory, EIT-KIC and INTRAW platforms. The IRP WG Metals platform is unknown by more than 40 %. At the same time, 35,6 % of EFG respondents do not use the Minventory platform at all. Given the mixed picture with regard to 'improve access' needs, those who need platform support in the realm of anthropogenic stocks and recycling may already draw upon it, though not receiving information in the quality needed. The ProSUM platform has been going online, so that at least for WEEE the information situation might improve.

**Raw Material Supply and Demand**: The most relevant platforms on these topics, CRM_InnoNet, RMIS and IRP WG Metals, count among the least known ones to the EGS Survey and Industry Survey respondents. The situation is slightly better for EIT KIC, EURare and INTRAW which also host a lot of other information. The raw material information needs *demand trends*, *supply trends* and *future criticality* could be met in principle by those who are interested, but they are likely to be not sufficiently met by the existing platforms.

### 3.2 Stakeholder Workshop

The Stakeholder Workshop took place on 27 September 2016 (10.00-16.00) at the Eurometaux premises in Brussels. It gathered 25 different stakeholders in mineral intelligence both involved in and affected by the MICA project.[12] After an introduction of the project and of the envisaged EU-RMICP the first phase of the multi-Stakeholder Workshop presented and discussed the Stakeholder Report (D2.1) and the interim findings of the stakeholder needs appraisal in plenary. The second phase of the multi-Stakeholder Workshop elicited stakeholder needs in four focus groups, gathered individual stakeholder needs in other domains and reflected the findings in plenary. The agenda and list of participants are provided in the Annex.

The four focus groups were built by four different communities reflecting four raw material information domains:

- Mineral Deposit Community (D1)
- Mine Development and Mining Community (D2)[13]
- Anthropogenic Stocks and Recycling Community (D3)[14]
- Material Production and Manufacturing Community (D4)[15]

Each focus group was hosted by a table moderator and informed by a synopsis of topics and questions expressing stakeholder needs gathered so far. The focus groups were given the task (1) to specify existing raw material information needs and (2) to raise novel raw material information needs.

An Open Space provided the opportunity to raise raw material information needs individually and anonymously on four further knowledge domains:

- Raw Material Supply and Demand / Criticality (D5)
- Political and Legal Framework (D6)
- Environment and Health (D7)
- Social Accountability and Reporting (D8)

The moderators of the four focus groups reported the key findings in plenary that were then discussed as a whole.

#### 3.2.1 Minerals Deposit Community

The Mineral Deposit Community included geological surveys at EU, member-state and non-European country level as well as geological data infrastructure representatives.

Major refinements and additions include:

[12] The stakeholder workshop shared the beginning (the introduction of the project and of the envisaged MICA Online Platform) and the end (the synthesis of workshop findings) with the parallel Expert Workshop of MICA WP 4 on methods.
[13] later labeled Mining Community
[14] later labeled Urban Mining Community
[15] later labeled Materials Community

**Minerals Deposit Community**

Questions:

- When will a certain resource be profitable to extract from this deposit?
- Who is in charge for: how much building material is available locally for a certain construction project (sand, limestone, etc.)?

Topics:

- land use information, resource information and exploration information (academic, industry, public, etc.)
- information on by-products in known deposits
- information to fill the vacuum between final raw material consumption and secondary raw materials amounts

Geological surveys are both producers and providers of mineral deposit information (or at least mineral occurrences) and of historical information, and they are responsible for geographical referencing and integration.

### 3.2.2 Mining Community

The Mining Community, including mine development, included intelligence platform promoters & operators, professional associations, geological surveys as well as consultants. The discussion referred to a large extent to the questions already provided.

Major refinements and additions include:

**Mining Community**

Questions:

- Where are the sites? (disaggregated data)
- What are the inhibiting factors and risks to a mining venture?

Topics:

- overall cost of bringing a commodity to a user
- case studies of mining venture successes and failures
- facts sheets on how to approach financing case studies
- facts sheets on how to approach permitting case studies

In particular, the focus group suggested to spell out what MICA should / cannot be doing; for example provide commercial cost or political stability information – or not.

### 3.2.3 Urban Mining Community

The Urban Mining Community, dealing with anthropogenic stocks, flows and recycling, included recycling and material recovery industry, sustainable industry, geological surveys active in tailings and recycling as well as representatives from applied sustainability research institutes. Buildings, WEEE and ELV and mining wastes and tailings were discussed.

Major refinements and additions include:

**Urban Mining Community**

Questions:

- Who provides registers of waste data?
- How can people be stimulated to contribute to a Circular Economy (lifestyles, nudging, regional differences)?

Topics:

- overview on / link to existing data bases and projects (PROSUM, CWIT, etc.)
- information about what is put on the market per region annually, including trade in semi-finished products' material content
- information about current product composition and inventory of stocks (in particular buildings)
- information about use time/life time
- information about fate and flows at EoL, incl. exports/cross-border shipments
- overview of existing collection & recycling standards/certification schemes in different countries for specific waste streams (incl. unregulated markets)[16]
- categorizations of wastes and semi-finished products
- recycling efficiency, including losses

The urban mine is unstable, while the geological mine is stable. Stocks and flows at each stage in the economy need to be characterized by its amount and composition (e.g. physical and chemical properties; valuable, hazardous/toxic[17] and stream-contaminating content). Meta-information needs to be provided such as data accuracy (e.g. correctness, liability, guesstimates, how sourced?), granularity (at sub-national level, sectoral level), and being up to date (when sourced?).

### 3.2.4 Materials Community

The Materials Community, i.e. conversion of raw materials into materials for manufacturing, included industrial minerals and chemicals industry, manufacturing industry, technology platforms as well as representatives from universities.

Major refinements and additions include:

**Materials Community**

Questions:

- What materials are in what condition in what stock and in what region? (Make use of digitalization such as pervasive sensing and Google Street View)
- What are global supply chains and who are the stakeholders involved?
- Do I deal with a critical raw material?

Information needs:

- alternative materials data (chemical, mechanical, cost, availability, new regulations, EHS, etc.)
- opportunities for secondary material use throughout the value chain

This focus group concluded, that MICA can't tell what a secure, responsible and sustainable supply chain is. It should provide information that is sufficient to make one's own opinion or direct to

[16] A company already looked into it.
[17] There are sufficient databases only looking into toxics.

others' assessments (e.g. lists of critical raw materials). MICA should direct to trustable data only. Making use of digitalization to map the urban mine may involve privacy issues.

### 3.2.5 Statements on other topics

In the Open Space phase participants chose out of the four knowledge domains not treated in focus groups and attached their respective raw material information needs. Two major questions each are extracted below:

| | |
|---|---|
| **Raw Material Supply and Demand / Criticality**<br>• Are appliance makers right that any shortage will be met by substitutes?<br>• How could a dynamic criticality measurement system look like that is simple and easily repeated? | **Political and Legal Framework**<br>• What repair/remanufacture/reuse legislation is in place?<br>• How good is the level of legal enforcement in different countries/regions? |
| **Environment and Health**<br>• What are the TRLs of recycling technology for new/emerging materials?<br>• How reliable are data in existing LCA databases? | **Social Accountability and Reporting**<br>• Where does the material come from? (transparent supply chain data including social and ethical information)<br>• Which suppliers are certified? (e.g. conflict mineral scheme) |

### 3.2.6 Resumée

The Stakeholder Workshop has sharpened the raw material information needs and has brought a number of additional aspects to the fore. Major amendments generated by the four focus groups are related to actors in charge of local raw material availability and waste registers, links to existing data bases and projects, information about by-products, inventory and composition of stocks, mining venture sites, profitability and risks, supply chains / value chains, material fate between primary production and its secondary production, and properties of alternative materials for the design.

The discussion emphasized that MICA should make clear, what kind of questions users should ask to avoid that the answer might be frustrating. The parallel Expert Workshop of MICA WP 4 on methods found that a word in a question can change everything. There was dissent whether to use existing waste classifications (e.g. the WEEE Forum's disaggregation into products, components and materials: 10 categories and 54 codes) or to build other, e.g. lifestyle/activity-related classifications. Discussions unveiled that consumer-oriented and investment perspectives could add significant value to the empirical needs appraisal. The mapping of all the ongoing and past activities in raw material intelligence was seen of great value.

### 3.3 Interviews

20 interviews explore raw material information needs in depth. Most interviews were conducted via telephone, one interviewee instantly referred to a written document expressing the raw material information needs of its affiliations, one person attended a conference to report her impressions on raw material information needs and two stakeholders submitted a written statement to our questions.

Roughly half of the interviews were conducted before and thus informed the Stakeholder Workshop. The other half of the interviews picked up recommendations along with the Stakeholder Workshop, the Second Advisory Board Meeting and the Second Consortium Meeting to fill in perceived gaps in the mapping of stakeholder needs.

To make the individual statements anonymous we have built four clusters of interviews: investment, supply chain / value chain, raw materials in society and urban mining & cities. Some interviewees belong to several affiliations. Salient statements are extracted and displayed in an integrated way.

#### 3.3.1 Investment Cluster

The Investment Cluster combines individual statements of people attached to the consultancy Blenheim Natural Resources Ltd., the European Investment Bank (EIB), the Greenland Business Association, the Ministry of Mineral Resources (Government of Greenland) and the Polish Geological Survey (PGI). The focus of the interviewees is on the financing mainly of exploration and mining ventures.

Raw material information needs raised by the interviewees of the Investment Cluster include:

**Investment Cluster**

Exploration:

- willingness to invest in exploration; how do they do in different countries/areas?
- radar for Greenfield/ Brownfield exploration projects (incl. contact data of persons, progress level, regulation in different areas/countries in particular when radioactivity is involved (shipment regulation, foreign affairs, vicinity of a town, etc.)

Feasibility:

- availability and economic costs of production factors: infrastructure & local service providers (e.g. power supply, water supply, transport), local work force, fee systems and financial burdens to investors in a country/area
- duration of the procedures for obtaining a license (prospection, exploration, research, mining): how do they do in different countries/areas?
- government demands for processing the exploited raw materials within its own territory how do they do in other countries/areas?
- commodity prices: 10 year forecasts (range, assumptions) / future supply and demand 'projections' labeling should be criticized, because they are in fact scenarios.
- environmental risk assessment: scope of environmental impact assessment (EIA) reporting and modes of their approval in a country/area, presence of Green parties
- social risk assessment: level of social acceptance (around a siting area, country-level)

Mining:

- how does the industry work? mechanisms between investment in exploration, bringing a project to a point of exploitation and profit distribution

- technology development (exploration, mining, use)
- the amount that is estimated to be left from a specific raw material in the origin source
- financial models for regeneration of mining areas (up-front payments, insurance, etc.); how do they do in different countries/areas?

Urban mining:

- capital demand and allocation for a circular economy (recycling, resource efficiency)

It is important to get independent, high quality information; if no such information is available this is also important to know.

### 3.3.2 Supply Chain / Value Chain Cluster

The Supply Chain / Value Chain Cluster combines the individual statements of people attached to the industry associations Critical Raw Material (CRM) Alliance, Euroalliages, the Minor Metals Trade Association (MMTA), the DG JRC, the consultancy IF Steelman and the European Steel Technology Platform (ESTEP). The focus of the interviewees is on viewing raw materials from a demand perspective.

Emerging information needs in the Supply Chain / Value Chain cluster include:

**Supply Chain / Value Chain Cluster**

Trade:

- trade flows: up to metals, stockpiling (at the border), changes in trade flows due to changes in ownership of mines, who are the importers of conflict minerals?
- trade incentives and disincentives: tariffs, restrictions (perceived by the OECD database on export restrictions, EU Trade Commission or developing countries, e.g. EU trade barriers) and subsidies
- trade defense cases (collection), compliance of conflict minerals importers with regulations
- fair playing field for international trade; Is trade fair or not fair for the materials a designer want to use?

Materials/Design:

- frugal design (development of simplified products as is currently done for the developing world): lower cost and longer durability versus lower performance
- eco-design, labelling, etc, are gaining importance in the society
- recyclability information

Trace the creation of value/ assess sustainability through the economy:

- security-of-supply, including critical raw materials, as well as conflict minerals are increasingly important at the EU, member state, sector, and specific company levels
- understand supply chains (e.g. of conflict minerals, MICA might be a good gateway to the trade associations), monitoring and analyses of security and sustainability of supply of raw materials, what are the biggest producers? what are the biggest consumer applications?
- link between raw material and end-product: manufacturing steps up to the final product are an issue for alloying metals / minor metals / small sectors; statistical loss of alloying metals / minor metals in alloys
- information relevant for the poorly recorded recycling rate of alloying metals / minor metals
- contribution of raw materials in general and alloying metals / minor metals / small sectors in particular to the economy (jobs and growth, etc.), circular economy and sustainability
- respository of LCA data and LCA studies, assessment of their methodological leeway,

sustainability assessments of raw materials (economic, social, environmental)

Regulation:

- new regulation and monitoring of implementation / enforcement in different countries/areas
- policy-support needs for the monitoring and analyses of security and sustainability of supply of raw materials (incl. consequential analyses related to scenarios for critical raw materials)
- How does a decision to restrict a material (e.g. REACH) affect the industry using that material?
- How does the Emission Trading Scheme (ETS) affect different commodities?

There is a need for independent data sources at global scale, but disaggregated as much as possible. A cross-cutting need is to get links to policies and ongoing projects (H2020, Tender, EIT) and activities/initiatives (Raw Materials Policy, etc.).

### 3.3.3 Raw Materials in Society Cluster

The Raw Materials in Society Cluster combines the individual statements of people attached to the trade union IndustriAll (EU), the consumer organization Verbraucherzentrale (Germany), the prosumer organisation Verbund Offener Werkstätten (Germany), the Initiative for Responsible Mining Assurance (IRMA), the environmental NGO World Wildlife Fund (WWF) and the secondary school Bundesrealgymnasium und Wirtschaftskundliches Realgymnasium in Vienna (Austria). The focus of the interviewees is on social accountability of the raw material sector and empowerment of civil society on raw material related issues.

The raw material information needs gathered include:

**Raw Materials in Society Cluster**

Corporate information (primary supply):

- mining companies: including corporate policies, managers, shareholders, networks
- financial information stripped down to regions or countries: data on revenue, other financial information
- social information: safety and social policies and practices, associated to time series and when relevant to GIS
- biodiversity information: broader ecosystem impacts, people's displacement, groundwater, tailings disposal

Sector information (primary supply):

- drivers of change affecting the [mining] sector
- process information (mining, milling, consumer product manufacturing, etc.)
- technological impacts on mining (soft data on automation, 4.0 industrial revolution)
- skill needs
- global trends in safety

Emerging issues for civil society organizations (primary supply):

- reduction of Greenfield sites: urban mining, restrictions of access to raw materials (definition of NO Go areas: competing land uses)
- infrastructure development of low value, high volume commodities
- divestment from problematic minerals to strategic minerals and minerals relevant for sustainable technologies
- biodiversity mitigation hierarchy to be applied to new investments (more transparent and inclusive)

- what constitutes a fairer, more equitable distribution of benefits? what is in it for a certain stakeholder group? greater retention of value in resource rich countries through benefication
- conflict minerals: certified material (BGR on coltan/cobalt) in DR Congo to incentivise change instead of problem shifting; supply chain due diligence - feedback to sourcing and transport of raw materials
- baseline data to inform strategic planning: real-time; overview and zoom-in functionality - stakeholder analysis, geopolitical analysis, situation analysis; identify hot spots where resources have to be mobilized (in the sense of civil society activism)
- professionals with knowledge and experience to act as auditors of responsible mining standards
- black lists of mining etc. companies that do not comply with environmental and social standards (i.e. comprehensive coverage of labor and living conditions: child labor, safety, death rates, conflict minerals, environmental damage doing harm to citizens (e.g. fishing), fair trade raw materials and products)

Material / design and procurement information:

- material composition of consumer products (e.g. REE content in mobile phones; what materials does a mobile phone contain? (navigation: mobile phone - battery - element - sources / origin - social and environmental impacts - ...)
- databases on materials with functional alternatives: material properties, costs, EHS properties (health, biodegradability, recyclability, environment, energy), renewability
- how can a prosumer ensure that the materials processed do not involve child labor or stir conflicts? Is there an option to procure fairly produced raw materials? if yes: contact data of traders / consumer consulting in this regard; what do I have to consider?
- color-coded Bill of Materials (BOM) for prototypes' material content: green - social and environmental friendly material available, yellow – alternatives' properties unknown, red - no alternatives available)
- waste-hierarchy oriented ecodesign for prosumers, facilitate repair and reuse by provisions in the design (like easy dismantling or modular design), limits to repair and upcycling
- small recommendations/hand-outs for designers, innovators, makers, social businesses, small companies; which fair material is available? what do I have to do?
- buy new products: refer to independent product tests, energy efficiency classes, longvity tests, life cycle costing, resource savings, what do I need to have in mind to buy products that are recyclable?
- buy used products: buy second hand, donate used products to serious collectors, save money

Circular Economy:

- avoidance in terms of materials/waste (non-extraction), planned/programmed obsolescence, impacts of limited lifetime on raw materials/waste
- which wastes are generated in open workshops? qualitative and quantitatively; e.g. accumulation of 3D misprints & printing scrap, what is the environmentally optimal recycling path for waste generated in open workshops?
- when does it make sense to recycle processed or EoL-material locally? support of decentralized availability of recycling machines, smaller and more local material cycles; ecological break even points of recycling

### 3.3.4 Urban Mining and Cities Cluster

The Urban Mining and Cities Cluster combines the individual statements of people attached to the company UMICORE Precious Metal Refining, Eurocities, ICLEI Local Government for Sustainability

Europe and the European Environmental Agency (EEA). The focus of the interviewees is on raw material information needs related to stocks and flows of materials in the technosphere.

Raw material information needs raised by the interviewees of the Urban Mining and Cities Cluster include:

**Urban Mining and Cities Cluster**

Procurement:

- green public procurement, sustainable procurement: work with cities drafting the technical specifications of products that contain critical raw materials and materials, local application of procurement guidelines

Waste management and recycling practices

- good waste management practices in cities (data base)
- innovative waste management and technologies in cities (data base)
- local, regional and national legislation on waste management and recycling (data base)
- quality characteristics of the composition of secondary materials to coordinate demand and supply of recycled materials (data base)
- quality standards for secondary resources preventing use of secondary materials (e.g. primary concrete lobby) / no uniform standard across countries
- transboundary movements (classification as hazardous to protect local industry, EU member-state classification systems, make it easier, harmonisation of product classifications (EU projects: North Sea Resources Roundabout, EU Innovation Deals),
- fast lane procedure to certified recyclers

Urban metabolism

- Material flow analysis of cities to trace hazardous substances, critical materials and raw materials
- product and material compositions, e.g. critical material content in compounds, compound content in products, hazardous substance content in materials that hinder recycling (database)
- Estimates of (critical) raw materials in urban stocks and when they come available for the secondary market
- to what degree are we already circular? virgin material and waste statistics do not correspond, indicator

Environmental assessment:

- critical raw materials and the environment: environmental criticality, environmental impact of CRMs, CRMs for environmental technology
- cradle-to-gate environmental impacts of materials (database)
- Life Cycle Assessment of products and services accounting for repair, reuse and recycling
- environmental benefits from recycling compared to virgin material: known for aluminum, but very interesting for many other materials
- eco-design, refurbishing without melting it down: priority over substance recycling

Circular Economy

- options for local slag use: value of 5 €/t does not allow for transport
- economies of scale: capital intensive recycling plants need input from a large radius
- Explore how regional and local actors (e.g. by creating and closing local value chains) can take an active role to achieve the vision of a circular economy model

### 3.3.5 Resumée

The 20 interviews have explored raw material information needs in depth. The investment perspective is leveraged asking for area/country comparisons (e.g. exploration project radar, propensity to invest, availability and costs of production factors, financial models for regeneration). A supply chain / value chain view is promoted asking for trade-related, material/design-related, transparency and sustainability issues. A number of consumer organizations, trade unions, environmental NGOs and transparency & democracy NGOs share the need for transparent information of corporate actors / networks and differ with regard to the part of the value chain they are engaged in. Civil society actors strive for being on eye-level with private and public sector actors through better access to raw material information. The interviews on urban mining and cities specify the information needs with regard to stocks and flows, actors, best practices and actors in detail.

The interviews were arranged to explore raw material information needs in depth and to account for the stakeholders who could not be reached sufficiently via the surveys and the stakeholder workshop.

The interview protocols are grouped to four clusters for reasons of anonymization. Revisiting the list of interviewees in the Annex reveals that in particular actors from trade and finance, government and civil society organizations have been amended.

# 4. Conclusion

The empirical appraisal of needs and requirements related to RMI lead to a heterogeneous picture of a broad range of stakeholders' positions. These positions are captured in this Synthesis Report and a related spreadsheet file mainly in order to revise the Main Ontology of the envisaged MICA Online Platform. After a critical reflection of what has been achieved, major avenues for redesigning the Main Ontology are sketched.

## 4.1 Critical reflection

In this section, we review the coverage of stakeholders in the empirical appraisal, reflect nature and limitations of what we got as stakeholder positions, and discuss the effort related to the results of the different means employed to gather stakeholder needs.

### 4.1.1 Coverage of stakeholders

It was aimed at reaching mainly definitive, dominant and dependent stakeholders. Discretionary and demanding stakeholders could be considered when they showed up in the needs appraisal and dormant stakeholders were treated in a case by case assessment.

Figure 4 provides an overview to which degree and how the stakeholders were reached.

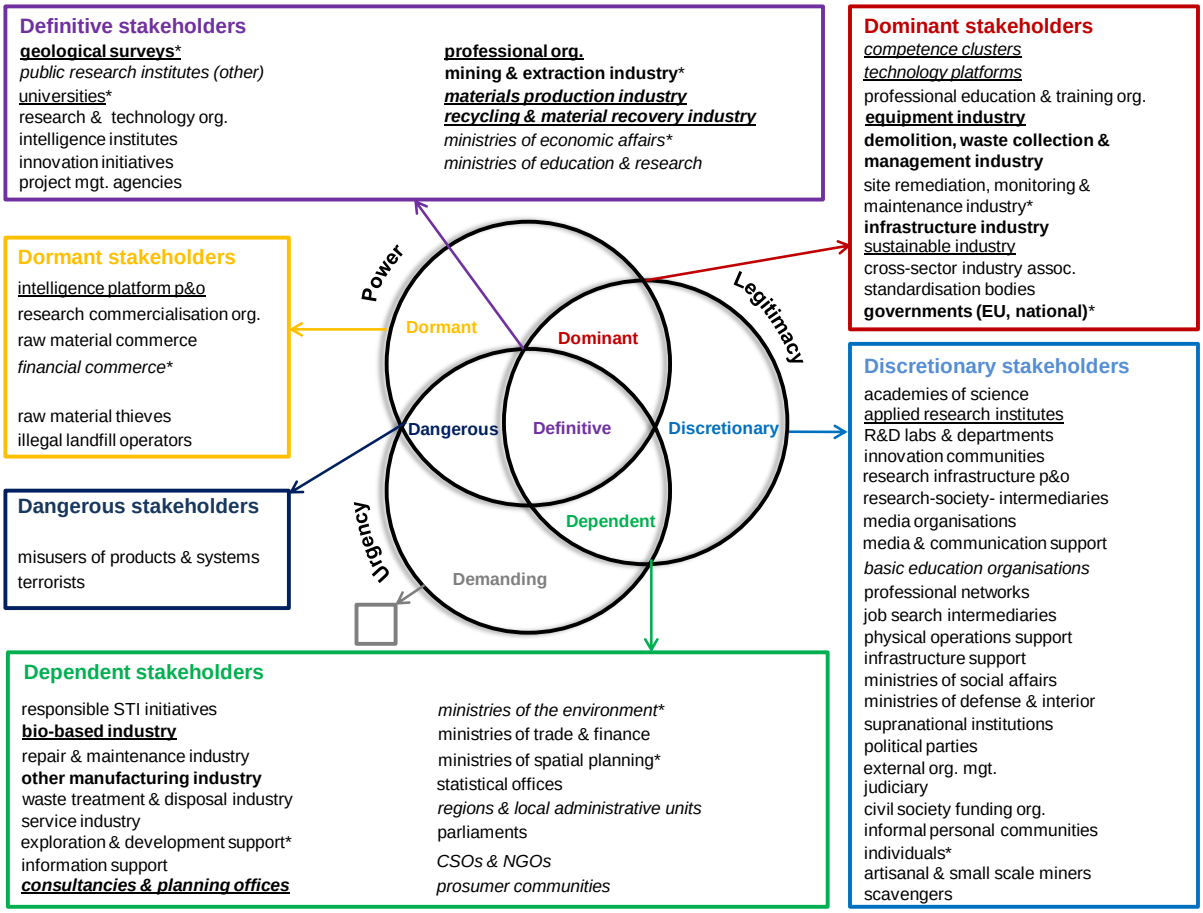


*Figure 4: 90 stakeholder groups and how they were treated. The rationale for not treating some stakeholder groups is provided in the main text. It distinguishes the surveys (in bold), the stakeholder workshop (underlined) and the interviews (in italics). Indirect appraisal in the surveys is marked with an asterix (*). Other ways of stakeholder need consideration include Advisory Board and Project Consortium Meetings (a), EIP OG (b) and Deliverable 2.1 Stakeholder Report (c), which maps stakeholder needs depicted from documents.*

Of the **definitive stakeholders,** geological surveys, professional organisations, material & extraction industry, materials production industry (construction material, metals, industrial minerals and chemicals), recycling & material recovery industry as well as (other) public research institutes and ministries of education & research all are reached through surveys and/or additionally the workshop or interviews. Other definitive stakeholders' positions are accounted for extensively through Advisory Board and Project Consortium Meetings (a), EIP OG (b) and Deliverable 2.1 Stakeholder Report (c), which maps stakeholder needs depicted from documents (cf. Figure 1).

