MICA Mineral Intelligence Capacity Analysis

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MICA ONTOLOGIES, METADATA, TRIPLE STORE, AND DDG: AN OVERVIEW

WP6: The European Raw Materials Intelligence Capacity Platform (EU-RMICP)

Geoscience for a sustainable Earth brgm

Daniel Cassard, and the MICA WP6 Team
BRGM, BGS, GeoZS, GEUS, GTK, JRC, LIG

Paris Meeting
June 13-15th, 2017

MICA ONTOLOGIES

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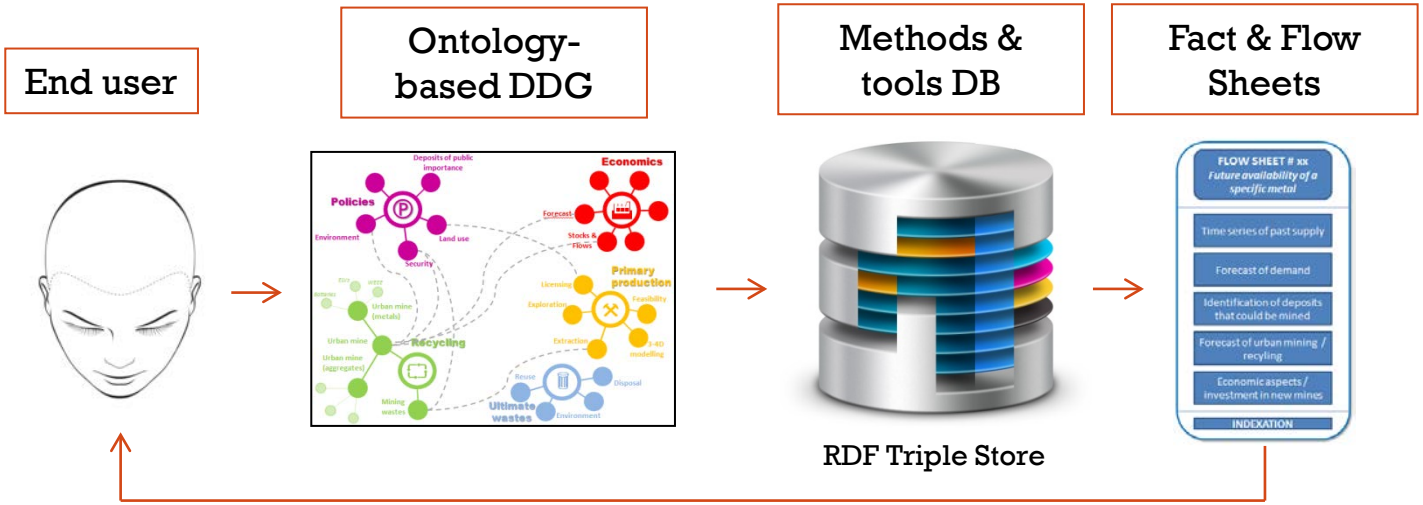
- **<u>The MICA Main ontology</u>**:
- In MICA, **the Main Multidimensional Ontology** represents the **Domain of questions** an end user may have about Mineral resources / Raw materials.
- It is used for supporting a **Dynamic Decision Graph (DDG)** which allows the end user to navigate & visualize the database content and to search for the most appropriate method(s) and tool(s) to use for resolving his problem.



MICA ONTOLOGIES

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- A reminder about ontologies

An ontology allows specifying in a formal language (machine understandable) the concepts of a domain of interest (here the raw materials) and their relationships.

(*A conceptualization being an abstract, simplified view of the world that we wish to represent for some purpose).*

- What is the EU-RMICP and what it is not

  - The aim of the EU-RMICP IS NOT to provide the end user with the answer to his/her question/query.
  - The objective is, (nearly) whatever the question the end user has in mind, to say him how to proceed to find a solution and to suggest one or several approaches, ranked by pertinence. This includes:
    - DocSheets = information related to the question;
    - FactSheets = methods/tools to apply to find a solution. FacSheets are produced by MICA;
    - LinkSheets = link toward an external and perenial source. Can replace a doc/factSheet;
    - FlowSheets = designed for answering complex queries, they can combine several doc/fact/linkSheets. **ALL THESE SHEETS ARE LINKED TO DATA**

FS CONTENT & INDEXATION

MICA Mineral Intelligence Capacity Analysis

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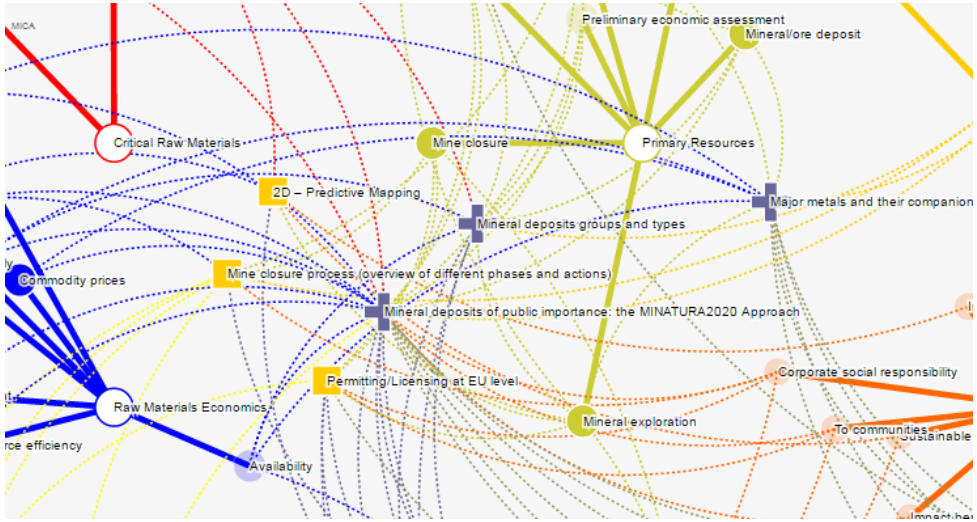
- What are the rubrics of a factSheet?

- FactSheets and docSheets are annotated with the Main ontology concepts and transversal ontologies



FactSheet

Scope (conceptual model & main characteristics)

....

Range of relevant applications or topics

....

Data needs, databases

....

Model used

....

System and/or parameters considered

....

Time / **Space** / Resolution /Accuracy

....

Indicators / Outputs / Units

....

Treatment of uncertainty, verification, validation

....

Main publications / references

....

Related methods

....

Key relevant contacts

....

ANNOTATION with ontologies, EUR-Lex, dataset sources…

- The relation 'matrix'

General rule:

Sheet — *can link to < - >* — *Sheet*

Relation ID	From	relation	To	Mandatory / optional	Description & Examples
1	FactSheets	links to <->	Factsheets	optional	One method linking to another similar method
2	FactSheets	links to <->	Docsheets	optional	One method linking to a definition provided in a docSheet. Or a DocSheet mentioning a method
3	FactSheets	links to ->	Legislation (EUR-Lex)	optional	FactSheets can be linked to a piece of legislation, if for example a method is required or mentioned in a piece of legislation (e.g. life Cycle assessment)
4	DocSheets	links to ->	Legislation (EUR-Lex)	optional	DocSheets can mention legislation. The legislation itself will not actively link to another sheet, as it has the nature of a linksheet: i.e. the content is provided by a party outside MICA (in this case: EUR-Lex)
5	FactSheets	links to ->	Data (WP3)	optional	In a factSheet data can be linked, if it is eg data necessaru for the method to be completed. It will be more likely though that the data will be mentioned in the flowSheet
6	DocSheets	?	Data (WP3)	?	
7	Fact/DocSheet	links to ->	DomainConcepts (onto)	mandatory	All sheets must link to the domain concepts. They might do so at a very high level, in which case they are marked as 'generic' and receive a low ranking in the results)
8	Fact/DocSheet	links to ->	Comodity (onto)	optional	A FactSheet might be annotated with the concepts of this transversal ontoology
9	Fact/DocSheet	links to ->	Time (onto)	optional	A FactSheet might be annotated with the concepts of this transversal ontoology
10	Fact/DocSheet	links to ->	Space (onto)	optional	A FactSheet might be annotated with the concepts of this transversal ontoology
11	FactSheets	links to ->	Methods (onto)	optional	A FactSheet might be annotated with the concepts of this transversal ontoology
12	Legislation (EUR-Lex)	links to ->	DomainConcepts (onto)	mandatory	All sheets must link to the domain concepts. They might do so at a very high level, in which case they are marked as 'generic' and receive a low ranking in the results)
13	Legislation (EUR-Lex)	links to ->	Comodity (onto)	optional	A FactSheet might be annotated with the concepts of this transversal ontoology
14	Legislation (EUR-Lex)	links to ->	Time (onto)	optional	A FactSheet might be annotated with the concepts of this transversal ontoology
15	Legislation (EUR-Lex)	links to ->	Space (onto)	optional	A FactSheet might be annotated with the concepts of this transversal ontoology
16	Data (WP3)	links to ->	DomainConcepts (onto)	mandatory	All data must be linked to the domain concepts
17	Data (WP3)	links to ->	Data type (onto)	mandatory	All data must be linked to the data type
18	Data (WP3)	links to ->	Comodity (onto)	optional	A Data might be annotated with the concepts of this transversal ontoology
19	Data (WP3)	links to ->	Time (onto)	optional	Optional link: a Data might be annotated with the concepts of this transversal ontoology
20	Data (WP3)	links to ->	Space (onto)	optional	Optional link: a Data might be annotated with the concepts of this transversal ontoology
21	Fact/DocSheet	links to ->	Questions (WP2)	optional	Existing factSheet and DocSheets can directly link to a question.
22	Question	links to ->	Data (WP3)	?	
23	FlowSheet	links to ->	Questions (WP2)	mandatory	The relationship between a question and a sheet is that the sheet acts as an asnwer to the question.
24	FlowSheets	links to ->	Factsheets	optional	FlowSheets are a composition of sheets of any kind. It is not a mandatory relationship as a flowSheet might also just consist of links to data.
25	FlowSheets	links to ->	Data (WP3)	optional	see above
26	**FlowSheet**	**links to ->**	**DomainConcepts (onto)**	**mandatory**	

Color coding	to be implemented in the triple store
Color coding	already implemented

The links between the different EU-RMICP components

MICA Sheets Annotation Tool

Annotate A New Sheet | Manage Existing Sheets | Daniel Cassard | Logout

You are successfully log in.

Type of sheet: DefSheet DocSheet FactSheet

Title: Enter title

Writers: Select one or several writer

Select one or several concepts:

Domains | Methods | ValueSupplyChain | Commodities | Temporal | Spacial | Data

- MICA
  - D1 PRIMARY RESOURCES
  - D2 SECONDARY RESOURCES
  - D3 INDUSTRIAL PROCESSING AND TRANSFORMATION
  - D4 RAW MATERIALS ECONOMICS
  - D5 CRITICAL RAW MATERIALS
  - D6 RAW MATERIALS POLICY & LEGAL FRAMEWORK
  - D7 ENVIRONMENT & HEALTH IN A LIFE CYCLE PERSPECTIVE
  - D8 INTERNATIONAL REPORTING

Selected concepts:

Submit

Initially developed by LIG within WP6. Currently being extended with:

- Links between sheets and other resources

- Creation of linkSheets and flowSheets

- Annotation of linkSheets, flowSheets & questions

MICA Sheet Editor

e.g., EUR-Lex (CELEX Nb.), DOI, Datasets & sources (from BGS), other relevant sets.

Add & annotate a new sheet | Manage Existing Sheets | Create Links Between Sheets | Create Links To Other Resources

LinkSheets, flowSheets and questions directly created by the Editor: no template.

ATTENTION: Some linkSheets are created as part of the links to other resources (EUR-Lex, references…). Annotation of those linkSheeets could therefore also be done under « **Manage Existing Sheets** ».

SELECT OR DROP

Type of sheet: ○ DefSheet ○ DocSheet ◉ FactSheet ◎ LinkSheet ○ FlowSheet ○ FAQs

Title: Enter title

Writers: Select one or several writer

Synopsis:
Summarise your fact sheet in a sentence or two.

List to be inserted here. Should be taken from the 'FS Production' document.

Links between FAQs and other artefacts (factSheets and flowSheets) should be done using « **Create Links Between Sheets**"

Select one or several concepts:

Domains | Methods | ValueSupplyChain | Commodities | Temporal | Spacial | Data

MICA
- D1 PRIMARY RESOURCES
- D2 SECONDARY RESOURCES
- D3 INDUSTRIAL PROCESSING AND TRANSFORMATION
- D4 RAW MATERIALS ECONOMICS
- ~~D5 CRITICAL RAW MATERIALS~~
- D6 RAW MATERIALS POLICY & LEGAL FRAMEWORK
- D7 ENVIRONMENT & HEALTH IN A LIFE CYCLE PERSPECTIVE
- D8 INTERNATIONAL REPORTING

Selected concepts:

Submit

MICA Sheets Editor

Add a new sheet | Manage Existing Sheets | Create Links Between Sheets | Create Links To Other Resources

Select Sheet

Mineral deposits groups and types

EU Legislation

None selected

Add

Publications (doi)

None selected

Add

Datasets & Sources (BGS)