Key **dominant stakeholders** such as the mechanical, electric & electronic and transport equipment industry, infrastructure industry, demolition, waste collection & management industry and governments are sampled through the surveys directly. Competence clusters' and technology platforms' needs are leveraged through interviews and the stakeholder workshop respectively. Professional education & training organizations are considered to be sufficiently covered through

the professional associations' EFG Survey (geology) and ISIE membership (industrial ecology) of a MICA WP leader.

The mobilization of **dependent stakeholders** required substantial efforts. While the bio-based industry showed up in the form of one workshop participant and one survey respondent only, consultancies & planning offices' needs and requirements are leveraged through interviews and the workshop. An extensive interview series captured the positions of an environmental agency, city organisations, CSOs and NGOs (transparency & democracy NGO, environmental NGO, trade union, consumer organization)[18] and prosumer communities. All were invited to the stakeholder workshop, but did not show up. Likewise responsible STI initiatives, repair & maintenance industry, waste treatment & disposal industry and parliaments did not respond to our enquiries.

Given these difficulties in acquisition of dependent stakeholders, we also refrained from inviting the service industry (e.g. tourism industry affected by offshore mining), cross-sector industry associations, standardisation organizations and ministries of trade & finance because activation of these stakeholders for the MICA project's purposes is expected to be extremely difficult.

Information support and statistical offices were not invited as their purposes are rather instrumental than having raw material intelligence needs in itself.

In addition to the direct involvement of dependent stakeholders we gathered stakeholder needs indirectly through the surveys, in particular of exploration & development support and ministries of spatial planning.

**Dormant stakeholders** were involved on a case by case assessment. Intelligence platform providers and operators contributed to the workshop. While interviews with investors and banks tapped into financial commerce issues, the raw material commerce stakeholders were invited but not responding. However, their positions are presumably covered to a large extent through interviews with trade associations.

**Discretionary stakeholders**' positions include the workshop participation of an applied sustainability institute and an interview with a secondary education affiliation.

**Dangerous** and/or **urgent stakeholders** did not show up during the empirical needs appraisal.

The second Advisory Board Meeting counted especially SMEs, NGOs, EU policy makers and – to a lesser extent education and research – among the main potential users of the MICA Online Platform.

⇨ The empirical needs appraisal **reached stakeholders in RMI systematically and in large breadth**, despite its shortcomings here and there.

[18] Development aid & relief CSOs', social welfare CSOs' and human rights NGOs' needs are believed to be largely covered by the umbrella transparency and democracy NGO interviewed. World view organizations and other special interest groups are very unspecific and thus not considered.

### 4.1.2 Methodological implications

The composition of various methods in the appraisal of raw material related needs has lead to diverse pieces of knowledge of different quality. It was attempted to treat any of these knowledge pieces as a legitimate claim in RMI. Therefore we refrain from judging and weighting of the bits and pieces. As any project, the MICA project is limited in its financial and human resources, thus restricting the amount of work that can be actually done to leverage raw material information needs. Under these restrictions, the choices made deserve particular attention.

All in all, we are of the opinion that the picture of raw material needs and requirements is very comprehensive, but far from complete or perfect. Due to the other MICA Work Packages' information needs, the three surveys, the stakeholder workshop planning and the interview phase all fell into summer time, causing difficulties in reaching the right people for the right purpose at the right time. The broad scope of MICA made approaching stakeholders a perpetual challenge, because they filter their world according to their focused remits. All people could only be addressed through targeted information in making use of the broad knowledge and contact networks of the MICA WP2 partners.

We strived for a high transparency of stakeholder choices. The commitment to engage was high for the definitive and dominant stakeholder groups, while dependent stakeholders were not reached to the same extent. However, we conducted a series of interviews particularly with dependent stakeholders which explored their raw material related information needs in depth.

The effort for the empirical appraisals can be mirrored against other means to leverage stakeholders and their needs. The quick and easy World Café has identified the majority of stakeholder groups already, however without gathering their stakes. The desk research done in the Stakeholder Mapping Report (D2.1) uncovered a lot of stakes that are already addressed in other arena such as R&I programmes and consultations. Only the empirical appraisal is really suitable to identify emerging issues and to actually explore stakeholder needs. The surveys have added broad legitimacy for topics to be considered, the stakeholder workshop has delivered a focused perspective of diverse stakeholders and the interviews have given depth to the analysis of needs and requirements of particular stakeholders related to raw materials.

⇨ Taking into account the methodological approach and the research restrictions, the entire picture of needs and requirements related to RMI is considered **sufficiently diverse and comprehensive**.

## 4.2 Avenues for redesigning the MICA Ontology

As an outlook, avenues for redesigning the MICA Ontology in its version of 29 July 2016 are suggested. We can distinguish specification needs ('s'), expansion needs ('e') and clarification needs ('c'). Ten hypotheses point at major avenues for a further development of the MICA Ontology.

1. *Differentiate existing concepts according to stakeholders' perceptions of the raw material field (s)*

The material gathered gives hints, how stakeholders see the raw material field. In particular the current and future strategic issues explored in two surveys may frame their perceptions in the coming years. In addition, a number of concepts can be rephrased, reframed and refined according to the manifold contributions.

2. *Consider to allow navigating the numerous raw-material related actors, initiatives and projects at EU and other levels (c)*

A frequently reoccurring need is to browse though all the actors, initiatives and projects, in particular at EU level. All stakeholder engaged in policy-making at EU level would benefit from such a navigation opportunity. This perspective could be either integrated into the thematically structured Main Ontology, or be enabled through a separate entry point.

3. *Unlock the black box of materials fate between virgin raw materials and waste statistics (s)*

The economic statistics starts with primary raw materials and ends with secondary raw materials, both singled out in their material form. Across a broad range of stakeholders (governments, industry, NGOs, research), there is a need to trace and map the material content (stocks and flows), up the value chain to consumption (concealed in intermediates, products) and down to recycling (concealed in historical stocks and waste).

4. *Technology/innovation (available/emerging) appears to be a raw-material related need within several domains (c)*

Stakeholders mention a need to be informed about available and emerging technologies/innovations here and there. There is no salient need related to a particular part of the raw material domain, but the repeated emergence of technology/innovation information needs could point at a general requirement to the MICA Online Platform.

5. *Disentangle raw material supply chains / value chains (s)*

All kind of stakeholders would appreciate better access to information on supply chains and value chains. To date, stakeholders who can afford consultancies' reports and advice have to rely on their information, which is not validated through others. There is a clear need for a gateway to independent and reliable information.

6. *Introduce a material/design perspective on raw materials (e)*

Raw materials are seen by designers or procurers from a demand perspective. In addition to material properties, a number of additional properties are gaining importance to foster secure, sustainable and responsible supply chains (e.g. EHS data, child labor). The moralization of material markets is also driven by prosuming communities, pioneering enterprises and ethical investment.

7. *Disclose financial information on mining companies and networks (s)*

Mainly dependent stakeholders frequently ask for shedding light on company structures, financial flows, investments and revenue streams in particular on the primary raw material side and up the value chain to final product manufacturing. This need is motivated in the ambition to be at eye-level with the often professional actors in policy-making, agenda-setting and negotiations.

8. *Account for trade as a well visible concept (e)*

The issue of raw material trade pops up frequently, even without having approached raw material trading companies. Raw material trade includes the related physical and financial flows. As in the case of the material/design perspective on raw materials, downsteam actors and societal actors perceive raw material from a trade perspective.

9. *Sort out, if and how to address procurement, standards, skills, property issues and communication (c)*

A number of themes brought up might be already embodied somewhere in the Main Ontology. It needs to be clarified whether the topics of procurement, standards, skills, property issues and communication shall be addressed at all and if yes, if they should not be displayed better accessible to account for the several claims emanating in the appraisal.

10. *Provide orientation according to the Sustainable Development Goals (s)*

Under the strategic issues, asked for in the surveys, the most often cited item is the Sustainable Development Goals. They also emerged again and again in open questions. Setting the agenda for a broad range of governments worldwide, the categories provided by the SDGs may assist in restructuring the Main Ontology.

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# 6. Annex: Basic information and detailed results of the empirical appraisal activities

## 6.1 Surveys

| Q | EGS survey | EFG survey | industry survey |
|---|---|---|---|
| 1 | How important are the following strategic issues for your geological survey?<br>(very important, important, unimportant, I don't know) | Please let us know your opinion on EFG's media<br>(I strongly agree, agree, disagree, strongly disagree, no opinion) | How important are the following strategic issues for your industry?<br>(very important, important, unimportant, I don't know) |
| 2 | How useful are the following raw material information platforms for your geological survey? (very useful, useful, useless, I don't know) | How often do you use these raw material information platforms?<br>(daily to weekly, monthly to quarterly, yearly or less frequent, not at all) | How useful are the following raw material information platforms for your industry?<br>(very useful, useful, useless, I don't know) |
| 3 | Which of the two improvement options do you consider as particularly important to your work?<br><br>(improve access, support responding, both, not relevant to our work)<br>a) mineral deposits<br>b) anthropogenic stocks<br>c) raw material supply and demand<br>d) other topics | Choose your needs for improvement of raw material information on the following themes<br><br>(improve access, support responding, both, not relevant to our work)<br>a) mineral deposits<br>b) mine development & mining<br>c) anthropogenic stocks and recycling<br>d) other topics | For which topics do you need better access to raw material information and/or support by responding to your specific raw material information needs?<br>(improve access, support responding, both, not relevant to our work)<br>a) raw material supply and demand<br>b) material production and manufacturing<br>c) anthropogenic stocks and recycling<br>d) other topics |
| 4 | Who are your key clients?<br>Please sort the client groups by relevance to your geological survey's extent of work<br>• Please fill in up to 3 most urgent, emerging raw material information needs of your national / regional ministries<br>• Please fill in up to 3 most urgent, emerging raw material information needs of your other key client | Who are your key clients?<br>Please select up to 3 key clients of your work<br><br>• What are emerging questions raised by your key clients, which might influence your work significantly until 2020? | • Please fill in up to 3 emerging key raw material information needs of your members<br>• Please fill in up to 3 emerging key raw material information needs of your external stakeholders |
| 5 | How important are the following future developments for your geological survey by 2020?<br>(very important, important, unimportant, I don't know) | | How important are the following future developments for your industry by 2020?<br>(very important, important, unimportant, I don't know) |
| 6 | What are your most important technical requirements to the envisaged MICA online platform?<br>Please select up to 3 most important functional requirements. | Please select up to 3 most important requirements that could make you an actual user of the MICA online platform | |

| | | | |
|---|---|---|---|
| 7 | | what's the type of organisation you work for?<br>• industry<br>• geological survey<br>• public authority<br>• academia, university, research institute<br>• consultancy / planning office<br>• other | part(s) of the value chain that your industry association covers<br>• processing of primary raw materials (e.g. blast furnace processing iron ore)<br>• processing of secondary raw materials (e.g. electric arc furnace processing steel scrap)<br>• basic material production (e.g. metals, burnt lime, etc.)<br>• material production (e.g. production of alloys, cement, composites, etc.)<br>• semi-finished products (e.g. coils, ingots, etc.)<br>• component and part manufacturing<br>• final end-product manufacturing<br>• construction and civil engineering<br>• installation of equipment<br>• dismantling (buildings, infrastructure, industrial facilities, etc.)<br>• waste collection and management |

| | | | |
|---|---|---|---|
| | Please tick your position at the geological survey:<br>• strategic management<br>• geological data, information and knowledge<br>• minerals research<br>• public relations | Please tick the principal thematic area(s) you work in:<br>• regional reconnaissance and prospection<br>• mineral exploration<br>• planning of mining ventures<br>• development/engineering of mining ventures<br>• financing of mining ventures<br>• licensing of mining ventures<br>• mining operation<br>• mining support services (consumables, explosives, etc.)<br>• environment, health and safety (EHS) issues of mining<br>• long-term stewardship of mines<br>• land use planning<br>• earth sciences and applied geological sciences<br>• professional training<br>• other: please specify | your position(s)<br>• strategic management of industry association<br>• public relations, information and communication of industry association<br>• technical committee / technical working group<br>• member company |

### 6.1.1 EGS Survey

#### *Basic information*

The EGS Survey took place between 22 June 2016 and 9 September 2016 using the EFS online tool. The questionnaire was co-developed by Fraunhofer ISI, EGS and LNEG including a pretest. 41 EGS members, national and regional geological surveys were invited to participate. Out of these, 26 geological surveys responded (almost) completely. This yields a response rate of 63,4 %.

The respondents were asked to indicate the profile of their activity at the respective geological survey (Figure 5).

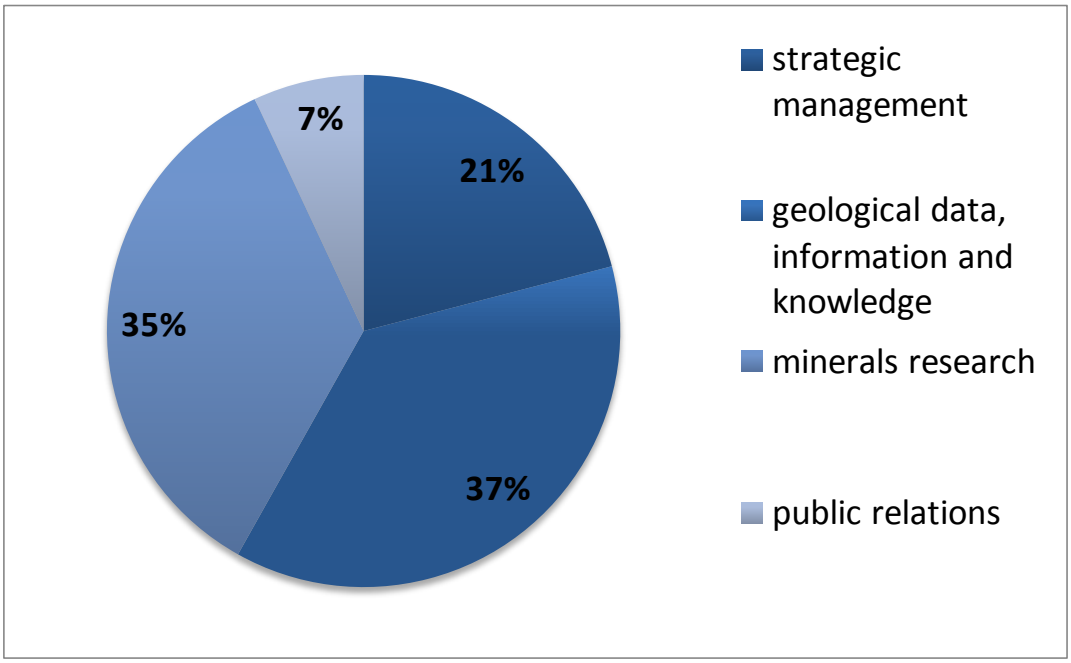



*Figure 5: Distribution of occupancy profiles of the 26 respondents in the EGS Survey. Multiple answers were possible (n=43).*

Only 9 out of 26 respondents assign themselves to the strategic management, whereas the most respondents' work profiles includes geological data, information and knowledge (n=16) and minerals research (n=15). Thus, the original intention to reach the strategic management of geological surveys has been achieved to an extent lower than expected.

#### *Results*

The results were analyzed question by question. Taking into consideration the total response numbers we present the results graphically and in absolute numbers, and refrain from indicating percentages.

**Q1 How important are the following current strategic issues for your geological survey?**

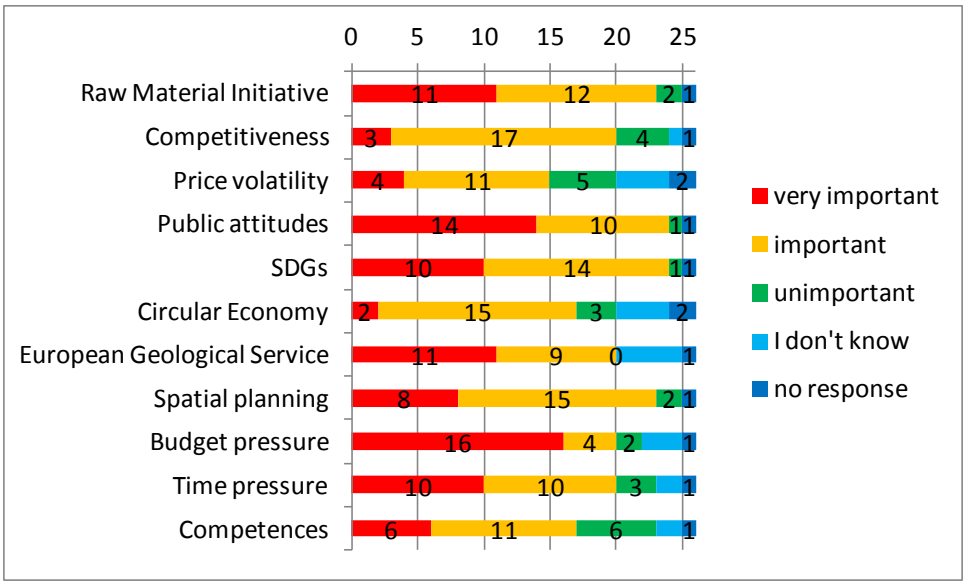



*Figure 6: Importance of Current Strategic Issues for geological surveys (n=26). SDGs – Sustainable Development Goals. Items shortened (for original items: see Appendix 1).*

The suggested current strategic issues are widely approved by the respondents as 'important' or 'very important' (Figure 6). *Budget pressure* on the geological survey (n=16) and *public attitudes* towards exploration (n=14) are clearly seen most frequently as 'very important'.

Selected amendments:

- renewal of minerals resources experts
- development of geological information system and e-commerce

**Q2 How useful are the following raw material information platforms for your geological survey?**

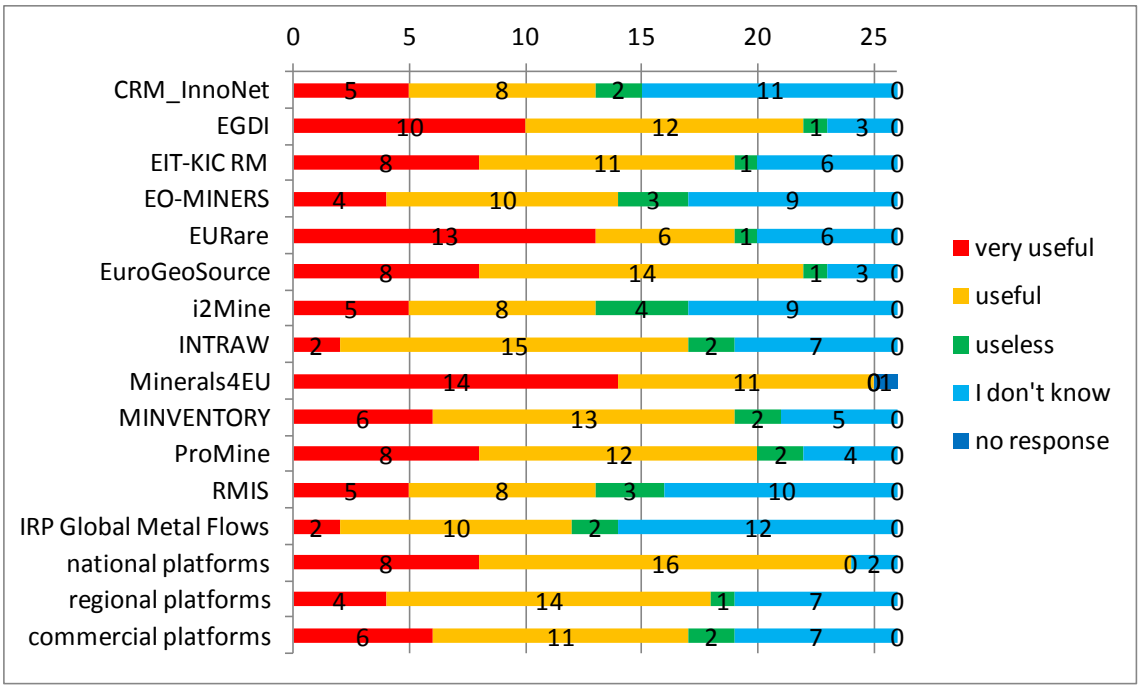



*Figure 7: Usefulness of existing raw material information platforms for geological surveys (n=26). Items shortened (for original items: see Appendix 1). For the project acronyms: see list of abbreviations and acronyms.*

Respondents consider most of the raw material information platforms provided in the questionnaire as 'useful' or 'very useful' (Figure 7). The *Minerals4EU* and *EURare* platforms yield by far the highest approval rates in terms of 'very useful' (n=14 and n=13 respectively). It is striking that *IRP Global Metal Flows*, *CRM_InnoNet*, the JRC's *RMIS*, *EO-MINERS* and *i2Mine* are not known by many respondents (n=14 to n=9 in declining order).

Selected amendments:

- ProSUM
- USGS

**Q3: Which of the two improvement options (improve access / support responding) do you consider as particularly important to your work?**

**Q3a: Mineral Deposits**

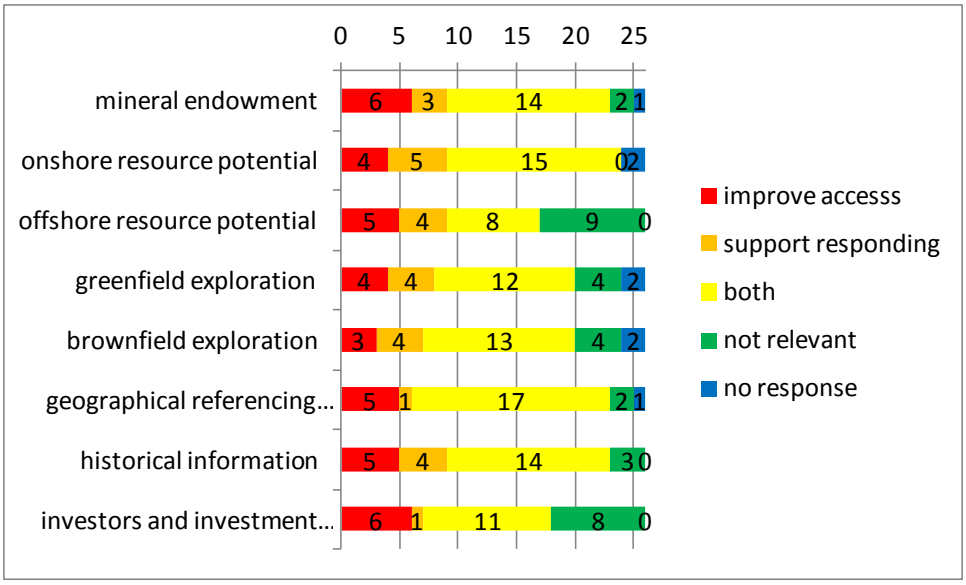



*Figure 8: Improvements needs of geological surveys in the realm of Mineral Deposits (n=26). Items shortened (for original items: see Appendix 1).*

Most items in the realm of Mineral Deposits require 'both', improve access to raw material information and support responding to stakeholder questions (Figure 8). *Offshore resource potential* and *investors and investment levels* are topics not relevant to n=9 and n=8 respondents respectively.

Selected amendments:

- reports of geological exploration works
- innovation in Greenfield exploration techniques

## Q3b: Anthropogenic Stocks

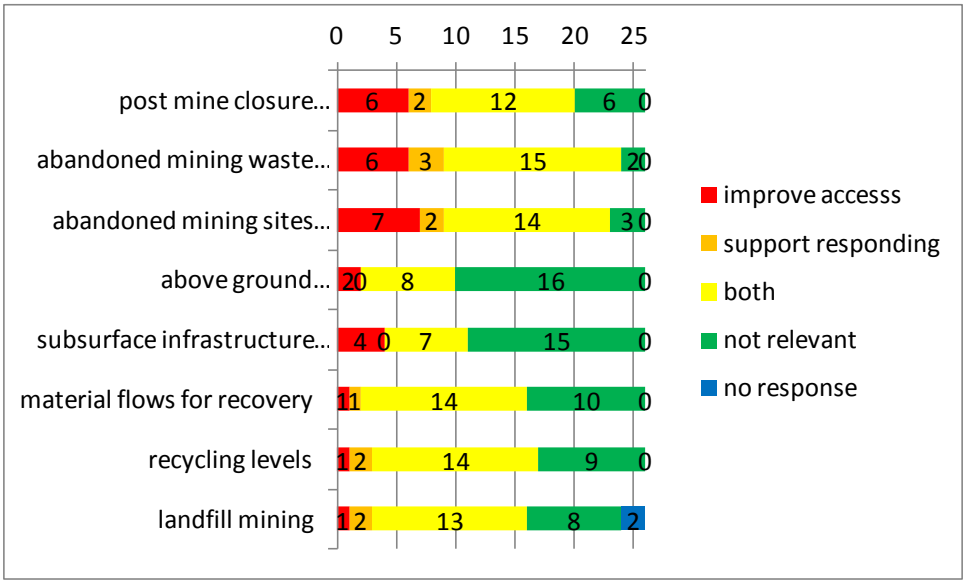



*Figure 9: Improvements needs of geological surveys in the realm of Anthropogenic Stocks (n=26). Items shortened (for original items: see Appendix 1).*

Again, 'both', improve access to raw material information and support responding to stakeholder questions is most frequently cited as improvement need, except for *above ground infrastructure* and *subsurface infrastructure*, which are not relevant topics for n016 and n=15 respondents respectively (Figure 9).

Selected amendments:

- abandoned mine tailings chemical information, contamination
- electronic waste – collection rate, share of real and potential recovery

## Q3c: Raw material Supply and Demand

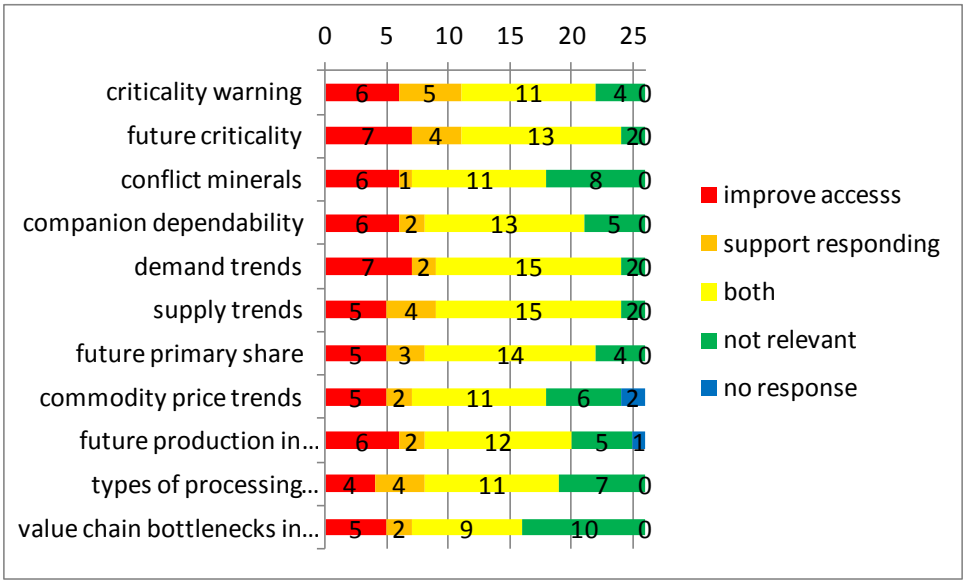



*Figure 10: Improvements needs of geological surveys in the realm of Raw Material Supply and Demand (n=26). Items shortened (for original items: see Appendix 1).*

For all topics suggested 'both', improve access to raw material information and support responding to stakeholder questions occurs as the improvement need of most respondents (Figure 10). *Value chain bottlenecks in Europe* appears to be an irrelevant topic for 10 respondents.

Selected amendments:

- awareness in the major trends of European raw material development
- historical production data

## Q3d: Other Fields

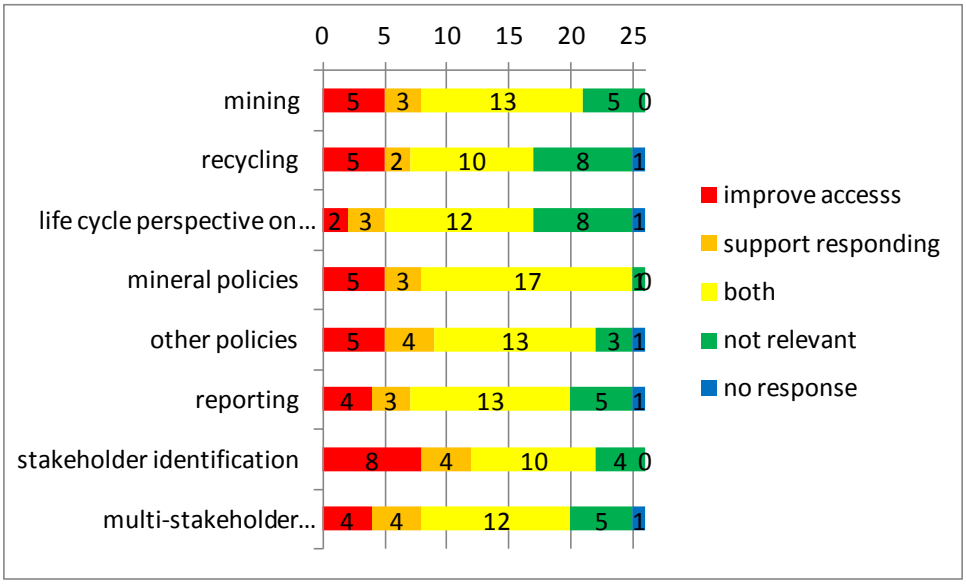



*Figure 11: Improvements needs of geological surveys in Other Fields (n=26). Items shortened (for original items: see Appendix 1).*

The topics suggested in other fields also require 'both', improve access and support responding (Figure 11). Salient are the 8 respondents who see stakeholder identification merely as an access problem.

Selected amendments:

- minerals policies at global, EU, national and regional level
- resource classification and inventory

**Q4a Who are your key clients?** Please sort the client groups by relevance to your geological survey's extent of work

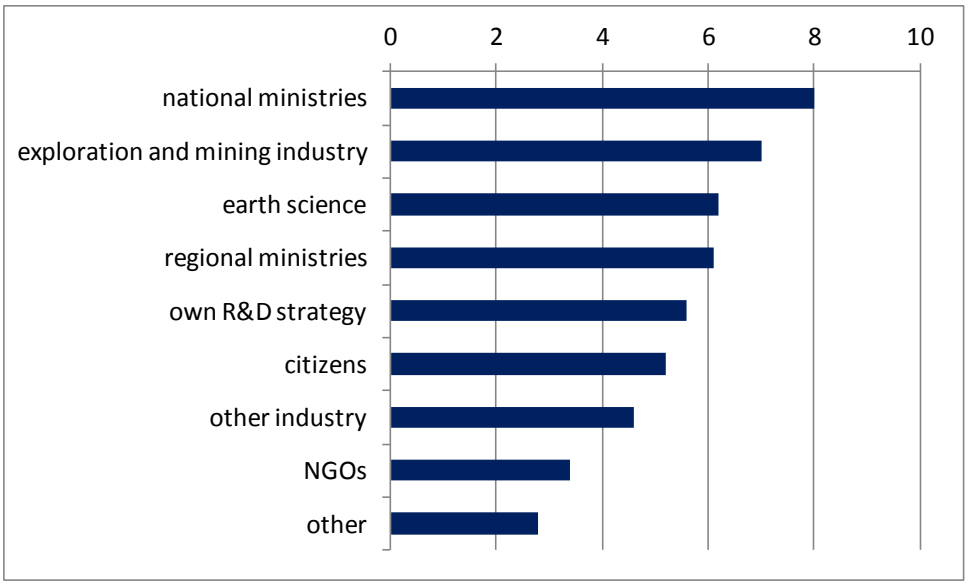



*Figure 12: Relevance index of client groups in declining order for geological surveys (n=26). The number of assessments received for each position is weighted with the position rank and summed up yielding the relevance index.*

On average, national ministries are the most important client group for the responding geological surveys (Figure 12). They are followed by the exploration and mining industry, earth science and regional ministries.

**Q4b What are emerging questions raised by your key clients?**

Selected emerging questions (national and regional ministries):

- access to primary and secondary raw materials
- information about a specific mineral resources objective and mineral resources from a specific area
- transparent information related to concession

Selected emerging questions (other key clients):

- availability of building and construction materials
- information about a specific raw material type / commodity
- circular (closed) raw materials utilization

**Q5 How important are the following future developments for your geological survey by 2020?**

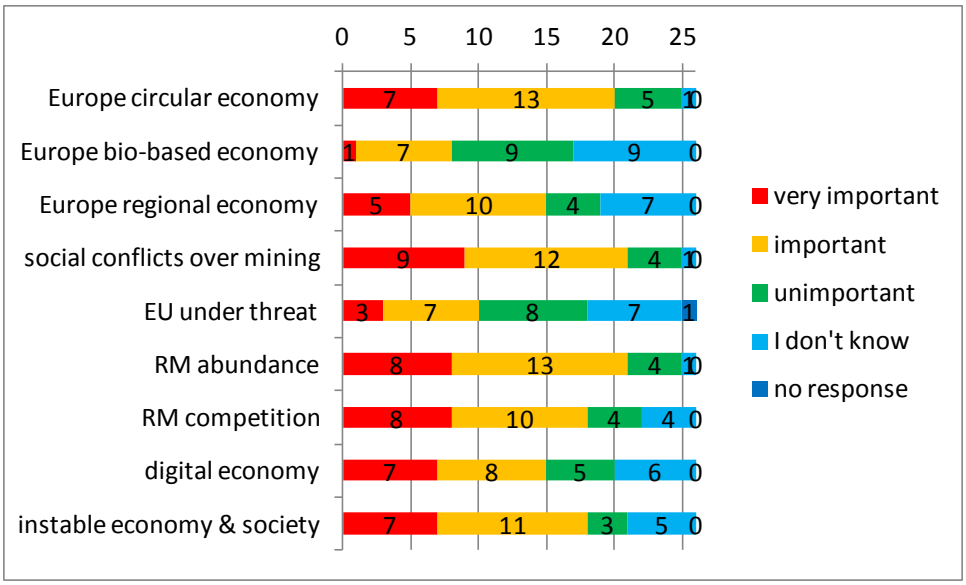



*Figure 13: Importance of Future Developments that could become relevant for the strategies of geological surveys by 2020 (n=26). Items shortened (for original items: see Appendix 1). RM – raw materials.*

Most future developments suggested are seen as relevant to the development of geological surveys' strategies by 2020 (Figure 13). A *bio-based economy in Europe* and *EU under threat* are unimportant for n=9 and n=8 respondents. In addition, many respondents don't know the importance of these two items and of a *regional economy in Europe*. All in all, the future uncertainty is reflected in the hesitant or rejecting response patterns to a certain extent.

Amendment (the only one received):

- new technological developments requiring a different package of raw materials to produce these new technologies

**Q6 What are your most important technical requirements to the envisaged MICA Online Platform?** Please select up to 3 most important functional requirements.

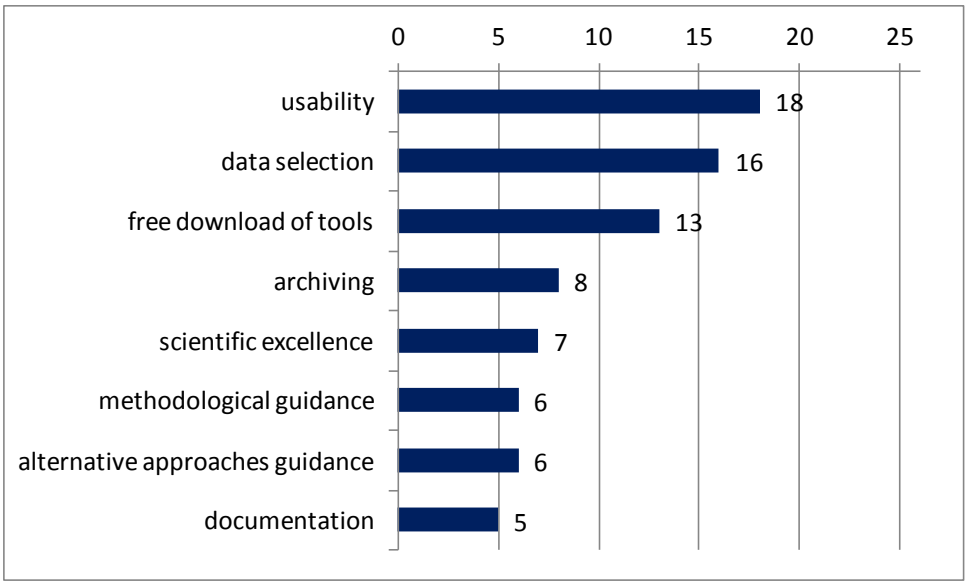



*Figure 14: Importance of technical requirements to the envisaged MICA Online Platform by frequency of mentions through the geological surveys (n=26). Three out of nine given technical requirements could be selected.*

Respondents of the EGS Survey mainly ask for usability of the MICA Online Platform (n=18) and in-built data selection features (n=16) (Figure 14).

Selected amendments:

- datasets need to be complete or gaps need to be indicated. Quality must be assured.
- explanation of terms, methods, etc.

### 6.1.2 EFG Survey

#### *Basic information*

This report details the outcomes of a survey designed for professional geologists as part of the works being developed by the MICA project. The survey has been conducted in the period from 21 June 2016 till 8 September 2016. The Google forms platform was used to prepare the questionnaire that was distributed via e-mail. The MICA survey and an Invitation letter (Appendix 2) together with the Mica data protection statement (Appendix 6) and a MICA leaflet were sent to participants in an e-mail message that included the link to the online survey.

The survey covered four main topics:

1. Use of raw material information platforms;
2. Needs for improvement of raw material information;
3. Emerging information needs of key clients;
4. Requirements to the online platform.

The universe surveyed comprised professional geologists, European Geologist (EurGeol) title holders. The EurGeol title is a professional title created by the European Federation of Geologists which recognizes the ability to deliver a high quality of services within the practice of geology. The title held by a professional geologist means that the holder has achieved suitable academic training and a level of professional experience, skill and competence to perform tasks within their professional practice. It also means that the geologist undertakes continuing education and training, demonstrating a personal commitment to stay up to date and informed within the sphere of their professional work. The EurGeols come from 21 European countries (UK, Ireland, Spain, Germany, France, Italy, Portugal, Finland, Hungary Belgium/Luxembourg, Sweden, Switzerland, Serbia, Netherlands, Czech Republic, Poland, Greece, Russia, Slovenia and Ukraine) as well as USA, Canada, Australia and South Africa covering different area of expertise such as: $CO_2$ Geological storage, Education, Engineering geology/Geotechnics, Geological heritage, Geothermal energy, Hydrogeology, Management, Minerals, Natural hazards, Oil and gas, Paleontology, Petrology, Sedimentology and Soil.

From the universe of EurGeols of 954 in total, 59 responses have been collected. This corresponds to a response rate of 6.2%. This rate is considered as a normal value in market research surveys. Considering that approximately 40% of all EurGeols work in mining, and that the survey was aiming professionals working in the raw materials field, the response rate increases to 15.5%.

The age of the majority of the respondents (79.3%) falls in the group of 40-60 years and older (Figure 15). This is in a line with the characteristics of the universe of EurGeols.

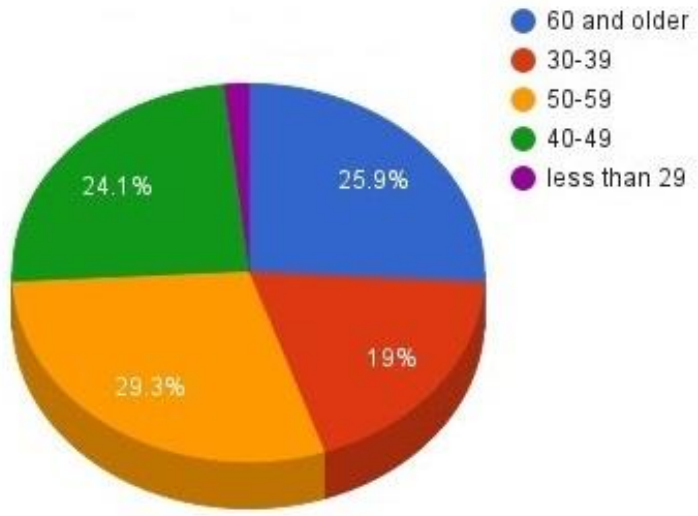



*Figure 15. Age distribution of the respondents.*

According to the responses, EurGeols work mostly in consultancy/planning office and industry, followed by the geological survey and academia/university/research, both in Europe and worldwide (e.g. Canada, Tanzania, Sudan, Peru, Morocco, DR Congo, China, India, Libya, Ghana, USA).

Four main groups of respondents have been established (Academia / University / Research institute, Consultancy / Planning office, Geological survey and Industry) according to their choice of the organization type they work for (Figure 16). These will be considered for future analysis as 'respondent categories' (only one response has been received representing "public authority" and "other" which are not representative for this survey, thus not considered further):

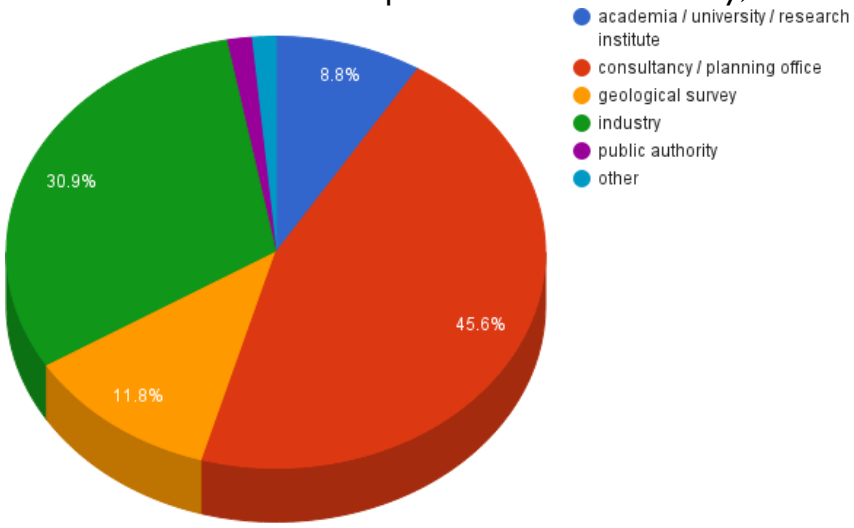



*Figure 16. Four main groups of EurGeols based on organization type they work for.*

In general, the respondents are mainly working in the following thematic areas: a) mineral exploration; b) earth science / applied geological sciences; and c) regional reconnaissance and prospection (Table 3).

*Table 3. Distribution of the principal thematic area respondents work in.*

| **Thematic area** | **Number of responses** | **Percentage (%)** |
|---|---|---|
| Regional reconnaissance and prospection | 26 | 44.1 |
| Mineral exploration | 41 | 69.5 |
| Planning of mining ventures | 13 | 22 |
| Development/engineering of mining ventures | 10 | 16.9 |
| Financing of mining ventures | 5 | 8.5 |
| Licensing of mining ventures | 7 | 11.9 |
| Mining operation | 14 | 23.7 |
| Mining support services (consumables, machinery, etc.) | 0 | 0 |
| Environment, health and safety (EHS) issues of mining | 12 | 20.3 |
| Long-term stewardship of mines | 3 | 5.1 |
| Land use planning | 7 | 11.9 |
| Earth sciences / applied geological sciences | 30 | 50.8 |
| Professional training | 14 | 23.7 |
| Other | 8 | 13.6 |

Since multiple answers were possible to this question, around 93% of respondents chose several thematic areas. A closer look into the above mentioned respondent categories shows different trends of the thematic areas they work in.
The respondents working for Academia/University/Research institute (6 responses) are mainly involved in a) earth sciences/applied geological sciences; and b) mining exploration (Figure 17).

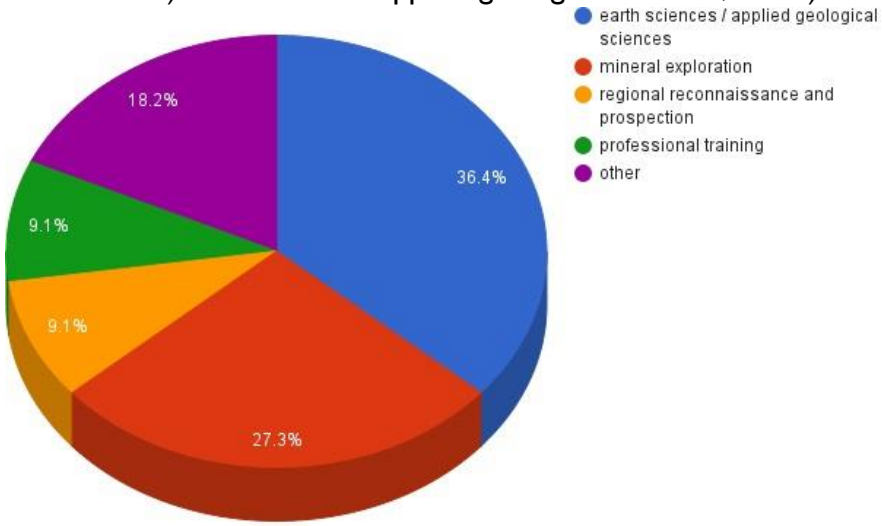



*Figure 17. Distribution of the thematic areas respondents work in within the Academia / University / Research respondent category.*

The respondents working for Consultancy/Planning office (31 responses) are mainly involved in a) earth sciences/applied geological sciences; and b) mineral exploration (Figure 18). Other thematic area indicated by this respondent category is environmental protection, monitoring and evaluation (two responses).

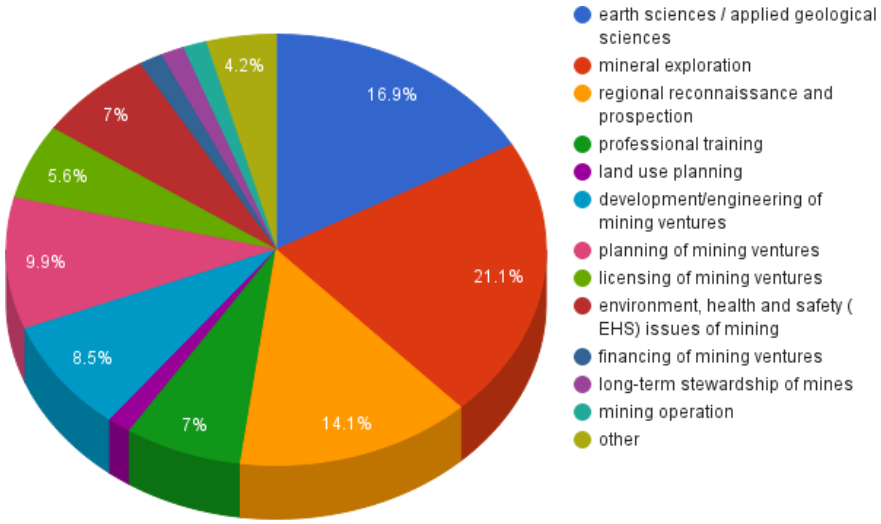



*Figure 18. Distribution of the thematic areas respondents work in within the Consultancy/Planning office respondent category.*

The respondents working for Industry (21 responses) are mainly involved in mineral exploration (Figure 19).

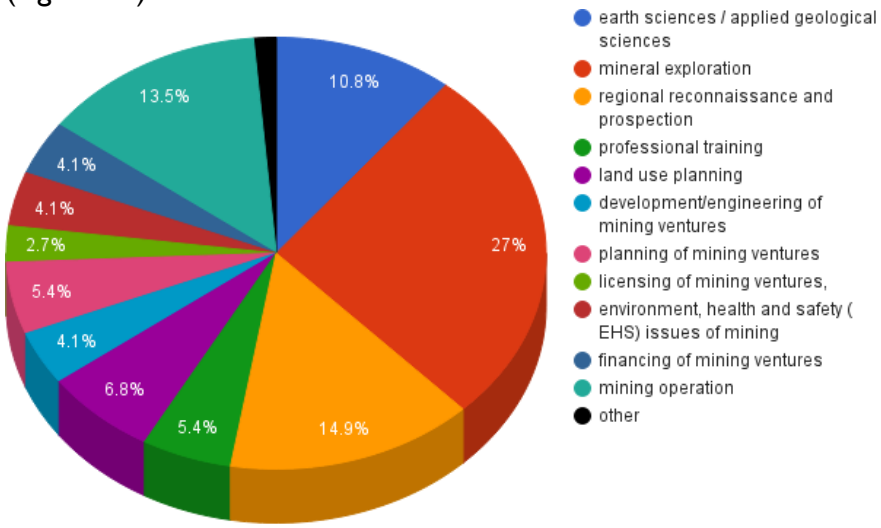



*Figure 19. Distribution of the thematic areas respondents work in within the Industry respondent category.*

The respondents working for Geological survey (8 responses) are mainly involved in a) regional reconnaissance and prospection; and b) EHS issues of mining (Figure 20).