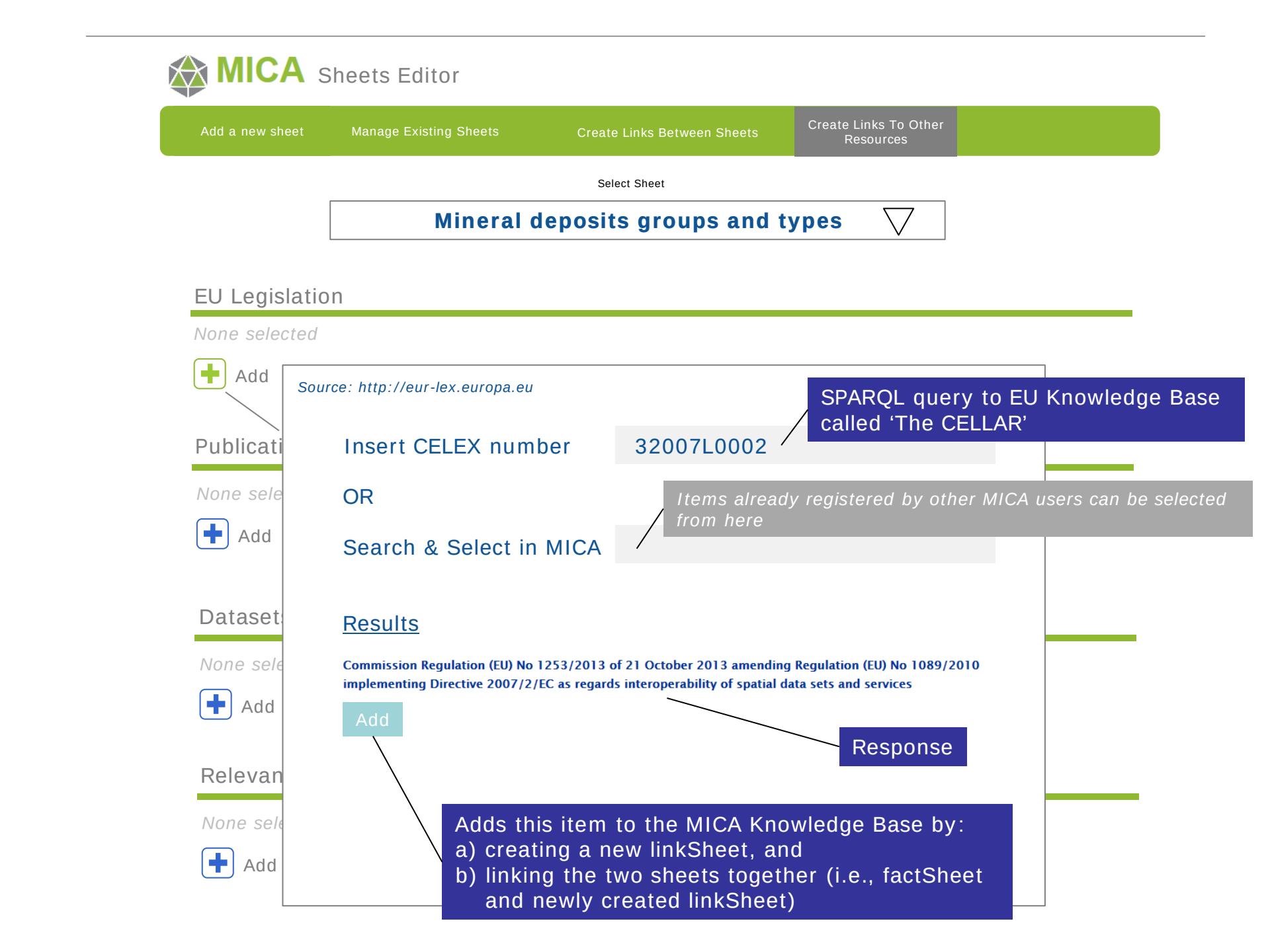
None selected

Add

Relevant result sets

None selected

Add


MICA Sheets Editor
Add a new sheet
Manage Existing Sheets
Create Links Between Sheets
Create Links To Other Resources
Select Sheet
Mineral deposits groups and types
EU Legislation
None selected
Add
Source: http://eur-lex.europa.eu
SPARQL query to EU Knowledge Base called 'The CELLAR'
Insert CELEX number
32007L0002
OR
Items already registered by other MICA users can be selected from here
Search & Select in MICA
Results
Commission Regulation (EU) No 1253/2013 of 21 October 2013 amending Regulation (EU) No 1089/2010 implementing Directive 2007/2/EC as regards interoperability of spatial data sets and services
Add
Response
Adds this item to the MICA Knowledge Base by:
a) creating a new linkSheet, and
b) linking the two sheets together (i.e., factSheet and newly created linkSheet)

Fact/Doc/Def/Link/FlowSheets Production

Document updated March 1st, 2017

12/06/2017

Doc/Fact/LinkSheets: 163

- done or in preparation: 98 (59 + 39)

- to be prepared: 65

FlowSheets to be prepared: 39 (scenarios already drafted)

Method:

1 – Add your name(s) and the name of your organization in **tables of sections 2 &3**.

2 – Send the file back to GTK (tuomo.tormanen@gtk.fi), Univ. Leiden – CML (Voet@cml.leidenuniv.nl), BGS (evpeta@bgs.ac.uk) and BRGM (d.cassard@brgm.fr) for consolidation and follow-up, and to avoid duplication.

1 – Fact/DocSheets done or under way

Methods to identify and assess geological and anthropogenic (urban) stocks			
Title	Description	Responsible	WP
Geological mapping	Geological mapping	BGS, Evi	4
Remote sensing/regional geophysics	Remote sensing, regional geophysics	BGS, Evi	4
Geochemical analysis	Geochemical analysis, regional and local scale	BGS, Evi	4
Ground investigation	Ground investigation, including drilling (boreholes), trial pits, trenching, etc.	BGS, Evi	4
Resource estimation of primary minerals	Resource estimation, including: 3D models, deposit modelling, deposit assessment (feasibility studies), etc.	BGS, Evi	4

Methods to assess society's metabolism and its environmental impacts			
Title	Description	Responsible	WP
Material Flow Accounting	Economy-wide Material flow accounting according to the Eurostat method	CML, Ester	4
Material/Substance Flow Analysis	Material flow analysis and substance flow analysis: accounting, static modelling and dynamic modelling	CML, Ester	4
Life Cycle Assessment	Life cycle assessment, including attributional and consequential LCA, and including Life Cycle Sustainability Analysis	CML, Ester	4
Environmentally extended	Environmentally extended Input Output	CML, Ester	4

MICA ONTOLOGIES: queries

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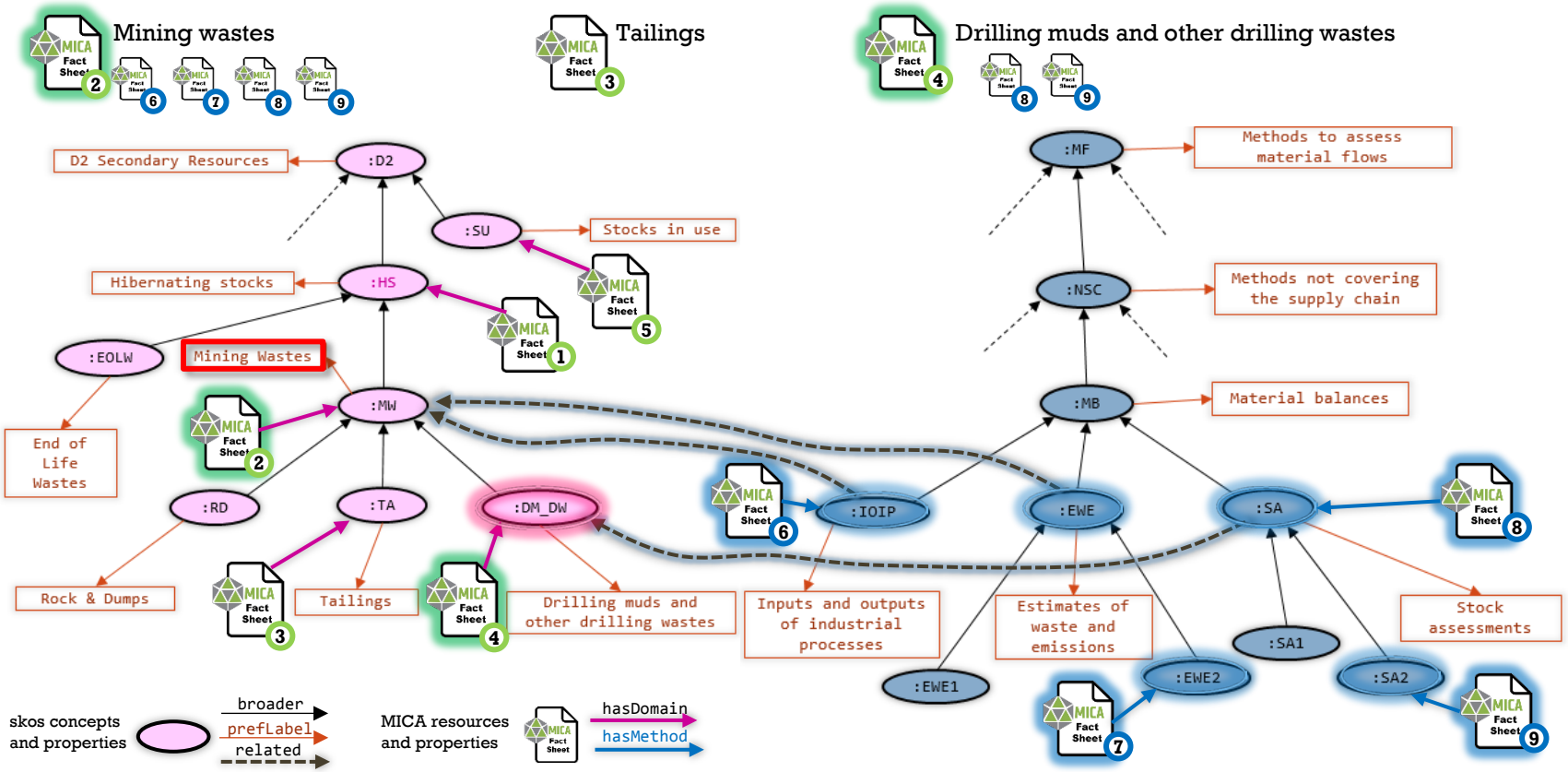
- Concepts hierarchies (and inferences) can be exploited to perform queries