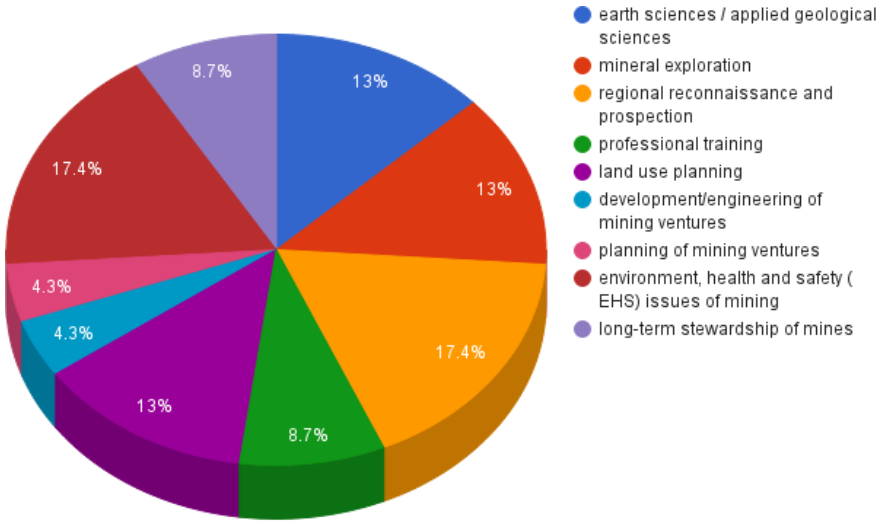



*Figure 20. Distribution of the thematic areas respondents work in within Geological survey respondent category.*

### *Results*

The results were analyzed based on 4 groups of questions in the survey: 1) Use of raw material information platforms; 2) Needs for improvement of raw material information; 3) Emerging information needs of key clients; and 4) Requirements to the online platform.

**Use of raw material information platforms (Q2)**

At the beginning of the survey, the respondents were asked how often they use raw materials' platforms and several were offered to choose from, namely: EGDI- European Geological Data Infrastructure, EIT-KIC, EO-MINERS, EuroGeoSource, i2Mine, International Raw Material Observatory INTRAW database, Minerals4EU, MINVENTORY, EURare, ProMine and Raw Materials Information System.

In general, information showed that most of the respondents rarely use these platforms, mostly on the yearly or less frequent basis or not at all (Table 4). A similar trend has been observed also with usage of other international, national, regional or commercial platforms. The only exception from this rule is the MINVENTORY and national platforms which are used more frequently, mostly on monthly bases. Additionally, some respondent mentioned they also use other platforms such as EFG EurGeol tool, LinkedIn, Infomine Kitco and Mining Journal.

*Table 4. Use of raw material information platforms*

| EU raw material information platforms | Frequency (number of responses) | | | | | Frequency (percentage %) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | daily to weekly | monthly to quarterly | yearly or less frequent | not at all | **valid answers** | daily to weekly | monthly to quarterly | yearly or less frequent | not at all |
| EGDI – European Geological Data Infrastructure | 2 | 15 | 17 | 25 | 59 | 3.4 | 25.4 | 28.8 | 42.4 |
| EIT-KIC Raw Materials | 1 | 18 | 16 | 24 | 59 | 1.7 | 30.5 | 27.1 | 40.7 |
| EO-MINERS | 0 | 14 | 22 | 23 | 59 | 0.0 | 23.7 | 37.3 | 39.0 |
| EuroGeoSource | 2 | 11 | 13 | 33 | 59 | 3.4 | 18.6 | 22.0 | 55.9 |
| i2Mine | 0 | 11 | 20 | 28 | 59 | 0.0 | 18.6 | 33.9 | 47.5 |
| INTRAW | 0 | 3 | 24 | 31 | 58 | 0.0 | 5.2 | 41.4 | 53.4 |
| Minerals4EU | 2 | 11 | 20 | 24 | 57 | 3.5 | 19.3 | 35.1 | 42.1 |
| MINVENTORY | 2 | 23 | 19 | 15 | 59 | 3.4 | 39.0 | 32.2 | 25.4 |
| EURare | 1 | 10 | 27 | 21 | 59 | 1.7 | 16.9 | 45.8 | 35.6 |
| ProMine | 1 | 9 | 23 | 26 | 59 | 1.7 | 15.3 | 39.0 | 44.1 |
| Raw Materials Information System | 0 | 12 | 21 | 26 | 59 | 0.0 | 20.3 | 35.6 | 44.1 |
| other EU raw material information platforms publicly available | 1 | 15 | 18 | 25 | 59 | 1.7 | 25.4 | 30.5 | 42.4 |
| **Other raw material information platforms** | | | | | | | | | |
| IRP - International Resource Panel Working Group on Global Metal Flows | 0 | 4 | 19 | 34 | 57 | 0.0 | 7.0 | 33.3 | 59.6 |
| national platforms (e.g. national geosurveys) | 7 | 24 | 15 | 12 | 58 | 12.1 | 41.4 | 25.9 | 20.7 |
| regional platforms (e.g. regional geosurveys) | 2 | 18 | 16 | 22 | 58 | 3.4 | 31.0 | 27.6 | 37.9 |
| commercial platforms (e.g. Roskill Information Services) | 3 | 5 | 17 | 32 | 57 | 5.3 | 8.8 | 29.8 | 56.1 |
| other platforms | 3 | 2 | 7 | 33 | 45 | 6.7 | 4.4 | 15.6 | 73.3 |

**Needs for improvement of raw material information (Q3)**

This section of the survey covered the needs of the raw material information improvement. The respondents could choose between several different possibilities such as:

- improve access to information;
- support responding to information needs;
- both;
- not relevant to my work.

The needs of improvement of raw material information were tested from the perspective of four following categories:

a) **Identification and assessment of mineral deposits** including:

a.1. Mineral endowment;

a.2. Onshore resource potential;

a.3. Offshore resource potential;
a.4. Greenfield exploration;
a.5. Brownfield exploration;
a.6. Geographical referencing and integration of earth observation, geological, land use, socioeconomic and other data;
a.7. Historical information.

More than 30% of respondents think that improvement of the access to information related to Identification and assessment of mineral deposits is needed. The only discrepancy from this trend is the "Offshore resource potential" which 49.1% of respondents consider not relevant to their work (Table 5). The respondents also used possibility to express another needs of improvement of raw material information if those were not offered on the list. They pointed out the importance of:

- Regulatory regimes and potential roadblocks for various commodity types (one response);
- Land use availability (one response);
- Expertise available for selected countries (one response);
- Consistent information provided to national, state and region agencies to ensure support during the exploration and exploitation (two responses).

*Table 5. Needs for improvement of raw material information related to Identification and assessment of mineral deposits.*

| **Category** | **Absolute figures** | | | | | | **Percentages (%)** | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | no response | improve access | support responding | both | not relevant | valid answers | improve access | support responding | both | not relevant |
| a.1 Mineral endowment | 2 | 21 | 7 | 18 | 11 | 57 | 36.8 | 12.3 | 31.6 | 19.3 |
| a.2 Onshore resource potential | 1 | 21 | 8 | 20 | 9 | 58 | 36.2 | 13.8 | 34.5 | 15.5 |
| a.3 Offshore resource potential | 2 | 14 | 6 | 9 | 28 | 57 | 24.6 | 10.5 | 15.8 | 49.1 |
| a.4 Greenfield exploration | 0 | 19 | 9 | 21 | 10 | 59 | 32.2 | 15.3 | 35.6 | 16.9 |
| a.5 Brownfield exploration | 0 | 20 | 8 | 21 | 10 | 59 | 33.9 | 13.6 | 35.6 | 16.9 |
| a.6 Geographical referencing and integration of earth observation, geological, land use, socioeconomic and other data | 0 | 21 | 9 | 20 | 9 | 59 | 35.6 | 15.3 | 33.9 | 15.3 |
| a.7 Historical information | 1 | 23 | 10 | 20 | 5 | 58 | 39.7 | 17.2 | 34.5 | 8.6 |

b) **Exploitation of mineral deposits** including:
   - b.1. Land use constraints;
   - b.2. Investors and investment levels;
   - b.3. Existing and planned mining ventures;
   - b.4. Financing options for mining ventures;
   - b.5. Licensing procedures;
   - b.6. Mining operations (miners, production);
   - b.7. Environment, health and safety (EHS) issues;
   - b.8. Closure requirements;
   - b.9. Post mine closure responsibilities.

More than 40% of respondents think that improvement of the access to information related to "Land use constraints" is needed (Table 6). On the contrary, "Financing options for mining ventures" are not relevant for their work. Respondents also used the possibility to express another needs of improvement of raw material information if those were not the offered list. They pointed out the importance of:

- Industrial minerals (one response);
- Future needs of nontraditional industrial minerals (one response).

*Table 6. Needs for improvement of raw material information related to Exploitation of mineral deposits.*

| **Category** | **Absolute figures** | | | | | | **Percentages (%)** | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | no response | improve access | support responding | both | not relevant | valid answers | improve access | support responding | both | not relevant |
| b.1 Land use constraints | 2 | 24 | 8 | 15 | 10 | 57 | 42.1 | 14.0 | 26.3 | 17.5 |
| b.2 Investors and investment levels | 1 | 14 | 10 | 15 | 19 | 58 | 24.1 | 17.2 | 25.9 | 32.8 |
| b.3 Existing and planned mining ventures | 0 | 23 | 8 | 17 | 11 | 59 | 39.0 | 13.6 | 28.8 | 18.6 |
| b.4 Financing options for mining ventures | 1 | 14 | 4 | 17 | 23 | 58 | 24.1 | 6.9 | 29.3 | 39.7 |
| b.5 Licensing procedures | 0 | 22 | 6 | 19 | 12 | 59 | 37.3 | 10.2 | 32.2 | 20.3 |
| b.6 Mining operations (miners, production) | 0 | 23 | 8 | 17 | 11 | 59 | 39.0 | 13.6 | 28.8 | 18.6 |
| b.7 Environment, health and safety (EHS) issues | 0 | 17 | 12 | 16 | 14 | 59 | 28.8 | 20.3 | 27.1 | 23.7 |
| b.8 Closure requirements | 0 | 17 | 8 | 18 | 16 | 59 | 28.8 | 13.6 | 30.5 | 27.1 |
| b.9 Post mine closure responsibilities | 0 | 17 | 9 | 17 | 14 | 59 | 28.8 | 15.3 | 28.8 | 23.7 |

c) **Anthropogenic stocks and recycling** including:

- c.1 Abandoned mining waste deposits and tailings;
- c.2 Abandoned mines for future land use (contamination, geological safety, etc.);
- c.3 Above ground infrastructure stock of commodities (buildings, railways, etc.);
- c.4 Subsurface infrastructure stock of commodities (water pipes, underground energy cables, etc.);
- c.5 Material flows for the recovery of commodities (demolition waste, industrial residues, etc.);
- c.6 Landfill mining for the recovery of commodities.

More than 30% of respondents think that improvement of the access to information related to "Abandoned mining waste deposits and tailings" is needed (Table 7). On the contrary, 50% of the respondents consider "Above ground infrastructure stock of commodities (buildings, railways, etc.)" not relevant to their work. Respondents also used the possibility to express another needs of improvement of raw material information if those were not the offered list. They pointed out the importance of:

- Environmental impact plans (one response);
- Legal aspects of mine waste ownership (one response).

*Table 7. Needs for improvement of raw material information related to Anthropogenic stocks and recycling.*

| Category | Absolute figures | | | | | | Percentages (%) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | no response | improve access | support responding | both | not relevant | valid answers | improve access | support responding | both | not relevant |
| c.1 Abandoned mining waste deposits and tailings | 1 | 19 | 8 | 20 | 11 | 58 | 32.8 | 13.8 | 34.5 | 19.0 |
| c.2 Abandoned mines for future land use (contamination, geological safety, etc.) | 1 | 13 | 8 | 22 | 15 | 58 | 22.4 | 13.8 | 37.9 | 25.9 |
| c.3 Above ground infrastructure stock of commodities (buildings, railways, etc.) | 1 | 12 | 6 | 11 | 29 | 58 | 20.7 | 10.3 | 19.0 | 50.0 |
| c.4 Subsurface infrastructure stock of commodities (water pipes, underground energy cables, etc.) | 1 | 14 | 9 | 11 | 24 | 58 | 24.1 | 15.5 | 19.0 | 41.4 |
| c.5 Material flows for the recovery of commodities (demolition waste, industrial residues, etc.) | 3 | 16 | 7 | 12 | 21 | 56 | 28.6 | 12.5 | 21.4 | 37.5 |
| c.6 Landfill mining for the recovery of commodities | 2 | 14 | 8 | 15 | 20 | 57 | 24.6 | 14.0 | 26.3 | 35.1 |

d) **Other fields** including:

- d.1 Life cycle perspective on environment, health and safety (EHS) impacts of exploration and mining;
- d.2 Mineral policies at global, EU, national and regional level;
- d.3 Other policies affecting minerals extraction (regional development, trade, etc.) at global, EU, national and regional level;
- d.4 Reporting (accountability to shareholders, employees, local communities and the general public);
- d.5 Stakeholder identification;
- d.6 Effective multi-stakeholder engagement.

Almost 40% of respondents think that improvement of the access to information related "Mineral policies at global, EU, national and regional level" is needed (Table 8). Respondents also used the possibility to express another needs of improvement of raw material information if those were not the offered list. They pointed out the importance of:

- Making project more visible on European market (one response);
- Establishment of the European central stock exchange (one response).

*Table 8. Needs for improvement of raw material information related to Other fields.*

| Category | | Absolute figures | | | | | | Percentages (%) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | no response | improve access | support responding | both | not relevant | valid answers | improve access | support responding | both | not relevant |
| d.1 | Life cycle perspective on environment, health and safety (EHS) impacts of exploration and mining | 0 | 16 | 6 | 17 | 20 | 59 | 27.1 | 10.2 | 28.8 | 33.9 |
| d.2 | Mineral policies at global, EU, national and regional level | 1 | 23 | 13 | 16 | 6 | 58 | 39.7 | 22.4 | 27.6 | 10.3 |
| d.3 | Other policies affecting minerals extraction (regional development, trade, etc.) at global, EU, national and regional level | 2 | 21 | 10 | 17 | 9 | 57 | 36.8 | 17.5 | 29.8 | 15.8 |
| d.4 | Reporting (accountability to shareholders, employees, local communities and the general public) | 3 | 16 | 10 | 17 | 13 | 56 | 28.6 | 17.9 | 30.4 | 23.2 |
| d.5 | Stakeholder identification | 3 | 18 | 10 | 15 | 13 | 56 | 32.1 | 17.9 | 26.8 | 23.2 |
| d.6 | Effective multi-stakeholder engagement | 1 | 16 | 12 | 14 | 15 | 57 | 28.1 | 21.1 | 24.6 | 26.3 |

**Emerging information needs of key clients (Q4)**

In this section of the survey the EurGeols were asked to provide information on their clients and particular what are the emerging questions raised by them which could influence on the EurGeols work until 2020. Several categories were offered (Table 9) with possibility to choose up to three answers. In general, the most regular clients belong to the exploration industry, followed by mining industry, geological surveys and consultancies/planning offices. Additionally, investors (two responses), international donors (one response), finance institutions (one response) and company stakeholders (one response) were also pointed out as potential clients.

*Table 9. Key clients of the respondents.*

| **Key clients** | **Number of responses** | **Percentage (%)** |
|---|---|---|
| Geological surveys | 22 | 37.3 |
| Environmental agencies | 13 | 22 |
| Mining authorities | 15 | 25.4 |
| Land use authorities | 7 | 11.9 |
| Consultancies / planning offices | 18 | 30.5 |
| Academia / universities / research institutes | 10 | 16.9 |
| Exploration industry | 42 | 71.2 |
| Mining industry | 38 | 64.4 |
| Raw material processing industry (e.g. metal smelters, cement production) | 11 | 18.6 |
| Civil society | 11 | 1.6 |
| Policy makers (ministries, parliaments, parties, etc.) | 12 | 20.3 |
| Other | 6 | 10.2 |

Considering the four respondent categories, different key clients can be distinguished per each category. The respondents working for Academia/University/Research institute (6 responses) mentioned a) exploration industry; b) geological surveys; and c) mining industry as their key clients (Figure 21).

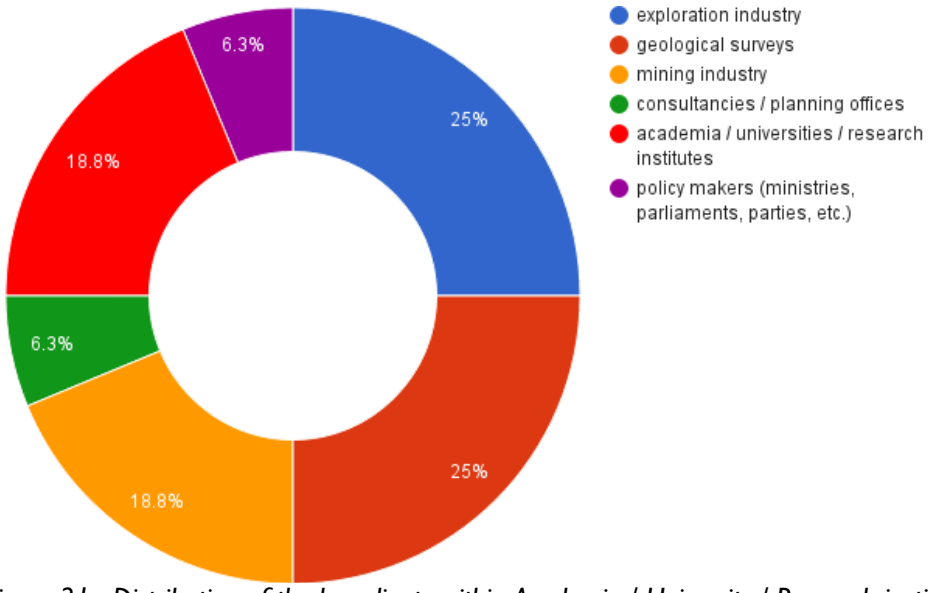



*Figure 21. Distribution of the key clients within Academia / University / Research institute respondent category.*

The respondents working for Consultancies/planning offices (6 responses) mentioned a) mining industry; b) exploration industry; and c) consultancies/planning offices as their key clients (Figure 22).

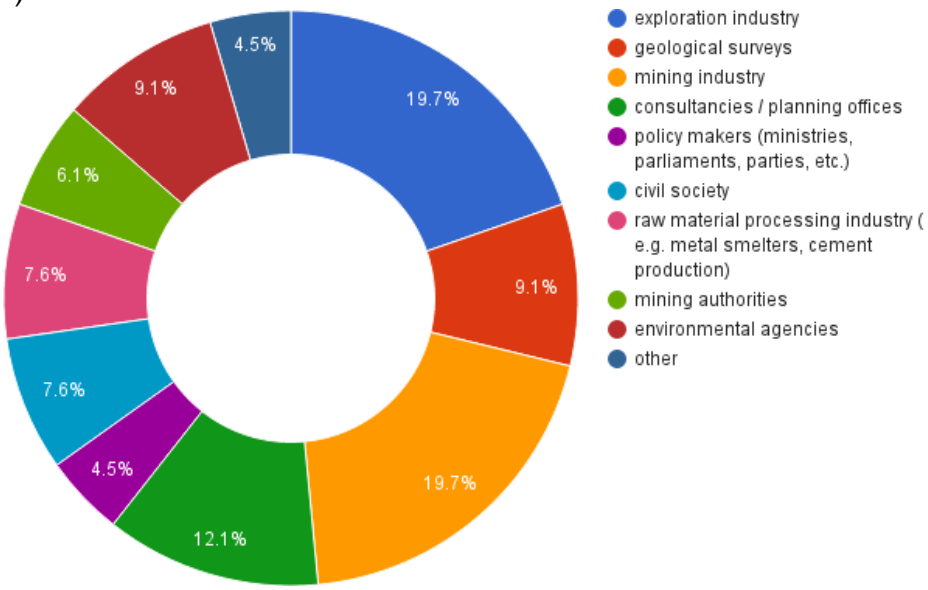



*Figure 22. Distribution of the key clients within Consultancies/planning office respondent category.*

The respondents working for Industry (21 responses) mentioned mining industry, exploration industry and geological surveys as their key clients (Figure 23).

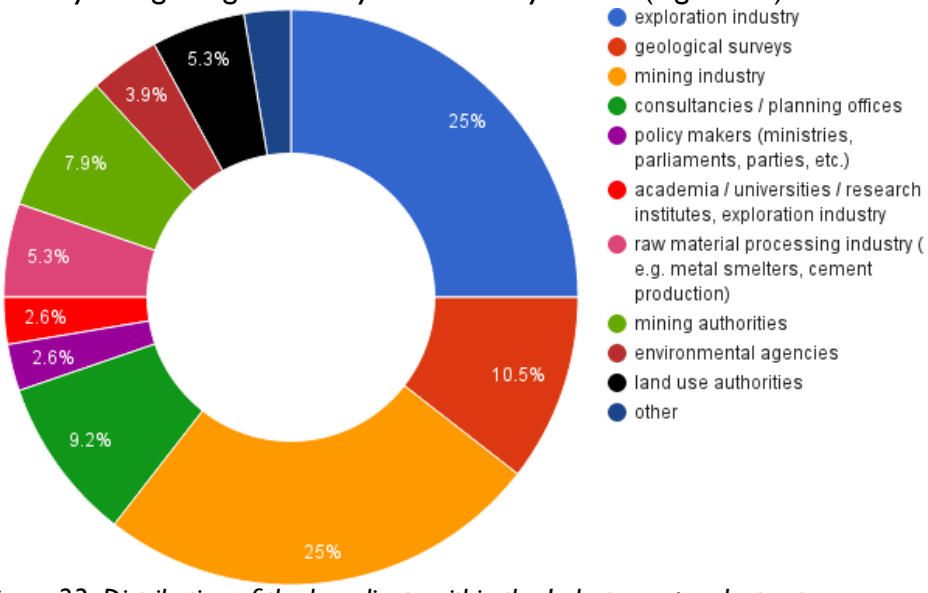



*Figure 23. Distribution of the key clients within the Industry respondent category.*

The respondents working for Geological survey (8 responses) mentioned a) mining industry; b) policy makers; and c) exploration industry as their top clients, although, comparing to other respondent categories, the distribution of the key clients here looks more homogeneous (Figure 24).

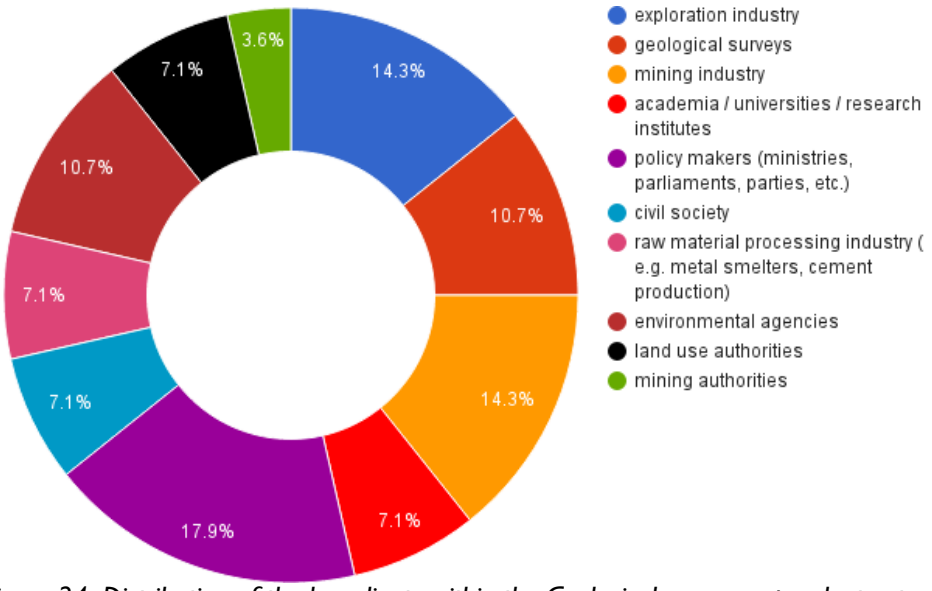



*Figure 24. Distribution of the key clients within the Geological survey respondent category.*

Based on the question of the survey, *What are emerging questions raised by your key clients, which might influence your work significantly until 2020?,* the responses have been analyzed according to the respondent categories. The questions raised by the clients were the base for the identification of the key words in each category. The Table 8 summarizes the main questions raised by the clients of each respondent categories. Additionally, key words, which could be used in the WP6 ontology level 2, are also listed.

*Table 10. Summary of the main questions raised by respondents' clients together with key words.*

| Respondent categories | Question raised by their clients | Key words |
|---|---|---|
| **Academia / University / Research Institutes (6 respondents)** | • Prediction of pricing of commodities<br>• Possibilities and outlook of financing of exploration projects<br>• Are the countries to be invested "mining pro" | • commodity pricing<br>• financing<br>• permitting |
| **Consultancies / planning office (31 respondents)** | • What is the EU position regarding the securization of mineral resources on its territory.<br>• What help is available to set up a tailings reprocessing operation?<br>• Where are the most suitable tailings?<br>• What is the likely timeframe for permitting a new mine?<br>• What is the likely timeframe for re-opening an old mine?<br>• Constraints to exploration and mining (social/ environmental)<br>• Environmental, infrastructure and security constraints<br>• What is the likely timeframe for permitting a new mine and/or re-opening the old one | • tailings operations<br>• permitting<br>• financing<br>• social constraints<br>• environmental restriction<br>• security constraints<br>• infrastructure<br>• groundwater impact |

| | | |
|---|---|---|
| | • What help is available to set up a tailings reprocessing operation? | |
| **Industry (21 respondents)** | • What commodities will do best in the coming years?<br>• Will there be any shortage of any mineral raw materials?<br>• Where could we possibly find the next "mega deposit"?<br>• Are there more cost effective exploration techniques?<br>• Easy access to public reporting of resources and reserves<br>• Clear information on environmental restrictions<br>• Evolution of the mining and metal market<br>• Funding<br>• Marked needs<br>• Cost of extraction<br>• Future needs, occurrence, deposits and extraction of lithium<br>• Uranium and nickel economy | • commodity pricing<br>• financing<br>• access to public data<br>• environmental restriction<br>• extraction costs<br>• lithium<br>• uranium<br>• nickel |
| **Geological survey (8 respondents)** | • Access to critical raw materials for our national industry<br>• Conflict of interest with regards to land use policies | • critical raw material<br>• permitting |

**Requirements to the online platform (Q5)**

At the end of the survey, respondents also provided their opinion on possible features of the future MICA platform and named 3 most important requirements for them to become the actual users of the MICA online platform. The following options were offered and the responses are summarized in Table 11:

a) Each stakeholder question and the respective platform response should be documented in a transparent and traceable way;
b) It should be possible to select between the latest data available, the most reliable data available, the most comprehensive data available and to select between freely and commercially available data;
c) The online platform should provide effective guidance to geologists how to employ the methods suggested;
d) The online platform should contain all tools suggested with a free download function;
e) The suggested sequence of operations to answer a question, i.e. a combination of information on data sets and methods & tools, should meet the scientific state of the art;
f) The online platform should provide additional guidance in case it suggests various ways to meet a raw material information need;
g) The queries and responses by the online platform should be achievable in text, spreadsheet and database format;

h) The online platform should display the output in an easy to understand and attractive graphical format.

*Table 11. Summary of the main questions raised by respondents' clients together with key words.*

| **Mica online platform requirements** | | **Number of responses** | **Percentage (%)** |
|---|---|---|---|
| a) | Question and the respective platform response should be documented in a transparent and traceable way | 11 | 19.3 |
| b) | Data selection (latest data available, the most reliable data available, the most comprehensive data) | 34 | 59.6 |
| c) | Effective guidance to geologists how to employ the methods suggested | 29 | 50.9 |
| d) | Tools suggested with free download function | 33 | 57.9 |
| e) | Suggested sequence of operations to answer a question | 10 | 17.5 |
| f) | Additional guidance in case it suggests various ways to meet a raw material information need | 10 | 17.5 |
| g) | Queries and responses by the online platform should be achievable in text, spreadsheet and database format | 19 | 19 |
| h) | Online platform should display the output in an easy to understand and attractive graphical format | 24 | 24 |

According to the responses, the MICA platform should provide the possibility to select between the latest data available, the most reliable data available, the most comprehensive data available and to select between freely and commercially available data (option b)), the platform should provide effective guidance to geologists how to employ the methods suggested (option c)) and the platform should contain all tools suggested with a free download function (option d)).

### 6.1.3 Industry Survey

#### *Basic information*

The Industry Survey took place between 22 June 2016 and 9 September 2016 using the EFS online tool. The questionnaire was developed by Fraunhofer ISI including a pretest with other departments and an industry consultant. 92 industry associations identified in the stakeholder mapping (Erdmann et al. 2016) were invited to participate. Out of these, 10 industry associations responded (almost) completely. This yields a response rate of 10,9 %, which is adequate for cold calling.

The respondents were asked to indicate the profile of their activity at the respective industry association (Figure 25).

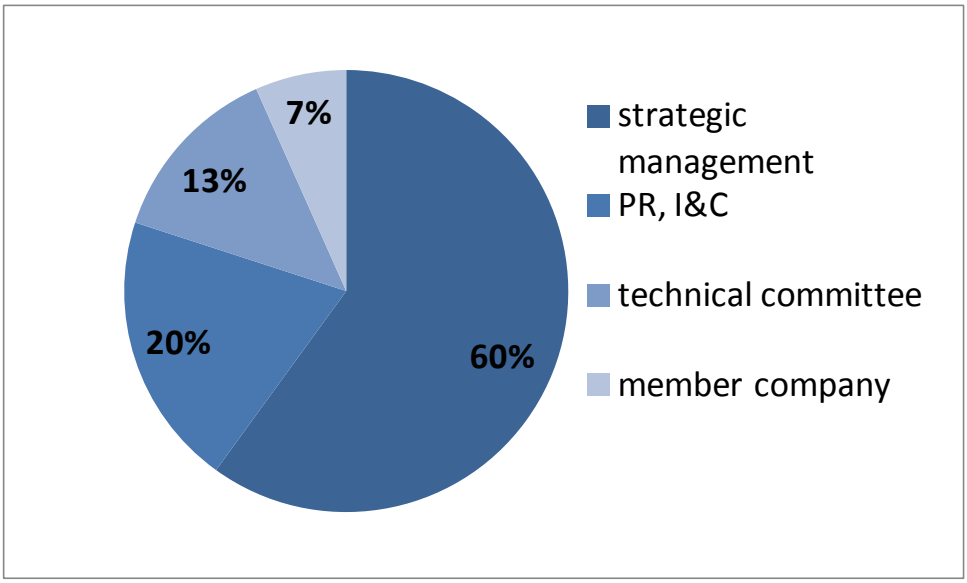



*Figure 25: Distribution of occupancy profiles of the 10 respondents in the Industry Survey. Multiple answers were possible (n=15). PR – public relation, I&C – information and communication*

All, but one respondent (n=9) assign themselves to the strategic management, which is an excellent coverage of the intention to reach the strategic management of industry associations.

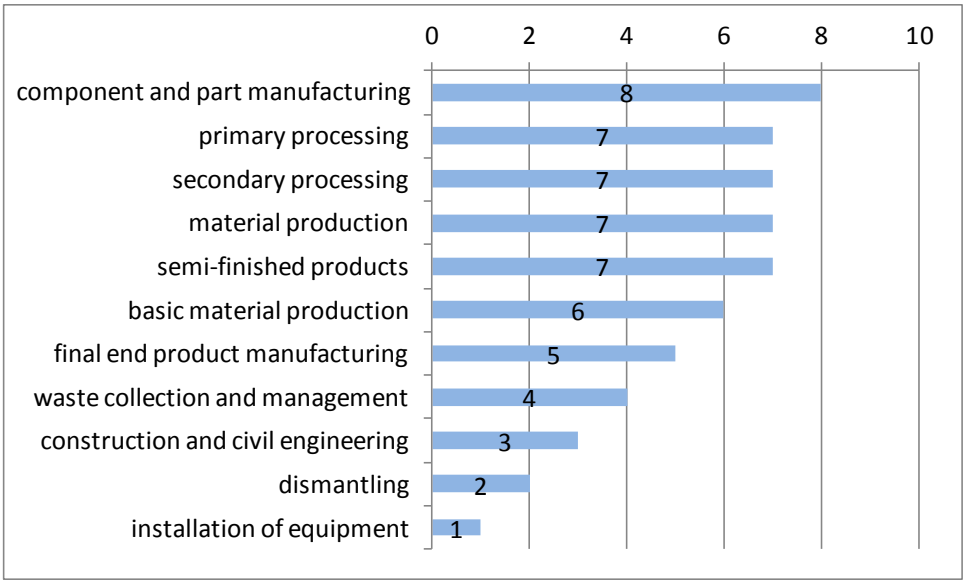



*Figure 26: Coverage of different parts of the value chain of the 10 respondents in the Industry Survey. Multiple answers were possible (n=57).*

The industry associations responding cover a wide part of the value chain, including primary and secondary processing (n=7 each) and component and part manufacturing (n=8). Coverage is weak for dismantling (n=2) and installation of equipment (n=1).

### *Results*

The results were analyzed question by question. Taking into consideration the total response numbers we present the results graphically and in absolute numbers, and refrain from indicating percentages.

**Q1 How important are the following current strategic issues for your industry association?**

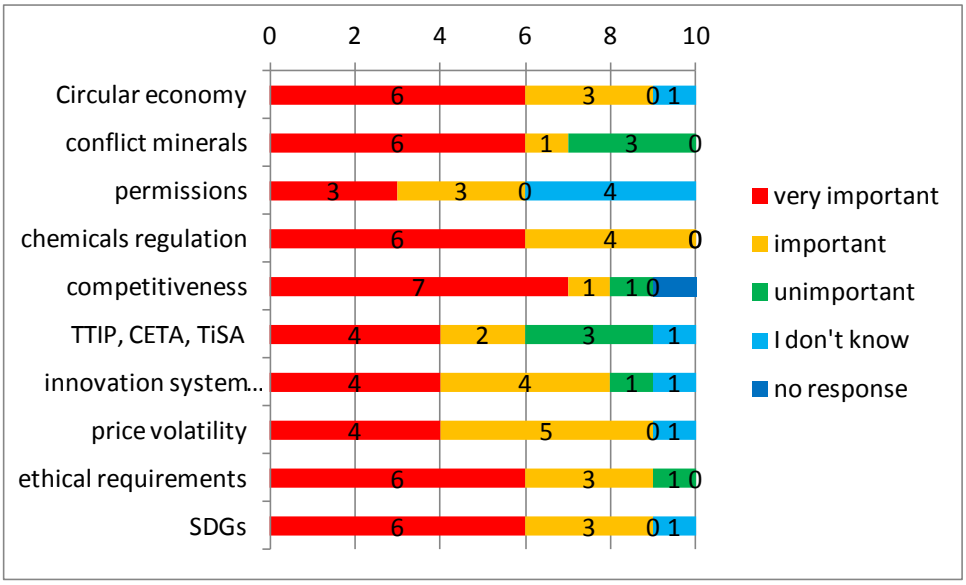



*Figure 27: Importance of Current Strategic Issues for industry associations (n=10). SDGs – Sustainable Development Goals. TTIP, CETA, TISA – international trade agreements under discussion during the survey. Items shortened (for original items: see Appendix 1).*

The suggested current strategic issues are widely approved by the respondents as 'important' or 'very important' (Figure 27). *Permissions of new industry facilities* received four times an 'I don't know' presumably because this is rather a member company issue than an industry association issue.

Selected amendments:

- trade regulation and policy
- environmental regulation and policy
- revision of regulation schemes

**Q2 How useful are the following raw material information platforms for your industry association?**

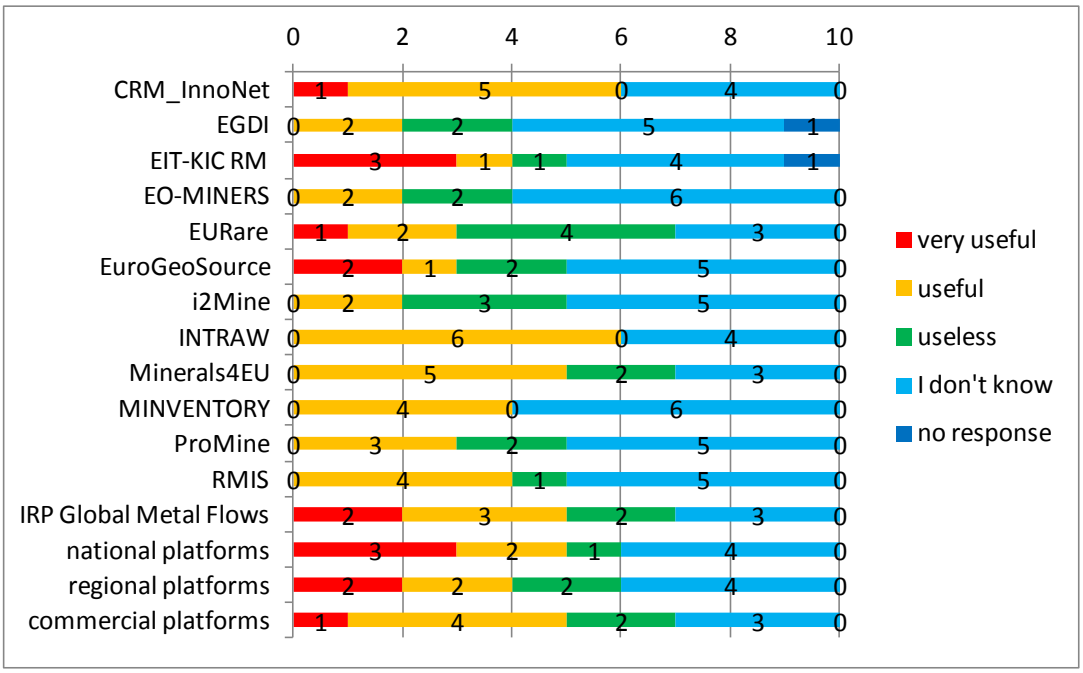



*Figure 28: Usefulness of existing raw material information platforms for industry associations (n=10). Items shortened (for original items: see Appendix 1). For the project acronyms: see list of abbreviations and acronyms.*

A significant share of the raw material information platforms suggested is unknown to roughly half of the respondents (Figure 28). In particular *CRM_InnoNet* and *INTRAW* are seen as useful by 6 respondents. Only two items, the *EIT-KIC Raw Materials* and unspecified *national platforms* get a 'very useful' from three respondents.

Selected amendments:

- ERAMIN-EU Critical Raw materials RM Scoreboard
- USGS
- Yale University publications

**Q3: Which of the two improvement options (improve access / support responding) do you consider as particularly important to your work?**

**Q3a: Raw Material Supply and Demand**

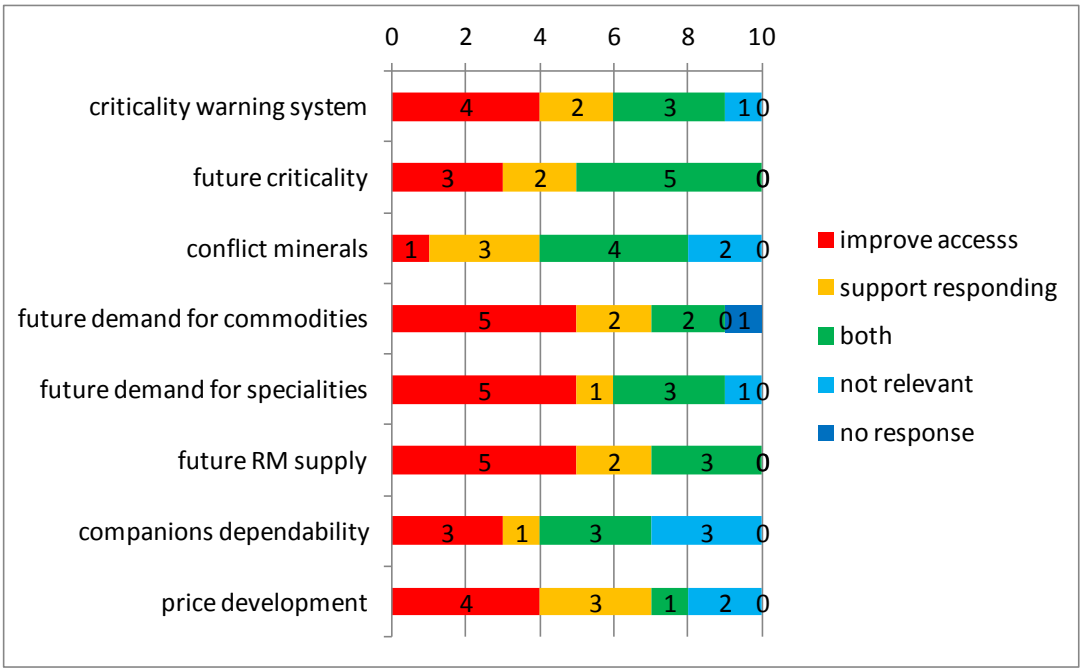



*Figure 29: Improvements needs of industry associations in the realm of Raw Material Supply and Demand (n=10). Items shortened (for original items: see Appendix 1). RM – raw materials.*

For a significant share of topics in the realm of Raw Material Supply and Demand there are clear needs to 'improve access to raw material information', among them *future demand for commodities* and *future demand for specialities* and future raw material supply (n=5 each) (Figure 29).

Amendment:

- global future raw material demand of emerging technologies

## Q3b: Material Production and Manufacturing

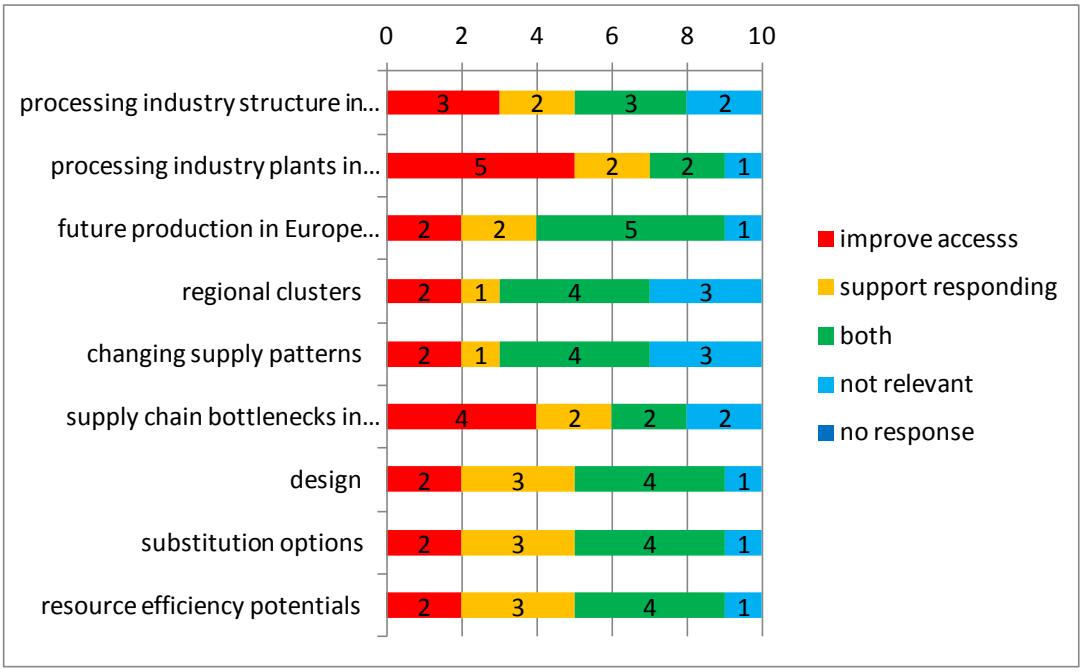



*Figure 30: Improvements needs of industry associations in the realm of Material Production and Manufacturing (n=10). Items shortened (for original items: see Appendix 1).*

In the realm of Material Production and Manufacturing five industry associations state a clear need for 'improving access to raw material information' for *processing industry plants in Europe*, still four industry associations for *supply chain bottlenecks in Europe* (Figure 30). Besides, industry associations often need 'both', improve access and support responding for the other topics.

Amendment:

- intermediate products

## Q3c: Anthropogenic Stocks and Recycling

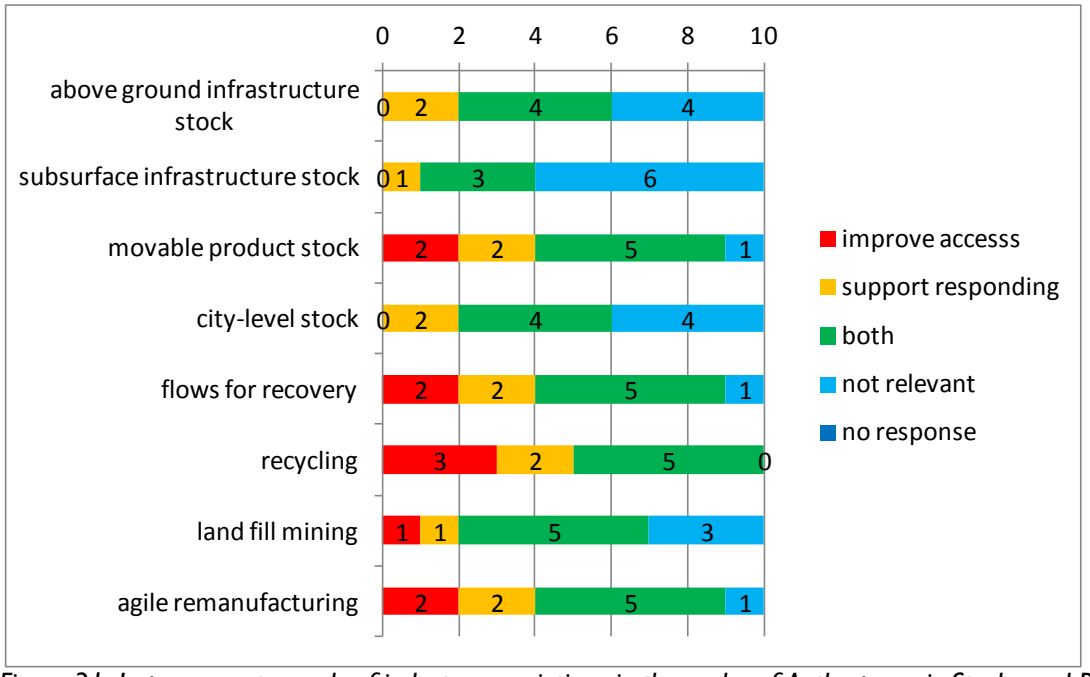



*Figure 31: Improvements needs of industry associations in the realm of Anthropogenic Stocks and Recycling (n=10). Items shortened (for original items: see Appendix 1).*

Most topics entail the need for 'both', improve access and support responding. *Subsurface infrastructure stock (n=6), above ground infrastructure* stock and *city-level stock* (n=4 each) are unimportant for several responding industry associations (Figure 31).

Amendment:

- material flows, recycling rates and LCA of minor metals

### Q3d: Other Fields

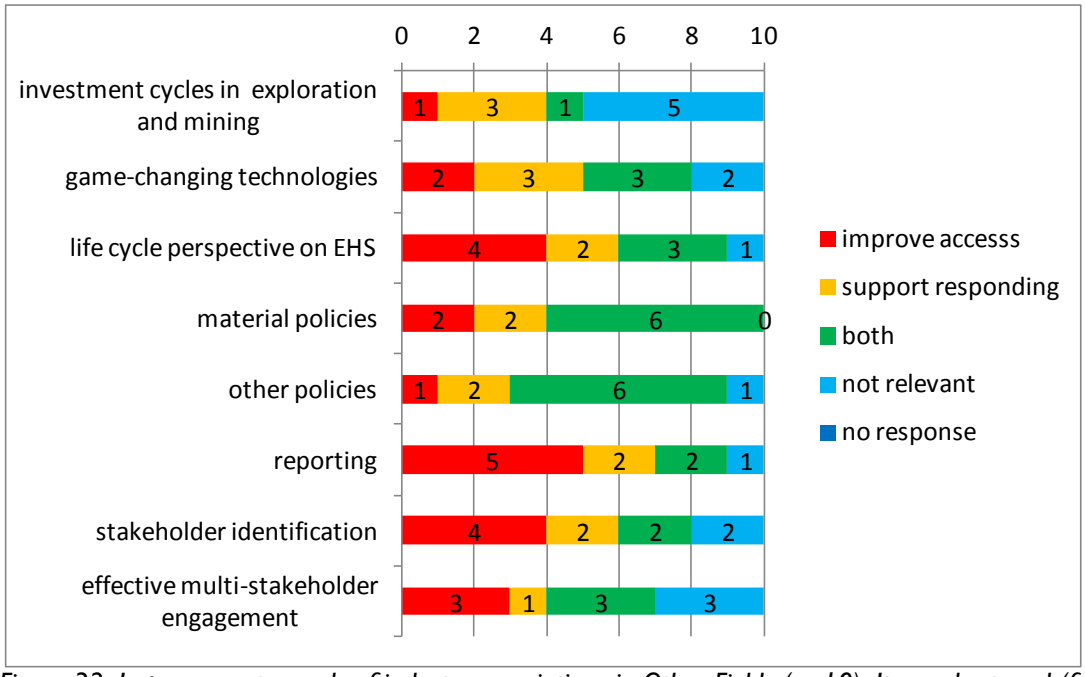



*Figure 32: Improvements needs of industry associations in Other Fields (n=10). Items shortened (for original items: see Appendix 1).*

Many topics suggested in other fields require 'both', improve access and support responding, in particular material policies and other policies affecting materials (n=6 each) (Figure 32). Salient are the 4-5 respondents who see *stakeholder identification*, *life cycle perspective on EHS* and *reporting* mainly as an information access problem.