Find all factSheets about "Mining Wastes" with factSheets about related methods



RMICP ARCHITECTURE

MICA
Minerals Intelligence Capacity Analysis

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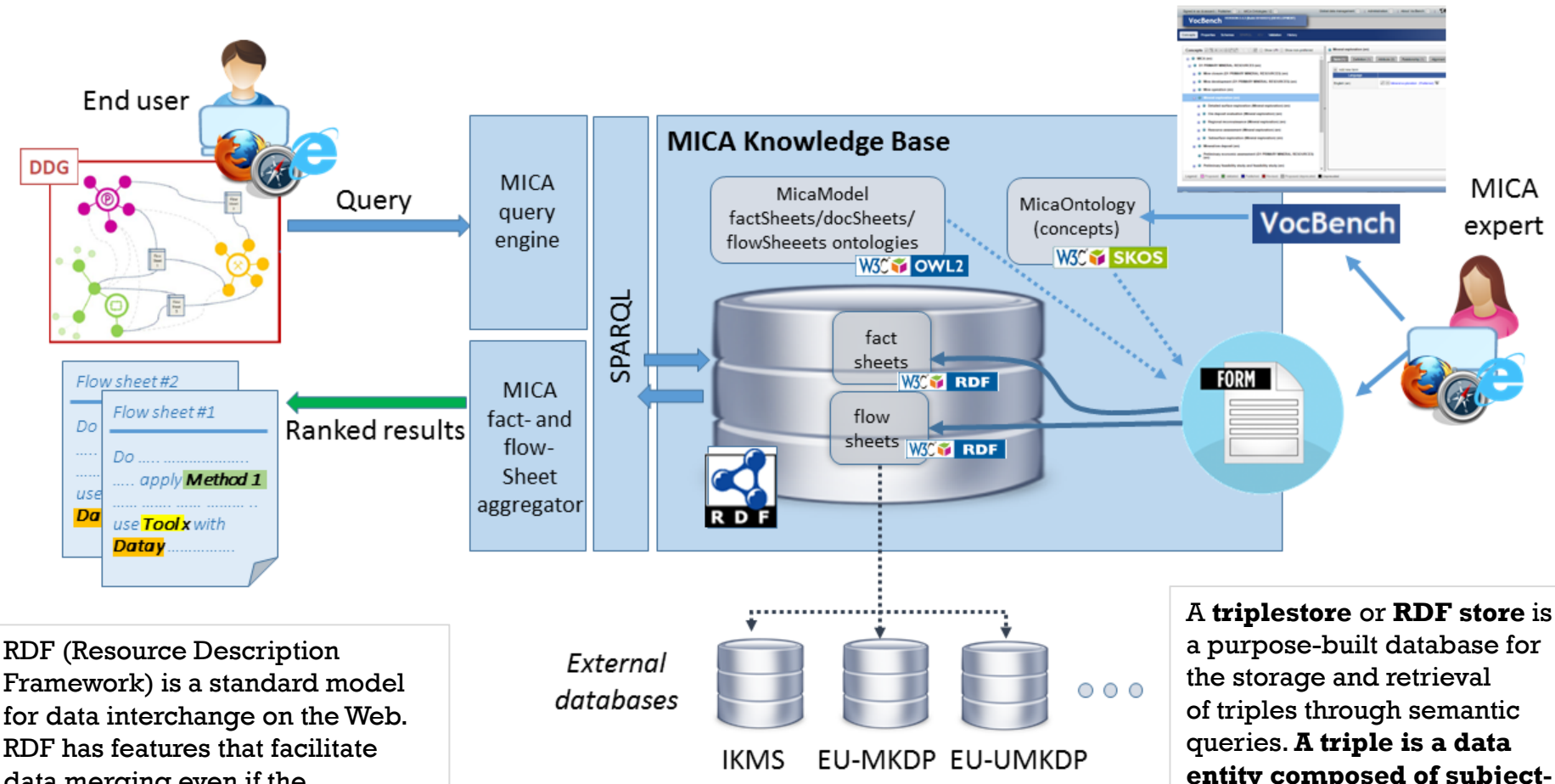

RDF (Resource Description Framework) is a standard model for data interchange on the Web. RDF has features that facilitate data merging even if the underlying schemas differ.

After Ph. Genoud - LIG

A **triplestore** or **RDF store** is a purpose-built database for the storage and retrieval of triples through semantic queries. **A triple is a data entity composed of subject-predicate-object**, like "Bob is 35" or "Bob knows Fred".

THE VOCBENCH COLLABORATIVE TOOL

MICA
Minerals Intelligence Capacity Analysis

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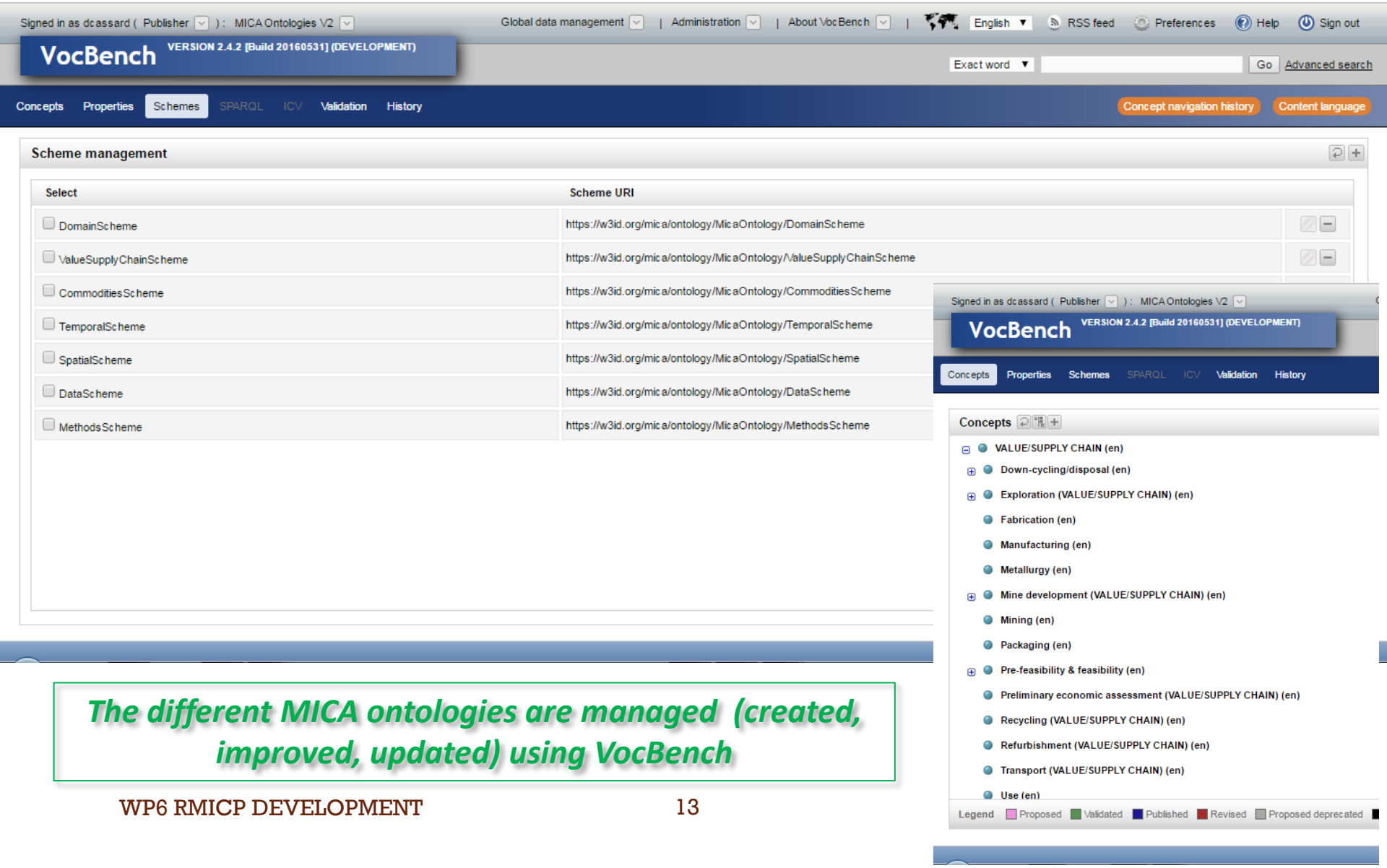
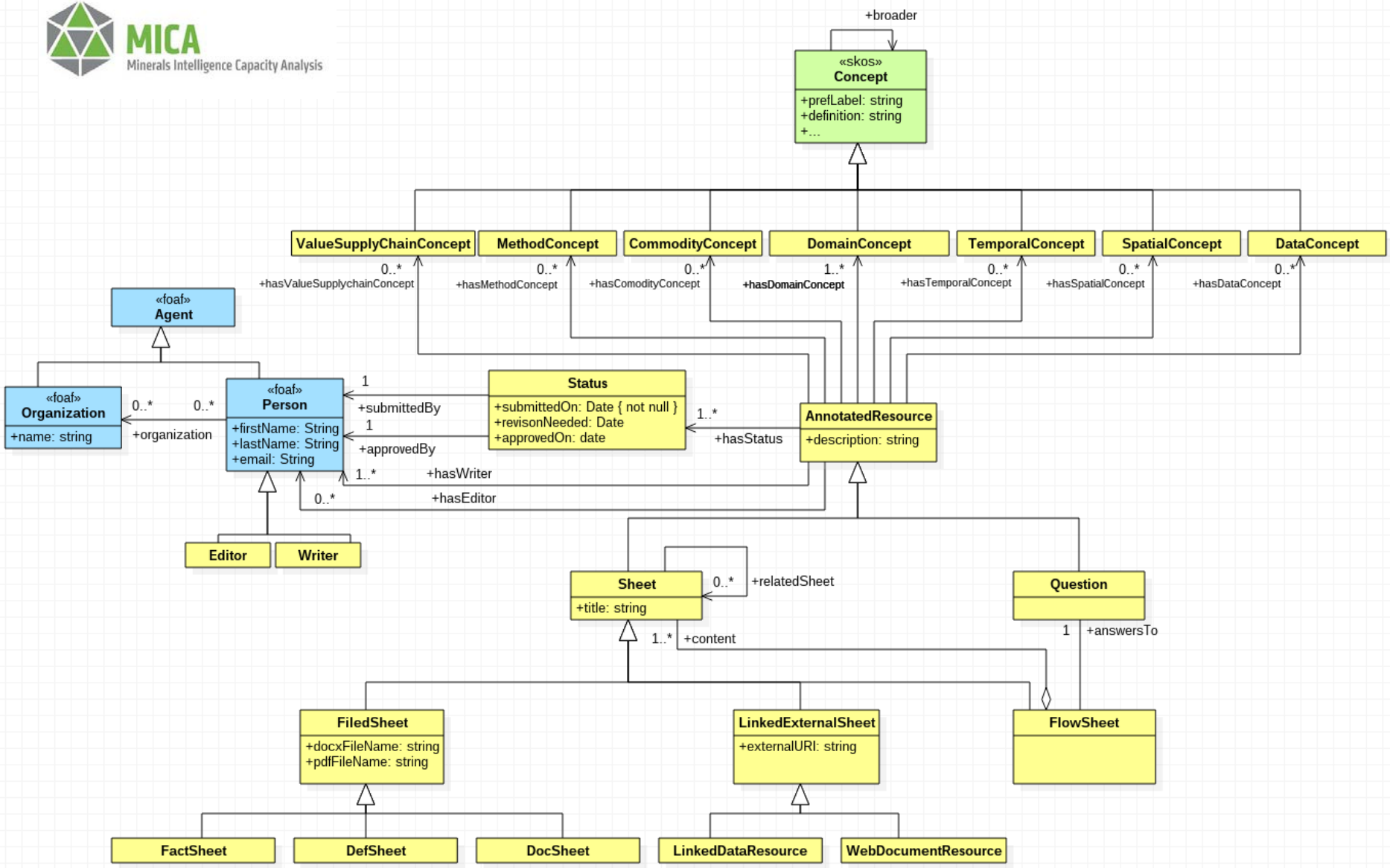