### Q4 What are emerging questions raised by your key clients?

Selected emerging questions (members):

- Life Cycle Analysis
- detailed information on the different recycling streams
- class 7 (radioactive material) port and shipping requirements

Selected emerging questions (key external stakeholders):

- innovation
- conflict mineral due diligence

**Q5 How important are the following future developments for your industry association by 2020?**

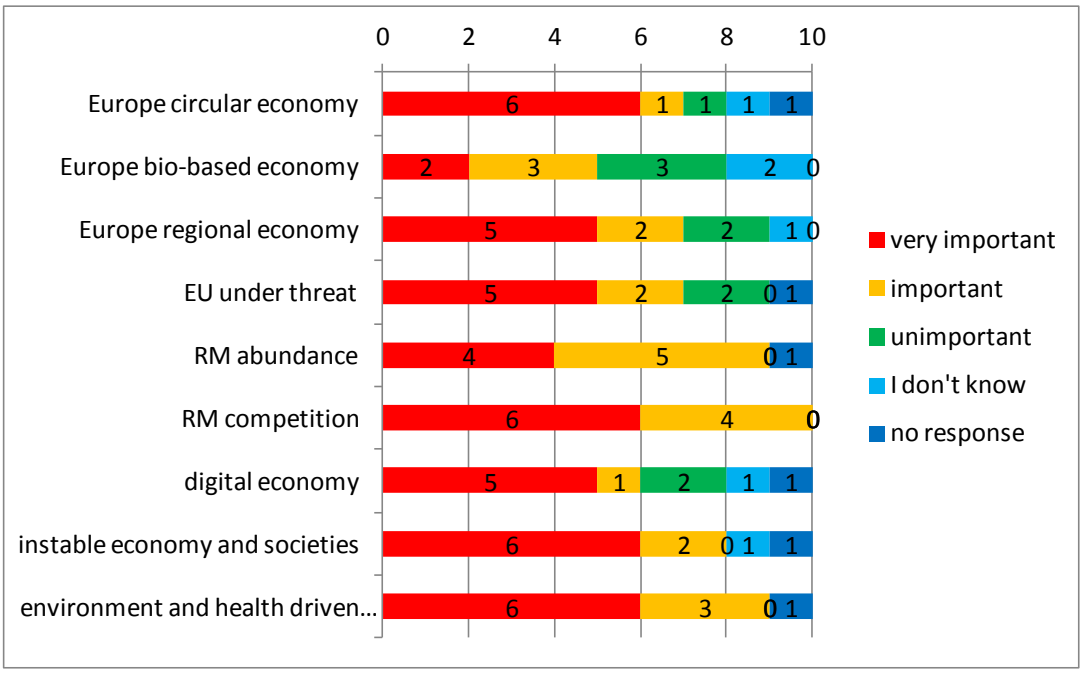



*Figure 33: Importance of Future Developments that could become relevant for the strategies of industry associations by 2020 (n=10). Items shortened (for original items: see Appendix 1). RM – raw materials.*

Most future developments suggested are seen as relevant to the development of geological surveys' strategies by 2020 (Figure 33). A *bio-based economy in Europe* is unimportant for n=3 and not assessable for n=2 respondents.

Selected amendments:

- renewal of manufacturing experts
- design/materials of primary or secondary origin

## 6.2 Stakeholder Workshop

### *Basic information*

The stakeholder workshop took place at 27 September 2016 at Eurometeax's premises along with MICA's Second Consortium Meeting.

Figure 34 shows the Agenda and Table 12 the list of participants. In addition, information material was provided for the focus groups (see Appendix 4).

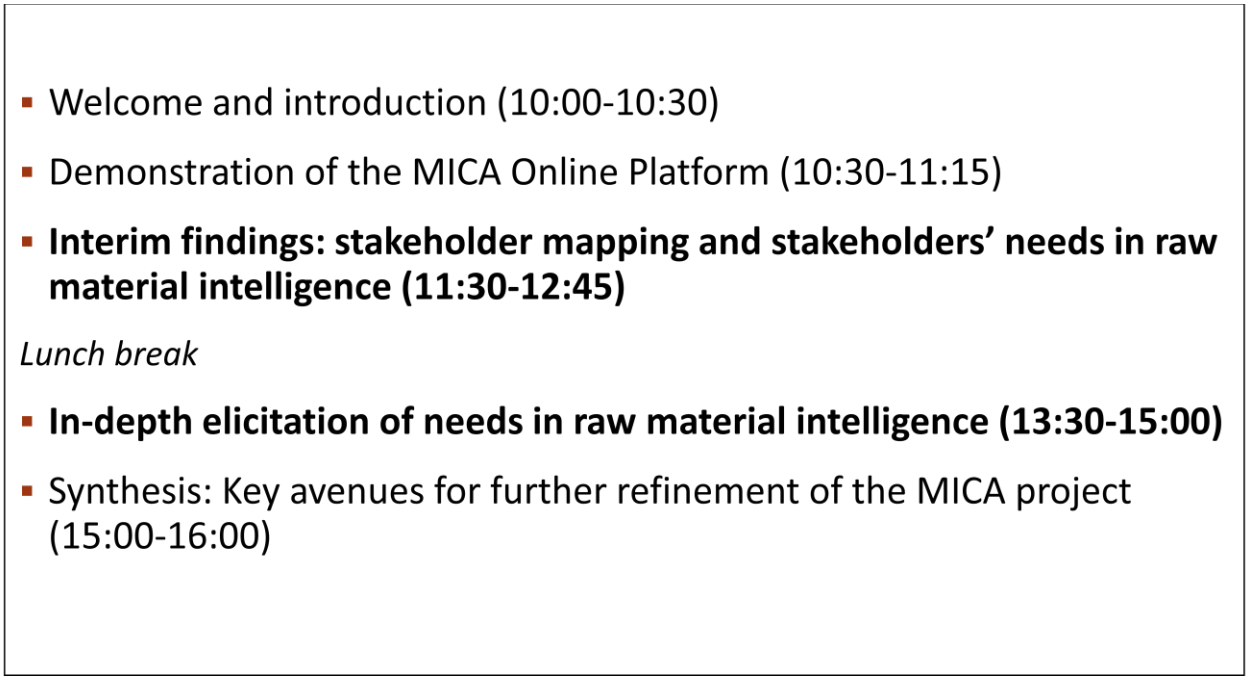



*Figure 34: Agenda of MICA's WP 2 Stakeholder Workshop (27 September 2016, Eurometaux premises in Brussels)*

There was a common introduction to the MICA project and a demonstration of the MICA Online Platform for the WP 2 Stakeholder Workshop and the WP 4 Method Workshop.

Then, the WP 2 participants only discussed the interim findings that were presented by Fraunhofer ISI.

After lunch, four focus groups were built, each one treating a raw material knowledge domain in depth. At the end, individuals had the opportunity to drop other RMI needs in raw material knowledge domains not chosen for collective discussion.

Finally, the results of the WP 2 Stakeholder Workshop and the WP 4 Method Workshop were synthesized in plenary.

*Table 12: List of participants of MICA's WP 2 Stakeholder Workshop (27 September 2016, Eurometaux premises in Brussels)*

| First Name | Last Name | Affiliation |
|---|---|---|
| Jan-Olof | Arnbom | SGU |
| Vincent | Aubert | Toyota Motors Europe |
| Guillaume | Bertrand | BRGM |
| Vanja | Bisevac | INTRAW / EFG |
| Teresa | Brown | BGS-NERC |
| Andy | Clifton | Rolls-Royce |
| Claudia | Delfini | EGS |
| Lorenz | Erdmann | Fraunhofer ISI |
| Eberhard | Falck | MinPol |
| Steven | Fortier | USGS |
| Christian | Hagelüken | Umicore |
| Sari | Katalin | MFGI |
| Dirk | Lauinger | NTNU |
| Pascal | Leroy | WEEE Forum |
| Erika | Machacek | GEUS |
| Björn | Moller | Fraunhofer ISI |
| David | Ovadia | Blenheim Natural Resources |
| Bjarni | Pjetursson | EGDI / GEUS |
| Henk | Pool | CEFIC |
| Lidia | Quental | LNEG (tailings) |
| Barbara | Radwanek-Bak | PGI (WEEE recycling) |
| Michael | Ritthoff | Wuppertal Institut (Cirular Economy) |
| Nancy | Savall | EGS |
| Mark | Simoni | NGU |
| Patrick | Wall | VERAM / EGS |

### *Results*

The qualitative results of the Stakeholder-Workshop are summarized in section 3.2 and extensively captured in the supplementary spreadsheet file.

## 6.3 Interviews

### *Basic information*

The interviews took place in two phases:

- The first interview phase from June-September 2016 explored NGOs and industry associations' positions in depth.
- The second interview phase was designed to close gaps identified along the Second Consortium Meeting, the Second Advisory Board Meeting and the Stakeholder Workshop all taking place in the last week of September 2016.

Interview candidates were identified by making use of the Stakeholder Report (Erdmann et al. 2016) and additional web-searches.

Interviews were mostly conducted by telephone, a few written statements to the questions posed were submitted and a WP 2 participant joint a conference on financing to report its impressions about raw material information needs. All these activities are covered under interviews for simplicity reasons.

### *Results*

The qualitative results of the interviews are summarized in section 3.3 and extensively captured in the supplementary spreadsheet file. They are not published in a disaggregated way for reasons of anonymization.

MICA Mineral Intelligence Capacity Analysis

Deliverable D2.2

# Appendix: Supplementary material

## Appendix 1: EGS Survey – invitation letter and questionnaire

### EGS Survey - Invitation Letter

<Subject:> EGS survey on raw material information needs of its members / MICA project

Dear #Person #Title #Last Name,

the MICA Project aims to improve the provision and delivery of raw material information to stakeholders in Europe through a powerful, user-friendly online platform. It focuses on mineral raw materials (metallic, industrial and construction minerals). The MICA online platform will integrate different data sets, methods and foresight tools in a single platform. To this end MICA carries out a careful analysis of stakeholder needs.
EuroGeoSurveys (EGS), The Geological Surveys of Europe, is a partner of MICA and is now running a survey among its members on geological surveys' information needs, in co-operation with the Fraunhofer Institute for Systems and Innovation Research (ISI).
You are receiving this request to take part in this survey because your views are vital to enhance our knowledge and understanding of raw material information needs of geological surveys as potential users of the envisaged online platform. The results will be used to account for the needs of the EGS members in the design and services of the MICA online platform (see MICA leaflet attached and website http://www.mica-project.eu).
The online survey will be open until July 22th, 2016. It should take not more than 15-20 minutes to complete. Your responses will remain strictly confidential and will only be used for the purposes of this study (see MICA data protection statement attached). We will provide to all participants in the survey a copy of the results, and we thank you in advance for your help in this effort.
To begin the survey, please follow your personalized link: #link
If you require any further information about the study or have any technical problems with the survey website, please do not hesitate to contact us directly by email.

Yours sincerely,

#Person EGS
EuroGeoSurveys
Phone: #phone number I Email: # email address

Lorenz Erdmann
Fraunhofer Institute for Systems and Innovation Research ISI
Phone: +49 721 6809 313 I lorenz.erdmann@isi.fraunhofer.de

# EGS Survey - Questionnaire



## Fragebogen

### 1 Start

### MICA project: information needs of geological surveys

Welcome to the survey on raw materials information needs. This survey is designed for geological surveys and it is part of the works being developed by the MICA project.

The MICA project aims to improve the provision and delivery of raw material information to stakeholders in Europe through a powerful, user-friendly online platform. It focuses on mineral raw materials (metallic, industrial and construction minerals) and anthropogenic stocks of secondary raw materials.

Your input will contribute to making project outputs more useful to yourself and others, and also to defining research needs for future work. The survey should take not more than 15-20 minutes to complete.

Your responses will remain strictly confidential and will only be used for the purposes of this study.

*To start the survey, please click "continue"*

### 2 Q1: Current Issues

**Current strategic issues**

EuroGeoSurveys (EGS) represents the national and regional geosurveys in Europe. We constantly review and refine our activities to assist our members in meeting their raw material information needs and leverage your Earth science knowledge to support the EU`s competitiveness, social well-being, environmental management and international committments.

**How important are the following strategic issues for your geological survey?**

*Please tick the respective box.*

| | very important | important | unimportant | I don't know |
|---|---|---|---|---|
| **The EU's Raw Material Initiative** | ☐ | ☐ | ☐ | ☐ |
| **Competitiveness** of the European primary raw material supply sector | ☐ | ☐ | ☐ | ☐ |
| **Volatile raw material prices** | ☐ | ☐ | ☐ | ☐ |
| **Public attitudes** towards exploration & mining (e.g. land use, environment, health & safety issues) | ☐ | ☐ | ☐ | ☐ |
| **Sustainable Development Goals** (impacts on the raw material strategy of our country/region) | ☐ | ☐ | ☐ | ☐ |
| **Circular Economy Action Plan** of the European Commission (incl. revision of waste directives) | ☐ | ☐ | ☐ | ☐ |
| A common **European Geological Service** to support national and EU institutions | ☐ | ☐ | ☐ | ☐ |
| **Spatial planning**: new strategies, legislation and acts (surface, subsurface, offshore) | ☐ | ☐ | ☐ | ☐ |
| **Budget pressure** on our geological survey | ☐ | ☐ | ☐ | ☐ |
| **Time pressure** on our geological survey to respond ever more quickly to clients' requests | ☐ | ☐ | ☐ | ☐ |
| **Competences** of our geological survey beyond Earth sciences (e.g. raw material economics, map anthropogenic stocks) | ☐ | ☐ | ☐ | ☐ |

*Please list up to 3 other very important strategic issues for your geological survey.*

## 3 Q2: Use of raw material information platforms

**Use of raw material information platforms**

Geological surveys are both providers and users of raw material information. A number of raw material information platforms have emerged that you might already know. We intend to incorporate some of them in the MICA online platform.

**How useful are the following raw material information platforms for your geological survey?**

*Please tick the respective box for EU platforms.*

| | very useful | useful | useless | I don't know |
|---|---|---|---|---|
| **CRM_InnoNet** – Substitution of critical raw materials (www.criticalrawmaterials.eu) | ☐ | ☐ | ☐ | ☐ |
| **EGDI** – European Geological Data Infrastructure (http://www.egdi-scope.eu) | ○ | ○ | ○ | ○ |
| **EIT-KIC Raw Materials** – turning the challenge of raw materials dependence into a strategic strength for Europe (http://eitrawmaterials.eu) | ○ | ○ | ○ | ○ |
| **EO-MINERS** – Earth Observation to improve best practice in mining (http://www.eo-miners.eu) | ☐ | ☐ | ☐ | ☐ |
| **EURare** –development of a European Rare Earth Element (REE) industry for uninterrupted supply of REE raw materials and products (http://www.eurare.eu) | ☐ | ☐ | ☐ | ☐ |
| **EuroGeoSource** – aggregated geographical information on geo-energy and mineral resources (http://www.eurogeosource.eu) | ○ | ○ | ○ | ○ |
| **i2Mine** – the Intelligent Deep Mine of the Future (http://www.i2mine.eu) | ○ | ○ | ○ | ○ |
| **INTRAW** – Fostering international cooperation on raw materials (http://intraw.eu) | ○ | ○ | ○ | ○ |
| **Minerals4EU** – provides data, information and knowledge on mineral resources and production around Europe (http://www.minerals4eu.eu) | ○ | ○ | ○ | ○ |
| **MINVENTORY** – directory of statistical data holders on stocks and flows of primary and secondary raw materials (https://ec.europa.eu/growth/tools-databases/minventory/content/minventory) | ○ | ○ | ○ | ○ |
| **ProMine** –stimulate the extractive industry to deliver new products to manufacturing industry (http://promine.gtk.fi) | ○ | ○ | ○ | ○ |
| **RMIS** - Raw Material Information System http://rmis.jrc.ec.europa.eu) | ☐ | ☐ | ☐ | ☐ |

**other very useful EU** raw material information platforms:

*Please tick the respective box for non-EU platforms.*

| | very useful | useful | useless | I don't know |
|---|---|---|---|---|
| **IRP International Resource Panel Working Group on Global Metal Flows** (http://www.unep.org/resourcepanel) | ○ | ○ | ○ | ○ |
| **national platforms** (e.g. national environmental information systems) | ☐ | ☐ | ☐ | ☐ |
| **regional platforms** (e.g. regional land use planning portals) | ○ | ○ | ○ | ○ |
| **commercial platforms** (e.g. Roskill Information Services) | ○ | ○ | ○ | ○ |

**other very useful non-EU** raw material information platforms:

## 4 Q3: Needs for improvement of raw material information

**Needs for improvement of raw material information**

Today geological surveys have to identify particular different sources in order to meet their raw material information needs. The development of the MICA online platform aims to

1. **Improve access to information:** different data sets (e.g. EU-wide geological data, socio-economic data, etc.) and methods & tools (e.g. 3D models, scenario tools for future land use) are made available in a single platform.
2. **support responding to information needs:** stakeholders first ask questions (e.g. from whom will we get how much raw material in a circular economy?), and then the platform suggests sequences of operations to answer the questions, i.e. it delivers combinations of information on data sets, methods & tools.

We want to know how you assess these two improvement options in four knowledge fields.

**Which of the two improvement options do you consider as particularly important to your work?**

*Please tick your needs in the field of **mineral deposits**.*

| | improve access to information (1) | support responding to information needs (2) | both: improve access (1) and support responding (2) | not relevant to our work |
|---|---|---|---|---|
| mineral endowment | ○ | ○ | ○ | ○ |
| onshore resource potential | ○ | ○ | ○ | ○ |
| offshore resource potential | ○ | ○ | ○ | ○ |
| greenfield exploration | ○ | ○ | ○ | ○ |
| brownfield exploration | ○ | ○ | ○ | ○ |
| geographical referencing and integration of earth-oberservation, geological, land use, socio-economic and other data) | ○ | ○ | ○ | ○ |
| historical information | ○ | ○ | ○ | ○ |
| investors and investment levels | ○ | ○ | ○ | ○ |

*Please specify up to 3 other very important raw material information needs in the field of mineral deposits:*

**5 Q3.2: Needs for improvement of raw material information**

*Please tick your needs in the field of **anthropogenic stocks**.*

| | improve access to information (1) | support responding to information needs (2) | both: improve access (1) and supporting responding (2) | not relevant to our work |
|---|---|---|---|---|
| post mine closure responsibilities | ○ | ○ | ○ | ○ |
| abandoned mining waste deposits and tailings | ○ | ○ | ○ | ○ |
| abandoned mining sites for future land use (contamination, geological safety, etc.) | ○ | ○ | ○ | ○ |
| above ground infrastructure stock of commodities (in buildings, railways, etc.) | ○ | ○ | ○ | ○ |
| subsurface infrastructure stock of commodities (in water pipes, underground cables, etc.) | ○ | ○ | ○ | ○ |
| | ○ | ○ | ○ | ○ |

| | | | | |
|---|---|---|---|---|
| material flows for the recovery of commodities (demolition waste, industrial residues, etc.) | | | | |
| recycling levels of commodities (collection rate, share of recycling in total production, etc.) | ○ | ○ | ○ | ○ |
| landfill mining for the recovery of commodities (materials, environment, etc.) | ○ | ○ | ○ | ○ |

*Please specify up to 3 other very important raw material information needs in the field of anthropogenic stocks:*

**6 Q3.3: Needs for improvement of raw material information**

*Please tick your needs in the field of **raw material supply and demand**.*

| | improve access to information (1) | support responding to information needs (2) | both: improve access (1) and support responding (2) | not relevant to our work |
|---|---|---|---|---|
| early warning system for criticality (indicators, monitoring etc.) | ○ | ○ | ○ | ○ |
| future criticality of minerals | ○ | ○ | ○ | ○ |
| conflict minerals (origin, certification, etc.) | ○ | ○ | ○ | ○ |
| dependability of companions from major commodities (e.g. molybdenum from copper) | ○ | ○ | ○ | ○ |
| demand trends for commodities | ○ | ○ | ○ | ○ |
| supply trends for commodities | ○ | ○ | ○ | ○ |
| future share of primary supply in total supply | ○ | ○ | ○ | ○ |
| commodity price trends | ○ | ○ | ○ | ○ |
| future primary and secondary production in Europe | ○ | ○ | ○ | ○ |
| types of raw-material processing industries developed in Europe in the near future | ○ | ○ | ○ | ○ |
| value chain bottlenecks in Europe | ○ | ○ | ○ | ○ |

*Please specify up to 3 other very important raw material information needs in the field of raw material supply and demand:*

**7 Q3.4: Needs for improvement of raw material information**

*Please tick your needs **in other fields.***

| | improve access to information (1) | support responding to information needs (2) | both: improve access (1) and support responding (2) | not relevant to our work |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| mining (finance, concession, development, operation, closure, etc.) | ○ | ○ | ○ | ○ |
| recycling (collection, logistics, waste management, material recovery processes, etc.) | ○ | ○ | ○ | ○ |
| life cycle perspective on environment, health and safety (EHS) impacts of exploration and mining | ○ | ○ | ○ | ○ |
| mineral policies at global, EU, national and regional level | ○ | ○ | ○ | ○ |
| other policies affecting minerals extraction (regional development, trade, etc.) at global, EU, national and regional level | ○ | ○ | ○ | ○ |
| reporting (accountability to shareholders, to employees, to employees, to local communities, to the general public) | ○ | ○ | ○ | ○ |
| stakeholder identification | ○ | ○ | ○ | ○ |
| effective multi-stakeholder engagement | ○ | ○ | ○ | ○ |

*Please specify up to 3 other very important raw material information needs:*

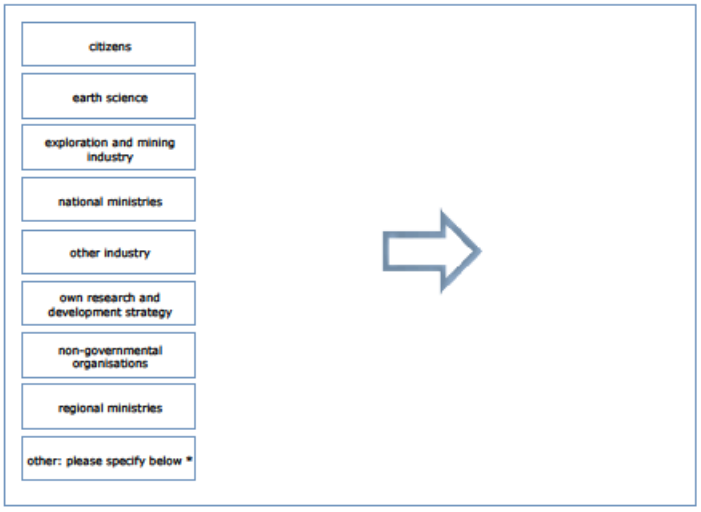
## 8 Q4: Emerging raw material information needs

**Emerging information needs of clients**

The MICA online platform aims to assist you in meeting emerging raw material information needs.

**Who are your key clients?**

*Please sort the client groups by relevance to your geological survey's extent of work:*



** Other client group:*

**What are emerging questions raised by your key clients, which might influence your future work by 2020 significantly?**

*Please fill in up to 3 most urgent, emerging raw material information needs of your **national / regional ministries**.*

*Please fill in up to 3 most urgent, emerging raw material information needs of your **other key clients**.*

**9 Q5: Future strategic issues**

**Future strategic issues**

A number of future developments are under way that may require strategic responses of your geological survey having implications for your raw material information needs.

**How important are the following future developments for your geological survey by 2020?**

*Please tick the respective box.*

| | very important | important | unimportant | I don't know |
|---|---|---|---|---|
| Europe striving for a **circular economy**, other world regions for traditional mining | ○ | ○ | ○ | ○ |
| Europe striving for a **bio-based economy**, other world regions for a minerals-based economy | ○ | ○ | ○ | ○ |
| European regions striving for **regional economies**, other world regions for global markets | ○ | ○ | ○ | ○ |
| Soaring **social conflicts** over exploration and mining in Europe (land use conflicts, scandalization of mountain top removal, offshore accidents, etc.) | ○ | ○ | ○ | ○ |
| **EU under threat** - fragmented European integration – | ○ | ○ | ○ | ○ |
| A world of **raw material abundance** (falling raw material costs, frontier mining, new technologies, etc.) | ○ | ○ | ○ | ○ |
| A world of increased **competition for raw materials** (volatile and long-term increase in raw material costs, clashing of national interests, etc.) | ○ | ○ | ○ | ○ |
| A global **digital economy** (hyper connectivity and big data, relocation of value chains, etc.) | ○ | ○ | ○ | ○ |
| **Instable world economy and societies (financial crisis, migration, etc.)** | ○ | ○ | ○ | ○ |

Other very important future developments:

**10 Q6: Requirements to the online platform**

**Functional requirements to the online platform**

The MICA online platform will host and combine different data sources and data types, methods and tools to respond to geological surveys' (and other stakeholders') raw material information needs. Your information needs may range from simple routine questions to single complex questions. The online platform shall be as powerful and user-friendly as possible.

**What are your most important technical requirements to the envisaged MICA online platform?**

*Please select **up to 3** most important functional requirements.*

- ☐ Each stakeholder question and the respective platform response should be documented in a transparent and traceable way.
- ☐ It should be possible to select between the latest data available, the most reliable data available, the most comprehensive data available and to select between freely and commercially available data.
- ☐ The online platform should provide effective guidance to technical experts how to employ the methods suggested.
- ☐ The online platform should contain all tools suggested with a free download function.
- ☐ The suggested sequence of operations to answer a question, i.e. a combination of information on data sets and methods & tools, should meet the scientific state of the art.
- ☐ The online platform should provide additional guidance in case it suggests various ways to meet a raw material information need.
- ☐ The queries and responses by the online platform should be archivable in text, spreadsheet and database format.
- ☐ The online platform should display the output in an easy to understand and attractive graphical format.