The different MICA ontologies are managed (created, improved, updated) using VocBench

MICA
Minerals Intelligence Capacity Analysis



The MICA model used for the design of the RDF Triple Store

MICA
Minerals Intelligence Capacity Analysis

RMICP ARCHITECTURE

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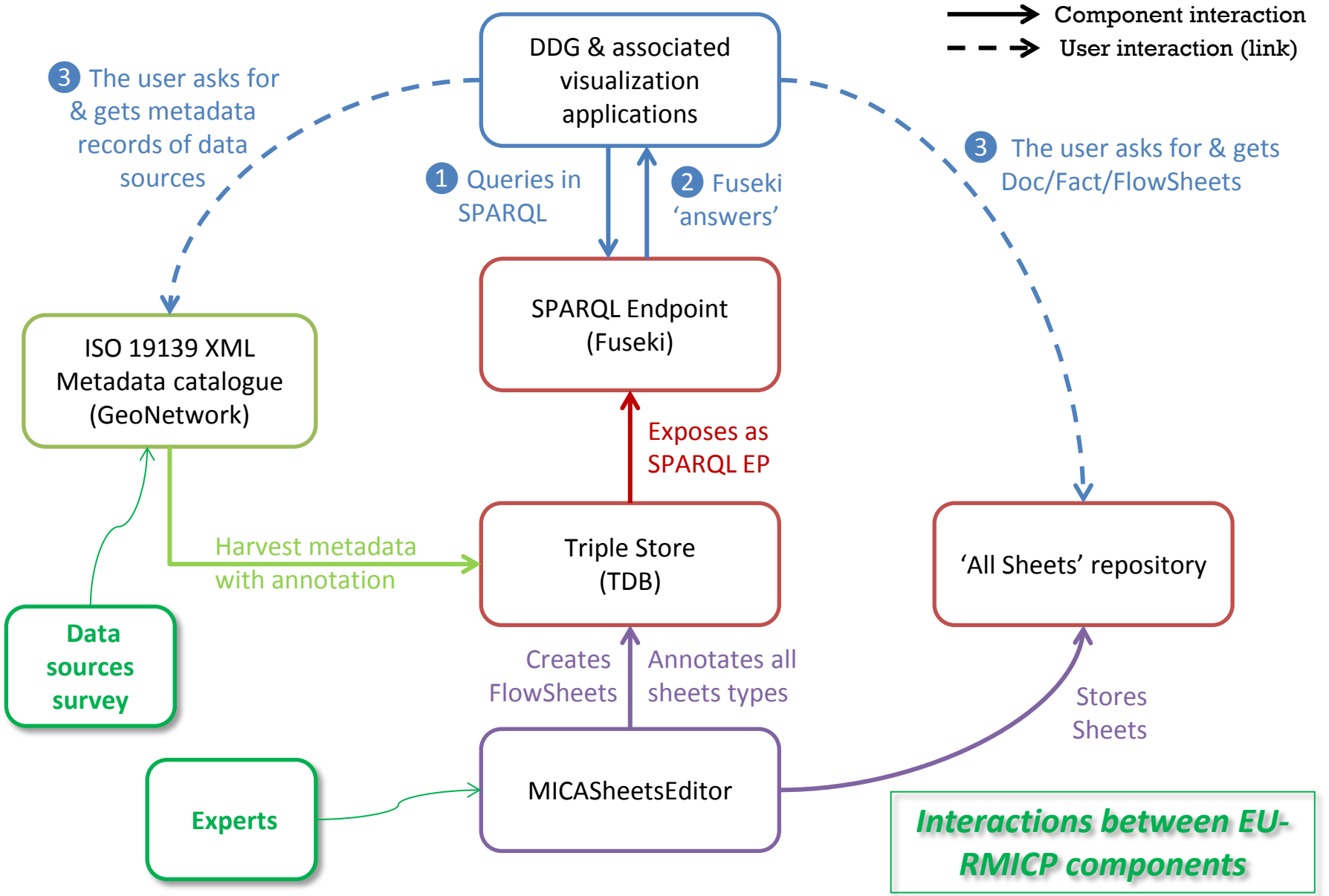

RMICP ARCHITECTURE

MICA
Minerals Intelligence Capacity Analysis

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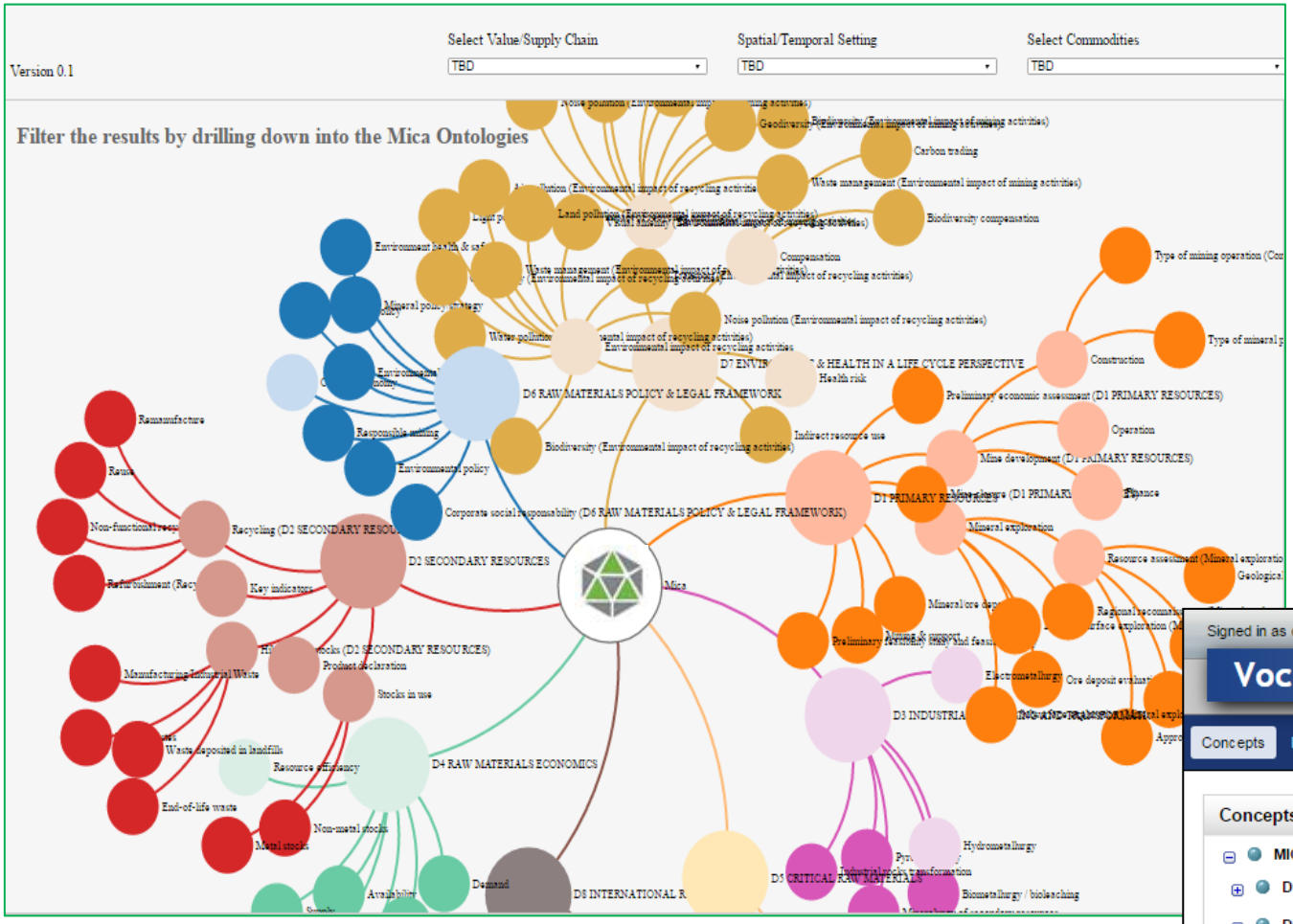
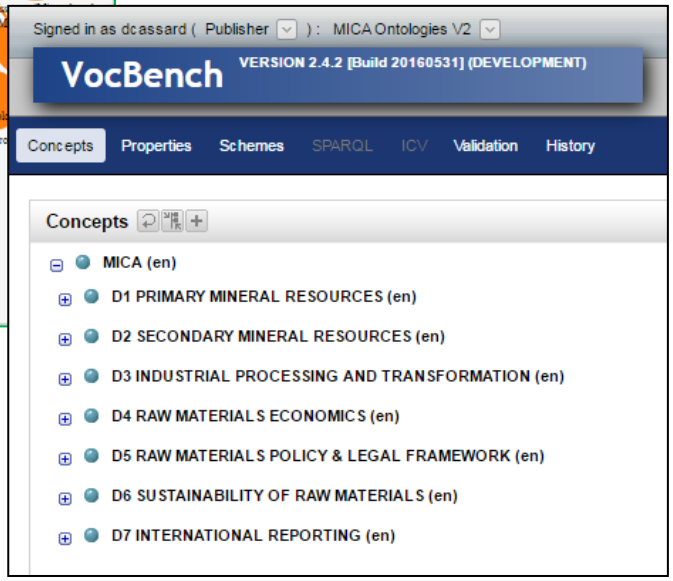


The 7 domains covered by the MICA Main Ontology



More than 300 concepts and sub-concepts

MICA

Knowledge Base

Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Vestibulum tortor quam, feugiat vitae, ultricies eget, tempor sit amet, ante. Donec eu libero sit amet quam egestas semper. Aenean ultricies mi vitae est. Mauris placerat eleifend leo. Quisque sit amet est et sapien ullamcorper pharetra. Vestibulum erat wisi, condimentum sed, commodo vitae, ornare sit amet, wisi. Aenean fermentum, elit eget tincidunt condimentum.

DYNAMIC DECISION GRAPH

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SEARCH

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WIZZARD

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Value/Supply: Nothing selected

Temporal: Nothing selected

Spacial: Nothing selected

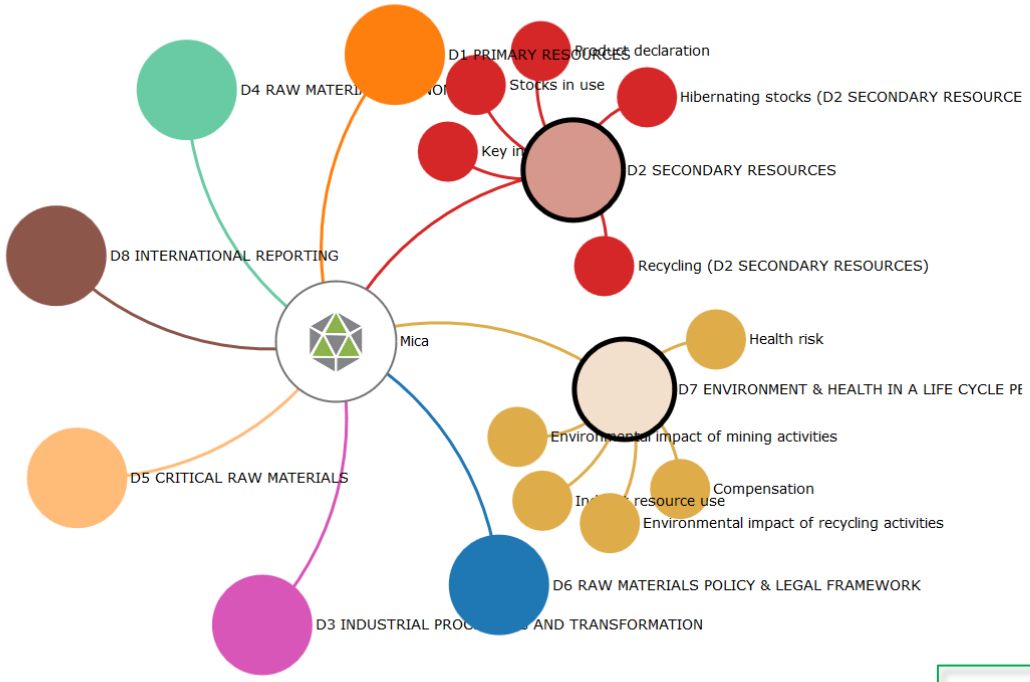
Commodities: Nothing selected

Apply Reset

Filter the results by drilling down into the Mica Ontologies

D2 SECONDARY RESOURCES

D7 ENVIRONMENT & HEALTH IN A LIFE CYCLE PERSPECTIVE



Results:

- FactSheets
- DocSheets
- Legislation
- Data
- Question
- FlowSheets

Filter Title

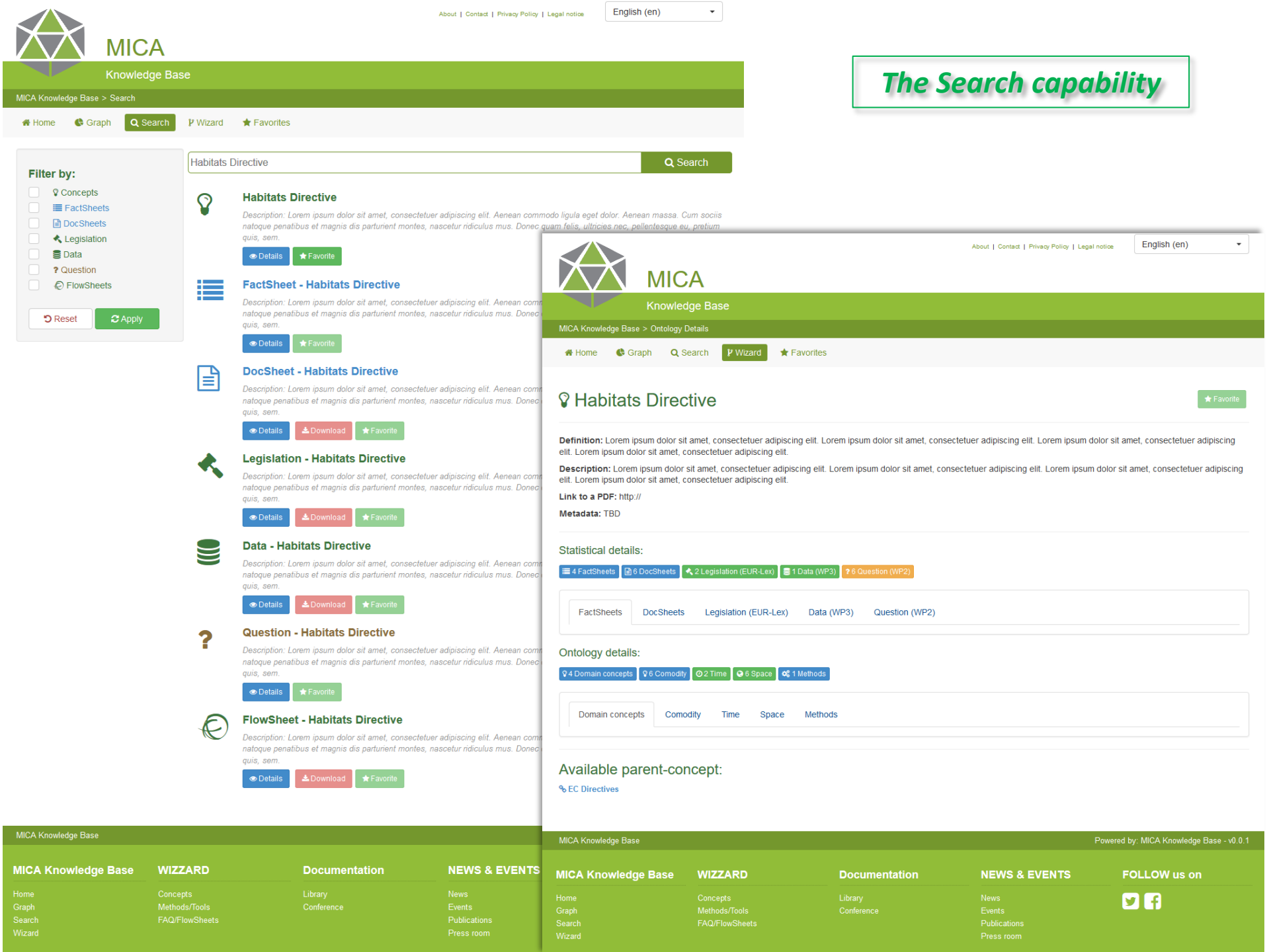
Title
FactSheet 1 title
FactSheet 10 title
FactSheet 11 title
FactSheet 12 title
FactSheet 13 title
FactSheet 14 title
FactSheet 15 title
FactSheet 2 title
FactSheet 3 title
FactSheet 4 title
Title

Show 10 entries

Showing 1 to 10 of 15 entries

First Previous 1 2 Next Last

The DDG and the window 'Results'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MICA Knowledge Base > Search
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Graph
Search
Wizard
Favorites
The Search capability
Filter by:
Concepts
FactSheets
DocSheets
Legislation
Data
Question
FlowSheets
Reset
Apply
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Search
Habitats Directive
Description: Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Aenean commodo ligula eget dolor. Aenean massa. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Donec quam felis, ultricies nec, pellentesque eu, pretium quis, sem.
Details
Favorite
FactSheet - Habitats Directive
DocSheet - Habitats Directive
Download
Legislation - Habitats Directive
Data - Habitats Directive
Question - Habitats Directive
FlowSheet - Habitats Directive
MICA Knowledge Base
MICA Knowledge Base
WIZZARD
Documentation
NEWS & EVENTS
Home
Graph
Search
Wizard
Concepts
Methods/Tools
FAQ/FlowSheets
Library
Conference
News
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Publications
Press room
About | Contact | Privacy Policy | Legal notice
English (en)
MICA
Knowledge Base
MICA Knowledge Base > Ontology Details
Home
Graph
Search
Wizard
Favorites
Habitats Directive
Favorite
Definition: Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Lorem ipsum dolor sit amet, consectetuer adipiscing elit.
Description: Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Lorem ipsum dolor sit amet, consectetuer adipiscing elit.
Link to a PDF: http://
Metadata: TBD
Statistical details:
4 FactSheets
6 DocSheets
2 Legislation (EUR-Lex)
1 Data (WP3)
6 Question (WP2)
FactSheets
DocSheets
Legislation (EUR-Lex)
Data (WP3)
Question (WP2)
Ontology details:
4 Domain concepts
6 Comodity
2 Time
6 Space
1 Methods
Domain concepts
Comodity
Time
Space
Methods
Available parent-concept:
EC Directives
MICA Knowledge Base
Powered by: MICA Knowledge Base - v0.0.1
MICA Knowledge Base
WIZZARD
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NEWS & EVENTS
FOLLOW us on
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Search
Wizard
Concepts
Methods/Tools
FAQ/FlowSheets
Library
Conference
News
Events
Publications
Press room

Please choose a category

Pellentesque habitant morbi tristique senectus et

et netus et malesuada fames ac turpis egestas.

Concepts Workflow

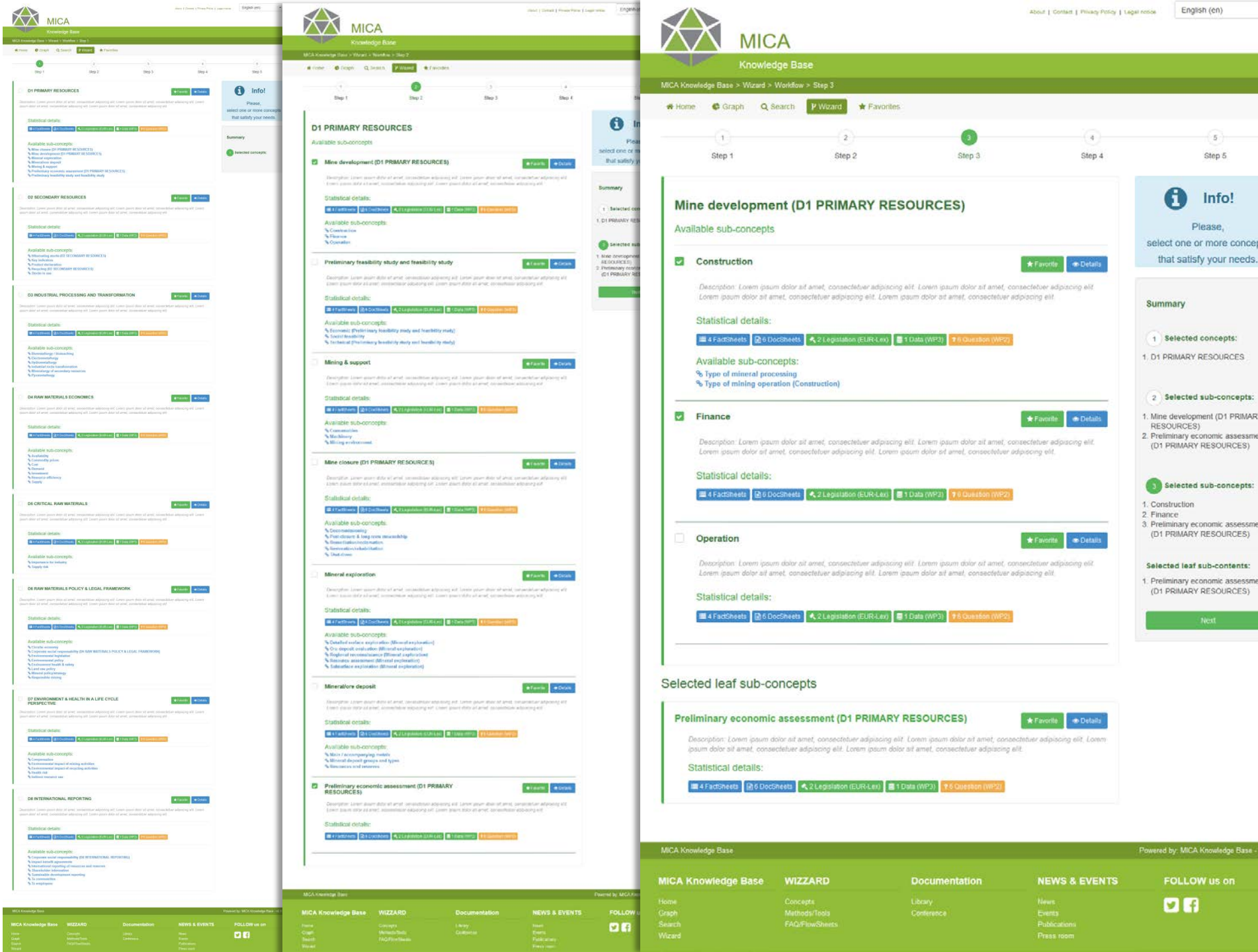
Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. turpis egestas. **Concepts**