*Please fill in up to 3 other most important functional requirements:*

**11 General information**

**General information**

*Please tick your position at the geological survey:*

- ☐ strategic management
- ☐ geological data, information and knowledge
- ☐ minerals research
- ☐ public relations

*other - please specify:*

*Do you have further comments?*

**12 Beenden**

You have reached the end of the survey.

**Please submit your questionnaire by clicking on "continue".**
**Afterwards, no changes are possible any more.**

**13 Endseite**

**You have succesfully submitted your responses.**

**Thank you very much for your participation!**

**The MICA Team**

## Appendix 2: EFG Survey – invitation letter and questionnaire

### EFG Survey - Invitation Letter

Dear Colleague,
The MICA Project aims to improve the provision and delivery of raw material information to stakeholders in Europe through a powerful, user-friendly online platform. It focuses on mineral raw materials (metallic, industrial and construction minerals). The MICA online platform will integrate different data sets, methods and foresight tools in a single platform. To this end MICA carries out a careful analysis of stakeholder needs.
The European Federation of Geologists (EFG) is a partner of MICA and is now running a survey among its members on geoscientists' information needs, in co-operation with the Fraunhofer Institute for Systems and Innovation Research (ISI).
You are receiving this request to take part in this survey because your views are vital to enhance our knowledge and understanding of raw material information needs of professional geologists as potential users of the envisaged online platform. The results will be used to account for the needs of the EFG members in the design and services of the MICA platform (see MICA leaflet attached and website http://www.mica-project.eu).
The online survey will be open until July 22nd, 2016. It should take not more than 15-20 minutes to complete. Your responses will remain strictly confidential and will only be used for the purposes of this study (see MICA data protection statement attached). We will provide to all participants in the survey a copy of the results, and we thank you in advance for your help in this effort.

To begin the survey, please follow your personalized link: MICA Survey

If you require any further information about the study or have any technical problems with the survey website, please do not hesitate to contact us directly by email.
Yours sincerely,
**Vanja Bisevac**
The European Federation of Geologists
Phone: +32 2 7887614 Email: vanja.bisevac@eurogeologists.eu
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Fraunhofer Institute for Systems and Innovation Research ISI
Phone: +49 721 6809 313 I Email: lorenz.erdmann@isi.fraunhofer.de

## EFG Survey - Questionnaire



# MICA project: information needs of geologists

Welcome to the survey on raw materials information needs. This survey is designed for geologists and it is part of the works being developed by the MICA project. The MICA project aims to improve the provision and delivery of raw material information to stakeholders in Europe through a powerful, user-friendly online platform. MICA focuses on mineral raw materials (metallic, industrial and construction minerals) and anthropogenic stocks of secondary raw materials.
Thank you very much for your willingness to participate. Your input will contribute to making project outputs more useful to yourself and others, and also to defining research needs for future work.
The survey should take not more than 15-20 minutes to complete. Your responses will remain strictly confidential and will only be used for the purposes of this study.


## EFG Communication <Question 1/5>

The EFG is a not-for-profit organisation whose purpose is to represent the professions of geology in Europe, especially to the European Union and its various bodies. We communicate regularly with our members through GeoNews, EFG's monthly newsletter, the biannual European Geologist Journal and social media.

### Please let us know your opinion on EFG's media:

(thick the appropriate box)

1. *Mark only one oval per row.*

| | I strongly agree | Agree | Disagree | Strongly disagree | I don't have an opinion |
|---|---|---|---|---|---|
| GEONEWS - The new layout facilitates reading | ◯ | ◯ | ◯ | ◯ | ◯ |
| GEONEWS - The newsletter is too long | ◯ | ◯ | ◯ | ◯ | ◯ |
| EUROPEAN GEOLOGIST JOURNAL - Thematic issues are appealing | ◯ | ◯ | ◯ | ◯ | ◯ |
| LINKEDIN - The information provided on EFG H2020 projects is sufficient | ◯ | ◯ | ◯ | ◯ | ◯ |
| TWITTER - EFG tweets are relevant | ◯ | ◯ | ◯ | ◯ | ◯ |

## Use of raw material information platforms <Question 2/5>

MICA project: information needs of geologists

Geologists are both providers and users of raw material information. Beyond the geological portals you are well familiar with, a number of European raw material information platforms have emerged. We intend to incorporate some of them in the MICA online platform.

2. **a) How often do you use these EU raw material information platforms?**
*Mark only one oval per row.*

| | daily to weekly | monthly to quarterly | yearly or less frequent | not at all |
|---|---|---|---|---|
| EGDI – European Geological Data Infrastructure (http://www.egdi-scope.eu) | ◯ | ◯ | ◯ | ◯ |
| EIT-KIC Raw Materials – turning the challenge of raw materials dependence into a strategic strength for Europe (http://eitrawmaterials.eu) | ◯ | ◯ | ◯ | ◯ |
| EO-MINERS – Earth Observation to improve best practice in mining (http://www.eo-miners.eu) | ◯ | ◯ | ◯ | ◯ |
| EuroGeoSource – aggregated geographical information on geo-energy and mineral resources (http://www.eurogeosource.eu/) | ◯ | ◯ | ◯ | ◯ |
| i2Mine – the Intelligent Deep Mine of the Future (http://www.i2mine.eu) | ◯ | ◯ | ◯ | ◯ |
| INTRAW – Fostering international cooperation on raw materials (http://intraw.eu) | ◯ | ◯ | ◯ | ◯ |
| Minerals4EU – provides data, information and knowledge on mineral resources and production around Europe (http://www.minerals4eu.eu/) | ◯ | ◯ | ◯ | ◯ |
| MINVENTORY – directory of statistical data holders on stocks and flows of primary and secondary raw materials (https://ec.europa.eu/growth/tools-databases/minventory/content/minventory) | ◯ | ◯ | ◯ | ◯ |
| EURare –development of a European Rare Earth Element (REE) industry for uninterrupted supply of REE raw materials and products (http://www.eurare.eu/) | ◯ | ◯ | ◯ | ◯ |
| ProMine –stimulate the extractive industry to deliver new products to manufacturing industry (http://promine.gtk.fi) | ◯ | ◯ | ◯ | ◯ |
| Raw Materials Information System (http://rmis.jrc.ec.europa.eu/) | ◯ | ◯ | ◯ | ◯ |
| other EU raw material information platforms publicly available | ◯ | ◯ | ◯ | ◯ |

3. **In case you chose "other EU information platforms", please specify.**

.....

MICA project: information needs of geologists

4. **b) How often do you use other raw material information platforms?**
*Mark only one oval per row.*

| | daily to weekly | monthly to quarterly | yearly or less frequent | not at all |
|---|---|---|---|---|
| IRP - International Resource Panel Working Group on Global Metal Flows (http://www.unep.org/resourcepanel) | ◯ | ◯ | ◯ | ◯ |
| national platforms (e.g. national geosurveys) | ◯ | ◯ | ◯ | ◯ |
| regional platforms (e.g. regional geosurveys) | ◯ | ◯ | ◯ | ◯ |
| commercial platforms (e.g. Roskill Information Services) | ◯ | ◯ | ◯ | ◯ |
| other platforms | ◯ | ◯ | ◯ | ◯ |

5. **In case you chose "other platforms", please specify.**

.....

## Needs for improvement of raw material information <Question 3/5>

Today geologists have to identify particular different sources in order to meet their raw material information needs. The development of the MICA online platform aims to:
(1) improve access to information: different data sets (e.g. Europe-wide geological data, socio-economic data) and methods & tools (e.g. 3D models, scenario tools for future land use) are made available in a single platform.
(2) support responding to information needs: stakeholders in Europe first ask questions (e.g. how large is the resource potential for a commodity considering land use constraints), and then the platform suggests sequences of operations to answer the questions, i.e. it delivers combinations of information on data sets and methods & tools.

We want to know which of these two improvement options you consider as particularly important in four knowledge fields.

## a) Identification and assessment of mineral deposits:

(choose your needs for improvement of information on the following themes)

MICA project: information needs of geologists

6. *Mark only one oval per row.*

| | improve access to information (1) | support responding to information needs (2) | both: improve access (1) and support responding (2) | not relevant to my work |
|---|---|---|---|---|
| mineral endowment | ◯ | ◯ | ◯ | ◯ |
| onshore resource potential | ◯ | ◯ | ◯ | ◯ |
| offshore resource potential | ◯ | ◯ | ◯ | ◯ |
| greenfield exploration | ◯ | ◯ | ◯ | ◯ |
| brownfield exploration | ◯ | ◯ | ◯ | ◯ |
| geographical referencing and integration of earth observation, geological, land use, socioeconomic and other data | ◯ | ◯ | ◯ | ◯ |
| historical information | ◯ | ◯ | ◯ | ◯ |

7. **Please specify other urgent raw material information needs for identification and assessment of mineral deposits (up to three):**

.....

8.

.....

9.

.....

## b) Exploitation of mineral deposits:

(choose your needs for improvement of information on the following themes)

MICA project: information needs of geologists

10. *Mark only one oval per row.*

| | improve access to information (1) | support responding to information needs (2) | both: improve access (1) and support responding (2) | not relevant to my work |
|---|---|---|---|---|
| land use constraints | ◯ | ◯ | ◯ | ◯ |
| investors and investment levels | ◯ | ◯ | ◯ | ◯ |
| existing and planned mining ventures | ◯ | ◯ | ◯ | ◯ |
| financing options for mining ventures | ◯ | ◯ | ◯ | ◯ |
| licensing procedures | ◯ | ◯ | ◯ | ◯ |
| mining operations (miners, production) | ◯ | ◯ | ◯ | ◯ |
| environment, health and safety (EHS) issues | ◯ | ◯ | ◯ | ◯ |
| closure requirements | ◯ | ◯ | ◯ | ◯ |
| post mine closure responsibilities | ◯ | ◯ | ◯ | ◯ |

11. **Please specify other urgent raw material information needs in the field of the exploitation of mineral deposits (up to three):**

.....

12.

.....

13.

.....

## c) Anthropogenic stocks and recycling:

(choose your needs for improvement of information on the following themes)

14. *Mark only one oval per row.*

| | improve access to information (1) | support responding to information needs (2) | both: improve access (1) and support responding (2) | not relevant to my work |
|---|---|---|---|---|
| abandoned mining waste deposits and tailings | ◯ | ◯ | ◯ | ◯ |
| abandoned mines for future land use (contamination, geological safety, etc.) | ◯ | ◯ | ◯ | ◯ |
| above ground infrastructure stock of commodities (buildings, railways, etc.) | ◯ | ◯ | ◯ | ◯ |
| subsurface infrastructure stock of commodities (water pipes, underground energy cables, etc.) | ◯ | ◯ | ◯ | ◯ |
| material flows for the recovery of commodities (demolition waste, industrial residues, etc.) | ◯ | ◯ | ◯ | ◯ |
| landfill mining for the recovery of commodities | ◯ | ◯ | ◯ | ◯ |

15. **Please specify other urgent raw material information needs in the field of anthropogenic stocks and recycling (up to three):**

.....

16.

17.

## d) Other fields:

(choose your needs for improvement of information on the following themes)

18. *Mark only one oval per row.*

| | improve access to information (1) | support responding to information needs (2) | both: improve access (1) and support responding (2) | not relevant to my work |
|---|---|---|---|---|
| life cycle perspective on environment, health and safety (EHS) impacts of exploration and mining | ◯ | ◯ | ◯ | ◯ |
| mineral policies at global, EU, national and regional level | ◯ | ◯ | ◯ | ◯ |
| other policies affecting minerals extraction (regional development, trade, etc.) at global, EU, national and regional level | ◯ | ◯ | ◯ | ◯ |
| reporting (accountability to she hareholders, employees, local communities and the general public) | ◯ | ◯ | ◯ | ◯ |
| stakeholder identification | ◯ | ◯ | ◯ | ◯ |
| effective multi-stakeholder engagement | ◯ | ◯ | ◯ | ◯ |

19. **Please specify other urgent raw material information needs on other fields (up to three):**

.....

20.

.....

21.

.....

## Emerging information needs of key clients <Question 4/5>

## Who are your key clients?

Please select up to three key clients of your work:

22. *Tick all that apply.*

- [ ] geological surveys
- [ ] environmental agencies
- [ ] mining authorities
- [ ] land use authorities
- [ ] consultancies / planning offices
- [ ] academia / universities / research institutes
- [ ] exploration industry
- [ ] mining industry
- [ ] raw material processing industry (e.g. metal smelters, cement production)
- [ ] civil society
- [ ] policy makers (ministries, parliaments, parties, etc.)
- [ ] other

23. **If you choose "other", please specify.**

.....

## What are emerging questions raised by your key clients, which might influence your work significantly until 2020?

Please mention up to 5 most urgent, emerging raw material information needs of your key clients.

24.

.....

25.

.....

26.

.....

27.

28.

## Requirements to the online platform <Question 5/5>

The MICA online platform will host and combine different data sources and data types, methods and tools to respond to geologists' (and other stakeholders') raw material information needs. Your information

needs may range from simple routine questions to single complex questions. The online platform shall be as powerful and user-friendly as possible.

29. **Please select up to 3 most important requirements that could make you an actual user of the MICA online platform.**
*Tick all that apply.*

- [ ] Each stakeholder question and the respective platform response should be documented in a transparent and traceable way.
- [ ] It should be possible to select between the latest data available, the most reliable data available, the most comprehensive data available and to select between freely and commercially available data.
- [ ] The online platform should provide effective guidance to geologists how to employ the methods suggested.
- [ ] The online platform should contain all tools suggested with a free download function.
- [ ] The suggested sequence of operations to answer a question, i.e. a combination of information on data sets and methods & tools, should meet the scientific state of the art.
- [ ] The online platform should provide additional guidance in case it suggests various ways to meet a raw material information need.
- [ ] The queries and responses by the online platform should be archivable in text, spreadsheet and database format.
- [ ] The online platform should display the output in an easy to understand and attractive graphical format.

30. **Please specify other urgent requirements to the MICA online platform:**

.....

.....

.....

.....

## General information

Please let us know more about you.

## What's the type of organisation you work for?

31. *Tick all that apply.*

- [ ] industry
- [ ] geological survey
- [ ] public authority
- [ ] academia / university / research institute
- [ ] consultancy / planning office
- [ ] other

32. **If you choose "other", please specify:**

.....

## Please tick the principal thematic area(s) you work in:

(you can choose more than one)

33. *Tick all that apply.*

- [ ] regional reconnaissance and prospection
- [ ] mineral exploration
- [ ] planning of mining ventures
- [ ] development/engineering of mining ventures
- [ ] financing of mining ventures
- [ ] licensing of mining ventures
- [ ] mining operation
- [ ] mining support services (consumables, machinery, etc.)
- [ ] environment, health and safety (EHS) issues of mining
- [ ] long-term stewardship of mines
- [ ] land use planning
- [ ] earth sciences / applied geological sciences
- [ ] professional training
- [ ] other

34. **If you choose "other", please specify:**

.....

35. **Please list the countries where you normally work**

36. **What is your current age?**
*Tick all that apply.*

- [ ] less than 29
- [ ] 30-39
- [ ] 40-49
- [ ] 50-59
- [ ] 60 and older

37. **Do you have any further comments?**

.....

.....

.....

.....

**Thank you for participation in this survey! We are looking forward to sharing the results with you!**

If you tick the "submit" button, no further changes of your responses will be possible. If you want to change your responses, you should click the "back" button(s).

Powered by Google Forms

## Appendix 3: Industry Survey – invitation letter and questionnaire

### Industry Survey - Invitation Letter

<Subject:> Survey on raw material information needs of industry associations / EU project "MICA"

Dear #Person #Title #Last Name,

the EU- funded MICA project aims to improve the provision and delivery of raw material information to stakeholders in Europe through a powerful, user-friendly online platform. It focuses on metals, industrial minerals and construction materials both of primary and secondary origin. This MICA online platform will integrate different data sets, methods and foresight tools in a single platform. To this end MICA carries out a careful analysis of stakeholder needs.
The Fraunhofer Institute for Systems and Innovation Research (ISI) is a MICA partner and conducts a survey among industry associations representing the materials, manufacturing and recycling industries with the aim to identify their raw material information needs.
#You# are receiving this request to take part in this survey because your views are vital to enhance our knowledge and understanding of raw material information needs in particular of European industry as potential users of the envisaged online platform. The results will be used to account for the needs of the different industry sectors in the design and services of the MICA online platform (see pdf attached and website http://www.mica-project.eu).
The online survey will be open until July 22nd, 2016. It should take not more than 15-20 minutes to complete. Your responses will remain strictly confidential and will only be used for the purposes of this study (see MICA data protection statement attached). We will provide to all participants in the survey a copy of the results, and we thank you in advance for your help in this effort.
Please convey this Email to a suitable person in your association.
To begin the survey, please follow the personalized link: #link
If you want several people to fill in the questionnaire, please send us a request for another personalized link with the email address of the recipient.

Please do not hesitate to contact us directly by email in case you require any further information about the project or have any technical problems with the survey.

Yours sincerely,

Lorenz Erdmann for the MICA team
Fraunhofer Institute for Systems and Innovation Research ISI
Phone: +49 721 6809 313 I Email: MICA@isi.fraunhofer.de

# Industry Survey - Questionnaire



## Fragebogen

### 1 Start

**MICA project: raw material information needs of industry associations**

Welcome to the survey on raw materials information needs. This survey is part of the EU-funded project MICA and specifically designed to gather the needs of industry associations representing the materials (incl. raw material processing), manufacturing and recycling industries.

The MICA project aims to improve the provision and delivery of raw material information to stakeholders in Europe and beyond through a powerful, user-freindly online platform. It focuses on metals, industrial minerals and construction materials both of primary and secondary origin (http://www-mica-project.eu).

Your input will contribute to making project outputs more useful to yourself and others, and also to defining research needs for future work. The survey should take not more than 15-20 minutes to complete.

Your responses will remain strictly confidential and will only be used for the purposes of this study.

### 2 Q1: Current Issues

**Current strategic issues**

Industry associations represent the interests of their member companies in particular at EU level and assist them in meeting their information needs in changing regulatory environments, dynamic markets and towards diverse societal claims.

**How important are the following strategic issues for your industry?**

Please tick the respective box.

| | very important | important | unimportant | I don't know |
|---|---|---|---|---|
| **Circular Economy Action Plan of the EC** (incl. revision of waste directives) | ○ | ○ | ○ | ○ |
| **Conflict minerals** (proposal for a EU regulation on imports) | ○ | ○ | ○ | ○ |
| **Permission of industrial facilities in the EU** (review of Best Available Technique Reference documents) | ○ | ○ | ○ | ○ |
| **REACH and non-REACH** (review of chemicals regulation) | ○ | ○ | ○ | ○ |
| **Competitiveness of the European industry** under current raw material supply conditions | ○ | ○ | ○ | ○ |
| **TTIP, CETA, TiSA** (impacts on raw material trade) | ○ | ○ | ○ | ○ |
| **Capability of the European innovation system** to deliver high value novel materials & products | ○ | ○ | ○ | ○ |
| **Volatile raw material prices** | ○ | ○ | ○ | ○ |
| **Ethical requirements** to European industry (e.g. responsibility for supply chain, own operations, end-of-life impacts) | ○ | ○ | ○ | ○ |
| **Sustainable Development Goals (SDS)** (impacts on raw material supply) | ○ | ○ | ○ | ○ |

Please list up to 3 other very important strategic issues for your industry.

### 3 Q2: Use of raw material information platforms

**Use of raw material information platforms**

A number of raw material information platforms have emerged that you might already know. We intend to incorporate some of them in the envisaged MICA online platform.

**How useful are the following raw material information platforms for your industry?**

Please tick the respective box for EU platforms.

| | very useful | useful | useless | I don't know |
|---|---|---|---|---|
| **CRM_InnoNet** – Substitution of critical raw materials (www.criticalrawmaterials.eu) | ○ | ○ | ○ | ○ |
| **EGDI** – European Geological Data Infrastructure (http://www.egdi-scope.eu) | ○ | ○ | ○ | ○ |
| **EIT-KIC Raw Materials** – turning the challenge of raw materials dependence into a strategic strength for Europe (http://eitrawmaterials.eu) | ○ | ○ | ○ | ○ |
| **EO-MINERS** – Earth Observation to improve best practice in mining (http://www.eo-miners.eu) | ○ | ○ | ○ | ○ |
| **EURare** –development of a European Rare Earth Element (REE) industry for uninterrupted supply of REE raw materials and products (http://www.eurare.eu) | ○ | ○ | ○ | ○ |
| **EuroGeoSource** – aggregated geographical information on geo-energy and mineral resources (http://www.eurogeosource.eu) | ○ | ○ | ○ | ○ |
| **i2Mine** – the Intelligent Deep Mine of the Future (http://www.i2mine.eu) | ○ | ○ | ○ | ○ |
| **INTRAW** – Fostering international cooperation on raw materials (http://intraw.eu) | ○ | ○ | ○ | ○ |
| **Minerals4EU** – provides data, information and knowledge on mineral resources and production around Europe (http://www.minerals4eu.eu) | ○ | ○ | ○ | ○ |
| **MINVENTORY** – directory of statistical data holders on stocks and flows of primary and secondary raw materials (https://ec.europa.eu/growth/tools-databases/minventory/content/minventory) | ○ | ○ | ○ | ○ |
| **ProMine** – stimulate the extractive industry to deliver new products to manufacturing industry (http://promine.gtk.fi) | ○ | ○ | ○ | ○ |
| **RMIS** – Raw Material Information System of the EC-JRC (http://rmis.jrc.ec.europa.eu) | ○ | ○ | ○ | ○ |

**other very useful EU** raw material information platforms:

Please tick the respective box for non-EU platforms.

| | very useful | useful | useless | I don't know |
|---|---|---|---|---|
| **IRP International Resource Panel** Working Group on Global Metal Flows (http://www.unep.org/resourcepanel) | ○ | ○ | ○ | ○ |
| **national platforms** (e.g. national geosurveys) | ○ | ○ | ○ | ○ |
| **regional platforms** (e.g. regional geosurveys) | ○ | ○ | ○ | ○ |
| **commercial platforms** (e.g. Roskill Information Services) | ○ | ○ | ○ | ○ |

**other very useful non-EU** raw material informations:

**4 Q3: Needs for improvement of raw material information**

**Needs for improvement of raw material information**

Today industries have to identify particular different sources in order to meet their raw material information needs.

The development of the MICA online platform aims to

1. **improve access to information**: different data sets (e.g. EU-wide raw material production data, socio-economic data, etc.) and methods & tools (e.g. life cycle analysis, scenario tools for future material demand) are made available in a single platform
2. **support responding to information needs**: stakeholders first ask questions (e.g. from whom will we get how much material in a circular economy?), and then the platform suggests sequences of operations to answer the questions, i.e. it delivers combinations of information on data sets, methods & tools.

We want to know how you assess these two improvement options in four knowledge fields.

**Which of the two improvement options do you consider as particularly important to your work?**

Please tick your needs in the field of **raw material supply and demand**.

| | improve access to information (1) | support responding to information needs (2) | both: improve access (1) and support responding (2) | not relevant to our work |
|---|---|---|---|---|
| **early warning system for criticality** to our industry (indicators, monitoring, etc.) | ○ | ○ | ○ | ○ |
| **future criticality** of raw materials | ○ | ○ | ○ | ○ |
| **conflict minerals** (origin, certification, etc.) | ○ | ○ | ○ | ○ |
| **future demand for commodities** | ○ | ○ | ○ | ○ |
| **future demand for specialities** | ○ | ○ | ○ | ○ |
| **future raw material supply** (primary and secondary share, sources, etc.) | ○ | ○ | ○ | ○ |
| **dependence of companions from major commodities** (e.g. molybdenum from copper) | ○ | ○ | ○ | ○ |
| **raw material price development** (short-, medium- and long-term) | ○ | ○ | ○ | ○ |

Please specify up to 3 other very important raw material information needs in the field of raw material supply and demand:

5 Q3.2: Needs for improvement of raw material information

Please tick your needs in the field of **material production and manufacturing**.

| | improve access to information (1) | support responding to information needs (2) | both: improve access (1) and support responding (2) | not relevant to our work |
|---|---|---|---|---|
| **raw-material processing industry structure** in Europe (types developed, investors, investment levels) | ○ | ○ | ○ | ○ |
| **raw-material processing plants** in Europe (sites, raw material sourcing, energy supply, etc.) | ○ | ○ | ○ | ○ |
| **future primary and secondary material production** in Europe (amounts, actors, etc.) | ○ | ○ | ○ | ○ |
| **regional clusters** (mining, processing and transforming raw materials into high value products) | ○ | ○ | ○ | ○ |
| **impacts of changing raw material supply patterns on value chains** | ○ | ○ | ○ | ○ |
| **supply chain bottlenecks** in Europe | ○ | ○ | ○ | ○ |
| **design of materials, products and infrastructure** (supporting raw material information, substitution options) | ○ | ○ | ○ | ○ |

| | | | | |
|---|---|---|---|---|
| **resource efficiency potentials** for European industry | ○ | ○ | ○ | ○ |

Please specify up to 3 other very important raw material information needs in the field of material production and manufacturing:

**6 Q3.3: Needs for improvement of raw material information**

Please tick your needs in the field of **anthropogenic stocks and recycling**.

| | improve access to information (1) | support responding to information needs (2) | both: improve access (1) and support responding (2) | not relevant to our work |
|---|---|---|---|---|
| above ground infrastructure stock of commodities (in buildings, railways, etc.) | ○ | ○ | ○ | ○ |
| subsurface infrastructure stock of commodities (in water pipes, underground cables, etc.) | ○ | ○ | ○ | ○ |
| movable product stock of commodities (vehicles, consumer electronics, etc.) | ○ | ○ | ○ | ○ |
| city-level stock of commodities (location, quantity, purity, buildings passport, etc.) | ○ | ○ | ○ | ○ |
| material flows for the recovery of commodities (demolition waste, industrial residues, etc.) | ○ | ○ | ○ | ○ |
| recycling (waste collection rates, share of recycling in total production, etc.) | ○ | ○ | ○ | ○ |
| landfill mining for the recovery of commodities (materials, environment, etc.) | ○ | ○ | ○ | ○ |
| agile remanufacturing (handle input variety, flexible adaptation, etc.) | ○ | ○ | ○ | ○ |

Please specify up to 3 other very important raw material information needs in the field of the anthropogenic stocks and recycling:

**7 Q3.4: Needs for improvement of raw material information**

Please tick your needs **in other fields**.

| | improve access to information (1) | support responding to information needs (2) | both: improve access (1) and support responding (2) | not relevant to our work |
|---|---|---|---|---|
| **investment cycles in exploration & mining** (time length, finance options, etc.) | ○ | ○ | ○ | ○ |
| **game-changing technologies** for industry (share operational field data with suppliers, additive manufacturing, etc.) | ○ | ○ | ○ | ○ |
| | ○ | ○ | ○ | ○ |

| | | | | |
|---|---|---|---|---|
| **life cycle perspective on environment, health and safety (EHS) impacts of raw materials** | | | | |
| **material policies** at global, EU, national and regional level | ○ | ○ | ○ | ○ |
| **other policies** affecting European industry's material base (regional development, trade, etc.) at global, EU, national and regional level | ○ | ○ | ○ | ○ |
| **reporting** (accountability to shareholders, to employees, to local communities and to the general public) | ○ | ○ | ○ | ○ |
| **stakeholder identification** | ○ | ○ | ○ | ○ |
| **effective multi-stakeholder engagement** | ○ | ○ | ○ | ○ |

Please specify any other very important raw material information needs (up to 3):

## 8 Q4: Emerging raw material information needs

### Emerging raw material information needs

It may be important for your industry association to identify first the emerging raw material information needs of your key clients. The MICA online platform aims to assist you in meeting such emerging raw material information needs.

What are emerging topics, which might influence your future work by 2020 significantly?

By 2020, we expect our **members** to raise these emerging topics:

By 2020, we expect our **key external stakeholders** to raise the following topics:

## 9 Q5: Future strategic issues

### Future strategic issues

A number of future developments are under way that may require strategic responses of your industry having implications for your raw material information needs.

**How important are the following future developments for your industry by 2020?**

Please tick the respective box.

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| | very important | important | unimportant | I don't know |
|---|---|---|---|---|
| Europe striving for a **circular economy**, other world regions for traditional mining | ○ | ○ | ○ | ○ |
| Europe striving for a **bio-based economy**, other world regions for a minerals-based economy | ○ | ○ | ○ | ○ |
| European regions striving for **regional economies**, other world regions for global markets | ○ | ○ | ○ | ○ |
| **EU under threat** – rising disintegration tendencies | ○ | ○ | ○ | ○ |
| A world of **raw material abundance** (falling raw material costs, frontier mining, new technologies, etc.) | ○ | ○ | ○ | ○ |
| A world of increased **competition for raw materials** (volatile and long-term increase in raw material costs, clashing of national interests, etc.) | ○ | ○ | ○ | ○ |
| A global **digital economy** (hyper connectivity and big data, relocation of value chains, etc.) | ○ | ○ | ○ | ○ |
| **Instable world economy and societies** (financial crisis, migration, etc.) | ○ | ○ | ○ | ○ |
| **Environment and health issues** drive raw material use globally (climate change, children's environmental health, etc.) | ○ | ○ | ○ | ○ |

**Spalte 1**

**Other very important future developments**

## 10 General information

### General information

Please tick the **part(s) of the value chain** that your industry association covers:

- ☐ processing of primary raw materials (e.g. blast furnace processing iron ore)
- ☐ processing of secondary raw materials (e.g. electric arc furnace processing steel scrap)
- ☐ basic material production (e.g. metals, burnt lime, etc.)
- ☐ material production (e.g. production of alloys, cement, composites, etc.)
- ☐ semi-finished products (e.g. coils, ingots, etc.)
- ☐ component and part manufacturing
- ☐ final end-product manufacturing
- ☐ construction and civil engineering
- ☐ installation of equipment
- ☐ dismantling (buildings, infrastructure, industrial facilities, etc.)
- ☐ waste collection and management

other: please specify

Please tick **your position**:

- ☐ strategic management of industry association
- ☐ public relations, information and communication of industry association
- ☐ technical committee / technical working group
- ☐ member company

other: please specify

Do you have further comments?

Please tick the following two boxes.

| | No | Yes |
|---|---|---|
| I want to get the results of the survey | ○ | ○ |
| You can contact me in case you have further questions for clarification | ○ | ○ |

If you have ticked one or two boxes with 'Yes', please drop your email address:

**11 Beenden**

You have reached the end of the survey.

**Please submit your reponses by clicking on "continue".**

**Afterwards, no changes are possible any more.**

**12 Endseite**

# Appendix 4: Information material provided at the Stakeholder Workshop

**D1 Mineral deposits**

| Topics | Subtopics |
|---|---|
| geo information | geological , geophysical, geochemical and mineral resources maps and databases;<br>national/regional /district scale (1:50.000), geological research archive, geological structures and formations;<br>published and unpublished, open geodata |
| land use information | current land use and land use plans, urban planning, area development;<br>protected areas (e.g. natural areas, cultural areas, recreational areas, indigenous people);<br>infrastructure plans (from government to municipality level, which municipalities where?);<br>groundwater capacity and competition, underground waters;<br>access (land use availability, restrictions), safeguarding of potential deposits and prospects |
| deposit information | mineral occurences: size, location, quality data and mineral endowment of deposits;<br>consistent information provided to national, state and region agencies, access to consultants;<br>geological information, interpretation and modeling |
| resource classification and documentation | onshore and offshore resource potential, resources and reserves (registered; licensed/proven);<br>per deposit, in Europe;<br>aggregate national datasets and databases from various sources, statistics easy access to public reporting |
| exploration information | existing data on greenfield and brownfield exploration;<br>exploration permits, license holders;<br>funding opportunities for exploration;<br>constraints to exploration (see: land use information (above), D7 Political & legal framework, D8 Social accountability & reporting) |
| historical information | drill core archives (national);<br>compilation of historical data on raw material occurrences |
| geographical referencing and integration | of earth observation, geological, land use, socio-economic and other data |

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**D1 Mineral deposits**

1. How large is the **possibility to find enough new resources** in any given area to open new mines (e.g. Greenland)?
2. Where are the **most promising future mining areas** (geological interpretation and modelling, R&D focus, feasibility of prospective deposits, proposal for strategic use of mineral resources)? Where could we possibly find the next "**mega deposit**"?
3. How much **building material** is **available** locally for a certain construction project (e.g. sand, limestone)?
4. Which **information on exploration works** is available (licensing, reports, mining industry/universities/companies involved, expertise available in a certain country)?
5. Which **innovations in greenfield exploration** will be available soon (e.g. more cost effective)?
6. Which **information** is available about a **specific** raw material type, **specific** mineral resources objective, mineral resources from a **specific** area (fact sheets)?
7. What are the possibilities and realistic prospects of **financing** exploration projects?
8. How can I get **expertise/assistance from EU or other geological surveys** for the exploration of deep deposits of mineral resources?

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**D2 Mine development & mining**

| Topics | Subtopics |
|---|---|
| constraints to mining | social/environmental/geological/technical constraints;<br>small, complex, difficult access;<br>see also constraints to exploration (D1 mineral deposits, D7 Political & legal framework, D8 Social accountability & reporting) |
| encouragement of mining | potential for expansion in Europe, economic viability;<br>small-scale mining;<br>technical and legal support, cross-border initiatives |
| Investment in mining | investors and investment levels;<br>financing options for mining ventures |
| existing and planned mining ventures | exploitation / mining concessions;<br>licensing procedures, ownership of mines, property protection, security of tenement;<br>See also D7 Political & legal framework |
| mining operations | mining companies, production amounts, (current and historical);<br>mining efficiency in times of low commodity prices, improvement of extraction rates |
| environment, health and safety issues | waste minimisation, waste utilization (e.g. quarry/marble )<br>mine closure requirements, post mine closure responsibilities (environmental impact plans)<br>Tailings: see also D3 Anthropogenic stocks & recycling , D7 Environment & health |
| Trends and issues | technological trends in mining processes, automated deep mining, integrated system for metals processing and refining, optimisation measures, technology overhaul needs, employment;<br>new sustainable concepts and solutions for mining, |

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**D2 Mine development & mining**

1. What is the overall **risk** of exploration and mining of mineral X in country Y?
2. What do we know about the **accessibility** of commodity X in country Y for mining?
3. How will the **political situation** in country Y develop with regard to mining in the next couple of years (e.g. REEs that contain Uranium in Greenland)?
4. Will **commodity prices** stay high enough to be able to effort the next phase of exploration?
5. What is the **cost of extraction** for mining commodity X?
6. Growing interest in **infrastructure developments** – especially for low value high volume commodities. Which infrastructure needs to be built to transport minerals in the future? Where are they built? What materials will be needed therefore?
7. What are the possibilities and realistic prospects of **financing** mining projects?
8. How long is the likely **timeframe for permitting** a new mine / to re-open an old mine?

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**D3 Anthropogenic stocks & recycling**

| Topics | Subtopics |
|---|---|
| above ground infrastructure stock of commodities | in buildings, railways, etc. |
| subsurface infrastructure stock of commodities | in water pipes, underground cables, etc. |
| movable product stock of commodities | vehicles, consumer electronics, etc. |
| city-level stock of commodities | location, quantity, purity, buildings passport, etc. |
| material flows relevant for the potential recovery of commodities | waste materials (demolition waste, industrial residues, etc.), material composition;<br>waste uses |
| recycling | recycling levels of commodities ,waste collection rates (e.g. WEEE), share of recycling in total production, real and potential recovery rates;<br>differences between recycling rates (calculation methods, closed vs. open recycling, input vs. production share, etc.);<br>input properties, recyclability data |
| re-manufacturing | effective and economic technologies for recycling and recovery, agile remanufactrung (handle input variety, flexible Adaptation), etc.;<br>output properties, improved downstream processing of mixtures |
| landfill mining for the recovery of commodities | waste fractions (site, location on landfill, materials contained in quality and quantity), environment (accessibility, degree of inertisation, etc.) |
| abandoned mines | waste deposits and tailings: potential for secondary use, chemical information<br>sites for future land use: contamination, geological safety, etc.<br>See also: D1 Mine development and mining, D7 Environment & health |

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**D3 Anthropogenic stocks & recycling**

1. How does the **urban environment interact with the subsurface**?
2. How much secondary material of commodity X is in **stock** (inventory per stock type, data harmonisation)
3. Where and when do **stocks occur as wastes and scraps** in which **quality and quantity**?
4. What are the **characteristics** of different **recycling streams** in detail?
5. When and where is how much **secondary raw material needed** and for what purposes (e.g. slags in concrete)?
6. Which **quality standards to secondary raw materials** are in place in which location?
7. What European **research** is available on the **treatment of tailings** for material recovery? Where are the **most suitable tailings** for reprocessing? What help is available to set up a **tailings reprocessing operation**?
8. What is the **waste resource potential** for secondary use in a circular economy?

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**D4 Material production & manufacturing**

| Topics | Subtopics |
|---|---|
| raw-material processing industry in Europe | structure: types developed, competition, relocation, types vanishing;<br>investment: investors, investment levels;<br>plants: sites, raw material sourcing, energy supply, etc. |
| future primary and secondary material production in Europe | amounts, primary and secondary share;<br>actors (companies, intermediaries, etc.);<br>materials and intermediates such as cement, resins, composites, NdFeB magnet material |
| regional clusters | mining, processing and transforming raw materials into high value products;<br>projected local demands and expansion possibilities for local supply (e.g. construction) |
| supply chain / value chain issues | impacts of changing raw material supply patterns on value chains;<br>bottlenecks in Europe (loss of manufacturing, future skills deficits);<br>flexible and delocalized approaches for intensified processing |
| design of materials, products and infrastructure | supporting raw material information, eco-design;<br>substitution options, risks and costs of new materials<br>support SMEs |
| resource efficiency potentials for European industry (processing, manufacturing) | energy efficiency, energy pricing;<br>material efficiency, no net loss;<br>self assessment tools, energy and resource managment systems in the process industry |
| external trends | game-changing technologies (industry 4.0, additive manufacturing, etc.);<br>socio-technological innovation, customer-driven small series production;<br>business challenges and opportunities in a circular economy |

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**D4 Material production & manufacturing**

1. What information is available to **support materials choices** comprehensively (e.g. informed criticality choices)?
2. Who are **the biggest producers and users** of any material (e.g. W, Co, Ta), component (e.g. battery) or OEM (e.g. electric vehicles) in Europe / globally?
3. Which companies strive for cost **competitiveness and innovation respectively** (investment focus in times of low raw material prices)?
4. How will **digitalisation / industry 4.0** affect raw material supply and demand patterns?
5. How is the **global supply chain / value net** of a certain commodity?
6. How do **material requirements** develop for certain technologies?
7. Can particular construction activities be adequately supplied with **local construction materials**? What is the **local context** of production **using critical materials** in the respective products?
8. What is the **contribution** of commodity x **to the economy** (value creation, circular economy, etc.)

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**D5 Raw material supply and demand / criticality**

| Topics | Subtopics |
|---|---|
| early warning system for criticality | Critical minerals as defined by the EU / USGS<br>to our industry / to a territory;<br>indicators, monitoring, etc. |
| future criticality of raw materials | future supply and demand (see below), abundance / competition for raw materials;<br>EU, global level, industry |
| conflict minerals | origin, certification, etc.<br>See also D8 Social accountability and reporting |
| trends in raw material demand | amounts at European and global level, industry sector (commodities, specialities);<br>material trends, material standards, new application fields of materials, new production lines of materials, competing materials (see also D4: Material production and manufacturing);<br>emerging technologies, developments requiring a different package of raw materials (e.g. Li, Co, Ta, W, U, Ni, glass fibre, carbon fiber, resins, non-traditional industrial minerals) |
| trends in raw material supply | amounts at European and global level, industry sector (commodities, specialities);<br>evolution of the mining and metal markets [geosurveys];<br>primary and secondary share, sources, competitiveness of Europe's primary sector, etc., |
| dependence of companions from major commodities | e.g. molybdenum from copper |
| raw material price development / trends | prediction of commodity prices (short-, medium- and long-term prices);<br>price volatility |

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**D5 Raw material supply and demand / criticality**

1. Will there be **any shortage of any mineral raw materials** (supply / demand projections) [consultancy] – where, when and for whom?
2. What data is available for **minor metals and minerals** (issue of small sectors; production, end-use / reliability and costs of data)?
3. How does the **economy of certain commodities / wastes** work (e.g. Ni, U, metal scap markets) (understand and enhance functioning)?
4. How do the **markets** for material X develop (spatial, temporal)? Which **trends and developments** drive the markets (producer-user relations, exporter/importer, legal aspects, innovation, etc.)?
5. How reliable and consistent are **minerals data for stock exchanges, commodity markets and financial systems**?
6. **What commodities will do best** in the coming years (market needs)? [consultancy]
7. How is the **access to primary and secondary raw materials** relevant for a certain territory or industry?
8. How long will **overcapacities in China** sustain? What will happen afterwards?

MICA Mineral Intelligence Capacity Analysis

**D6 Political and legal framework**

| Topics | Subtopics |
|---|---|
| Sustainable Development Goals | environment and health issues drive global raw material use |
| Raw materials policy and regulation | Raw Material Initiative, (pan-)European Geological Service;<br>conflict minerals regulation;<br>regulations for exploration and mining (minerals act, minerals permits), national / regional |
| Areas policy and regulation | international ocean governance (offshore mining), bio-based economy;<br>Natura2000, nature conservation, national / regional<br>Spatial planning, land use, property rights<br>See also D1 Mineral deposits (availability/restrictions) |
| Industry, economy and trade policy and regulation | EC's policies on digital economy, regional economy, electricity market reform, electromobility market framework;<br>industrial emissions directive, European Pollutant Release and Transfer Register, Emission Trading Scheme ETS review; environmental fiscal reform;<br>WTO regulation, most favored nation decisions (esp. China), data on trade and trade restrictions (OECD database, EC trade commission); EU trade tariffs, shipping and port requirements for radioactive material; Chinese trade policy and regulations, market economy status, dumping; also NZ and CN |
| Materials policy and regulation | Chemicals regulation (REACH impacts on raw material supply; big investment for Europeans but no so big control at the borders and no equivalent measures outside of Europe; non-REACH review) |
| Circular economy policy and regulation | EC Circular Economy package and national / regional regulation: waste framework directive, waste lists (Which countries classify which products as hazardous?), waste shipment regulation (Which countries allow easy shipping of EOL products?), landfill directive, product responsibility;<br>amendment mining waste directive;<br>incentives and barriers for the circular economy, markets in the circular economy, lifestyle changes |

MICA Mineral Intelligence Capacity Analysis

**D6 Political and legal framework**

1. What is the impact of different primary and secondary raw material supply options on the **Sustainable Development Goals**?
2. What is the **national mineral strategy / EU position** regarding the securization of mineral ressources on its territory?
3. What are the **regulatory regimes and potential roadblocks for mining** of commodity X in country Y (e.g. will cyanide in Au make permitting possible in Brazil)? Are the **countries** to be invested "**mining pro**"?
4. Is **trade fair** for **commodity X**? (level playing field: independent disaggregated data, trade flows, tariffs, subsidies, stockpiling, energy prices, etc.)
5. What are the most relevant "**trade defense cases**" (reliable data to convince the EC)
6. Which **environmental and health regulation** is **applicable** to mining and materials production in country/region Y? How are different commodities impacted by the revision of the **Emission Trading Scheme**?
7. What is the **impact of overregulation**, particulary on SMEs?
8. What are **regulatory bottlenecks** to recover materials by the process industry?

MICA Mineral Intelligence Capacity Analysis

**D7 Environment & health issues**

| requirements | subtopics |
|---|---|
| Clean technologies | Environmentally friendly extraction and separation technology |
| water | Water use and consumption: quality, quantity;<br>impacts of mining on water, groundwater and marine ecosystems (mine water discharge into the sea) |
| waste | waste minimisation;<br>mining waste (legal aspects of ownership, amounts, management techniques);<br>end-of-life waste;<br>See also D3 Anthropogenic stocks & recycling, D6 Political & legal framwork; |
| air | greenhouse gas emissions, air quality, noise, vibrations, |
| Resource efficiency | relation to cimate change and land use;<br>See also D4 Material production and manufacturing |
| areas | protected areas, nature conservation (NATURA2000), biodiversity outside officially protected areas<br>See also D6 Political & legal framwork |
| toxics | cyanide, mercury management |
| Environmental impact assessment | life cycle perspective on EHS impacts of mining and recovery of materials from waste;<br>LCA, footprinting of raw materials, MFA for waste;<br>recycling rates;<br>See also D3 Anthropogenic stocks & recycling, D5 Raw material supply & demand, criticality |

MICA Mineral Intelligence Capacity Analysis

**D7 Environment & health issues**

1. What **LCA** data and studies are available (repository, methodological leeway compared to LCA standard, footprint of materials, link product systems and raw materials)?
2. What is the **environmental impact of primary supply** of commodity X compared to its **secondary supply**?
3. How large are the **environmental improvement potentials** for primary and secondary raw material supply?
4. How do environmental and health related measures **affect** the **life cycle costs of a mine or material production facility**?
5. Where are and where will be „**no go areas**“ for mining from an environmental perspective (efforts for a stringent definition)?
6. Who are the **stakeholders** in this field to be gathered in multi-stakeholder initiatives?
7. What are the best metrics in the calculation of concepts such **No Net Loss/ Net Gain** in the translation of raw material (Natural Capital) into more sustainable opportunities?
8. How **safe** is mining of certain commodities (e.g. Uranium) in a certain natural environment (e.g. Greenland)?

MICA Mineral Intelligence Capacity Analysis

**D8 Social accountability & reporting**

| requirements | subtopics |
|---|---|
| ethical requirements | social conflicts over mining;<br>public attitudes towards mining |
| business integrity | legal compliance;<br>revenue and payments transparency |
| social responsibility | fair labor and terms of work, occupational health and safety;<br>emergency prerparedness and response, security arrangements;<br>human rights due diligence and compliance, mining and conflict-affected or high-risk areas;<br>community health and safety, community and stakeholder engagement, obtaining community support and delivering benefits, free, prior and informed consent (FPIC);<br>cultural heritage, resettlement;<br>grievance meachanism and access to other remedies |
| positive legacies | (environmental and) social impact assessment;<br>reclamation and closure |

**note**:

- IRMA:
  2 business integrity requirements, 13 social responsibility requirements, 10 environmental responsibility requirements, 2 positive legal requirements
- environmental responsibility and environmental impact assessment: D7

**D8 Social accountability & reporting**

1. How can the multitude of **assurance and certification schemes** be rationalized? (also compliance with different standards)
2. Will the Initiative for Responsible Mining Assurance **(IRMA**) Standard (Draft April 2016) requirements drive the raw material information needs? (CSO)
3. How can **recognition** of responsibly produced materials be gained by the **downstream** commodity companies?
4. Which are the **public attitude**s towards mining in any given area?
5. Which **knowledge** has to be made available and communicated to whom to establish trust?
6. What has to be done to get a **social license to operate** (exploration, onshore and offshore mining, recycling facility)?
7. What constitutes a **'fairer' distribution** of benefits from resource exploitation?
8. What would be the impacts of **enforced anti-slavery and child labour legislation** on primary and secondary raw material supply?

## Appendix 5: Interview guideline

**Introduction:**

The MICA project aims to improve the provision and delivery of raw material information to key stakeholders. We have identified your organization as such a key stakeholder group. You can benefit most from the envisaged MICA online platform, if you raise your particular raw material information needs. That's why we want to find out, what you really need.

The conversation is planned for approximately 20 minutes. Your views will be analysed and expressed only in aggregated anonymized form.

**Section I - Topics**

1) What are your major raw-material related topics?

2) Are there any emerging topics that are gaining importance?

3) How can MICA support the raw material information needs for topic x? What kind of information must it contain (e.g. data on actors, investment volumes, spatial resolution)

**Section II - Questions**

4) Who are your key stakeholders that need raw material information?
Please specify, who that is.

5) What are emerging questions raised by your key stakeholders (out to 2020)?
What do they want to know in more detail?

6) What do you want to know for your own specific purposes (out to 2020)?
Please specify, what exactly.

Is there another kind of information that indicates the emerging raw material information needs of your stakeholders?

## Appendix 6: MICA data protection statement

### What is MICA?

The MICA project is an EC-financed research project that aims to develop a Raw Material Intelligence Capacity Platform that can help answer a broad range of stakeholder questions on raw materials. This MICA online platform identifies data, methods, tools and policies related to stakeholder questions and shows the steps to take towards an answer. Further information is available in the brochure attached (see pdf) and on the website (http://www.mica-project.eu).

### Why participate in the MICA survey?

The MICA project aims to improve the provision and delivery of raw material information to stakeholders in Europe through a powerful, user-friendly online platform. To this end, a number of surveys are conducted. You are receiving this request to take part in this survey because your views, as a potential user of the envisaged online platform, are vital to enhance our knowledge and understanding of raw material information needs. The results of the survey will be accounted for in the design and services of the MICA online platform. Your participation is voluntary and you are free to withdraw any time. A refusal to participate will not have any consequences for you.

### How is data protection ensured?

The MICA project complies with the EU directive on data protection and with any updates it might receive during the life time of the project. Contact information (name, phone number and professional email address) has been collected only for the purpose of selecting participants for the survey. All your responses are confidential. Any project results will be published in anonymised form only, with no means of linking them to individual people or organizations.
The information you provide is stored on secure computers, with access only by the immediate research team. You are guaranteed that no personal details such as your name, telephone number or email address will be revealed to people outside the project. All email communication will be archived during the life of the project and used only for the purposes of the MICA project. Retention of personal data is limited to the final documentation of the survey. After this period the personal data will be destroyed.

### Informed consent

By taking part in the survey you confirm your informed consent. If you require any further information about the study, have further questions or have any technical problems with the survey website, please contact us directly by email (see invitation letter).