Methods/Tools

Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. fames ac turpis egestas. **Methods/Tools**

FAQ/FlowSheets

Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. fames ac turpis egestas. **? FAQ/FlowSheets**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Knowledge Base
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English (en)
MICA Knowledge Base > Wizard > Workflow > Step 3
Home
Graph
Search
Wizard
Favorites
Step 1
Step 2
Step 3
Step 4
Step 5
Mine development (D1 PRIMARY RESOURCES)
Available sub-concepts
Construction
Favorite
Details
Description: Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Lorem ipsum dolor sit amet, consectetuer adipiscing elit.
Statistical details:
4 FactSheets
6 DocSheets
2 Legislation (EUR-Lex)
1 Data (WP3)
6 Question (WP2)
Available sub-concepts:
Type of mineral processing
Type of mining operation (Construction)
Finance
Operation
Selected leaf sub-concepts
Preliminary economic assessment (D1 PRIMARY RESOURCES)
Info!
Please,
select one or more concepts
that satisfy your needs.
Summary
Selected concepts:
1. D1 PRIMARY RESOURCES
Selected sub-concepts:
1. Mine development (D1 PRIMARY RESOURCES)
2. Preliminary economic assessment (D1 PRIMARY RESOURCES)
Selected sub-concepts:
1. Construction
2. Finance
3. Preliminary economic assessment (D1 PRIMARY RESOURCES)
Selected leaf sub-contents:
1. Preliminary economic assessment (D1 PRIMARY RESOURCES)
Next
MICA Knowledge Base
Powered by: MICA Knowledge Base
MICA Knowledge Base
Home
Graph
Search
Wizard
WIZZARD
Concepts
Methods/Tools
FAQ/FlowSheets
Documentation
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Conference
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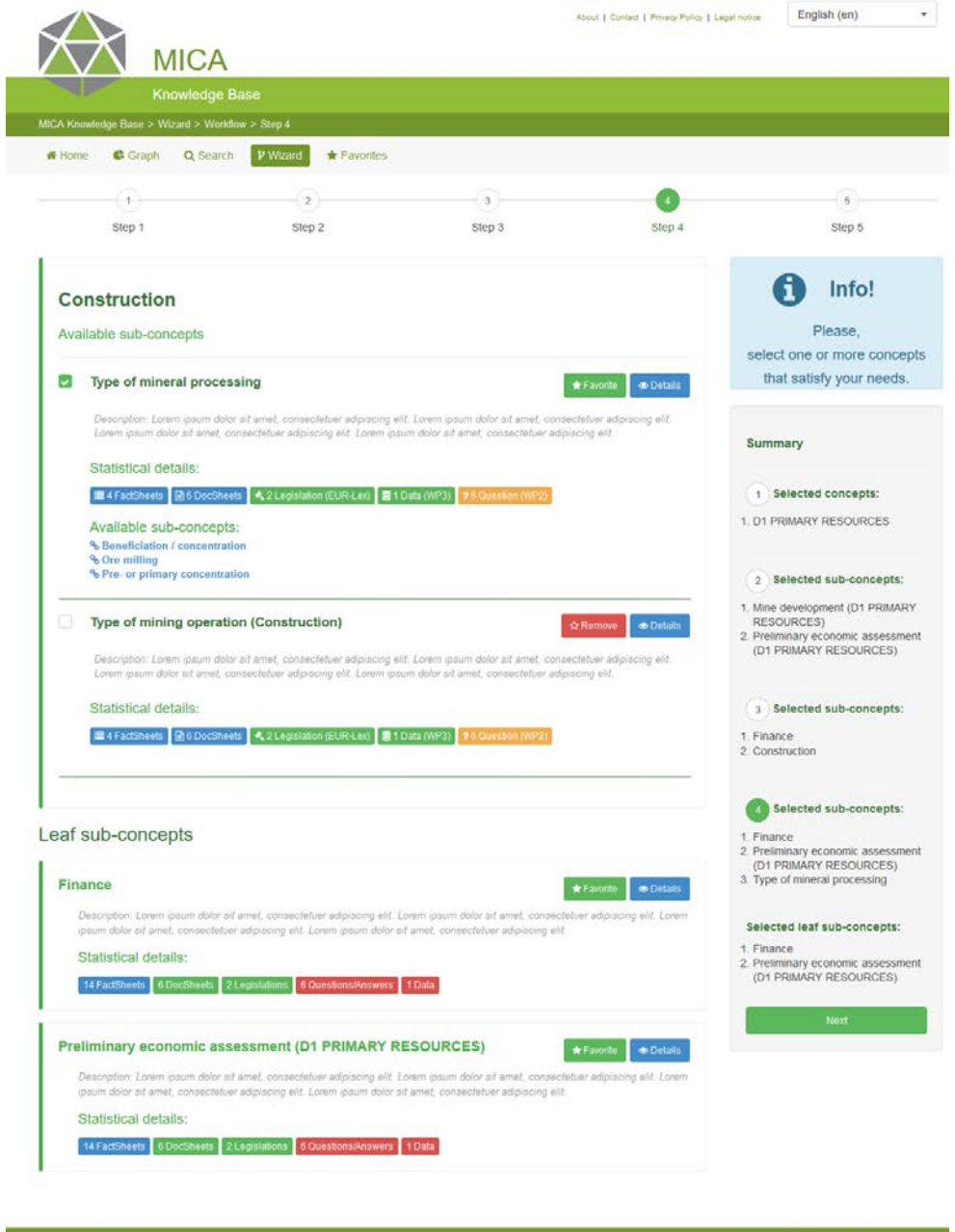
News
Events
Publications
Press room
FOLLOW us on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Knowledge Base
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Step 1
Step 2
Step 3
Step 4
Step 5
Construction
Available sub-concepts
Type of mineral processing
Favorite
Details
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Statistical details:
4 FactSheets
6 DocSheets
2 Legislation (EUR-Lex)
1 Data (WP3)
0 Question (WP2)
Available sub-concepts:
Beneficiation / concentration
Ore milling
Pre- or primary concentration
Type of mining operation (Construction)
Remove
Details
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Leaf sub-concepts
Finance
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Statistical details:
14 FactSheets
6 DocSheets
2 Legislations
6 Questions/Answers
1 Data
Preliminary economic assessment (D1 PRIMARY RESOURCES)
Favorite
Details
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Statistical details:
14 FactSheets
6 DocSheets
2 Legislations
6 Questions/Answers
1 Data
Info!
Please,
select one or more concepts
that satisfy your needs.
Summary
1 Selected concepts:
1. D1 PRIMARY RESOURCES
2 Selected sub-concepts:
1. Mine development (D1 PRIMARY RESOURCES)
2. Preliminary economic assessment (D1 PRIMARY RESOURCES)
3 Selected sub-concepts:
1. Finance
2. Construction
4 Selected sub-concepts:
1. Finance
2. Preliminary economic assessment (D1 PRIMARY RESOURCES)
3. Type of mineral processing
Selected leaf sub-concepts:
1. Finance
2. Preliminary economic assessment (D1 PRIMARY RESOURCES)
Next
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WIZZARD
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Methods/Tools
FAQ/FlowSheets
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Publications
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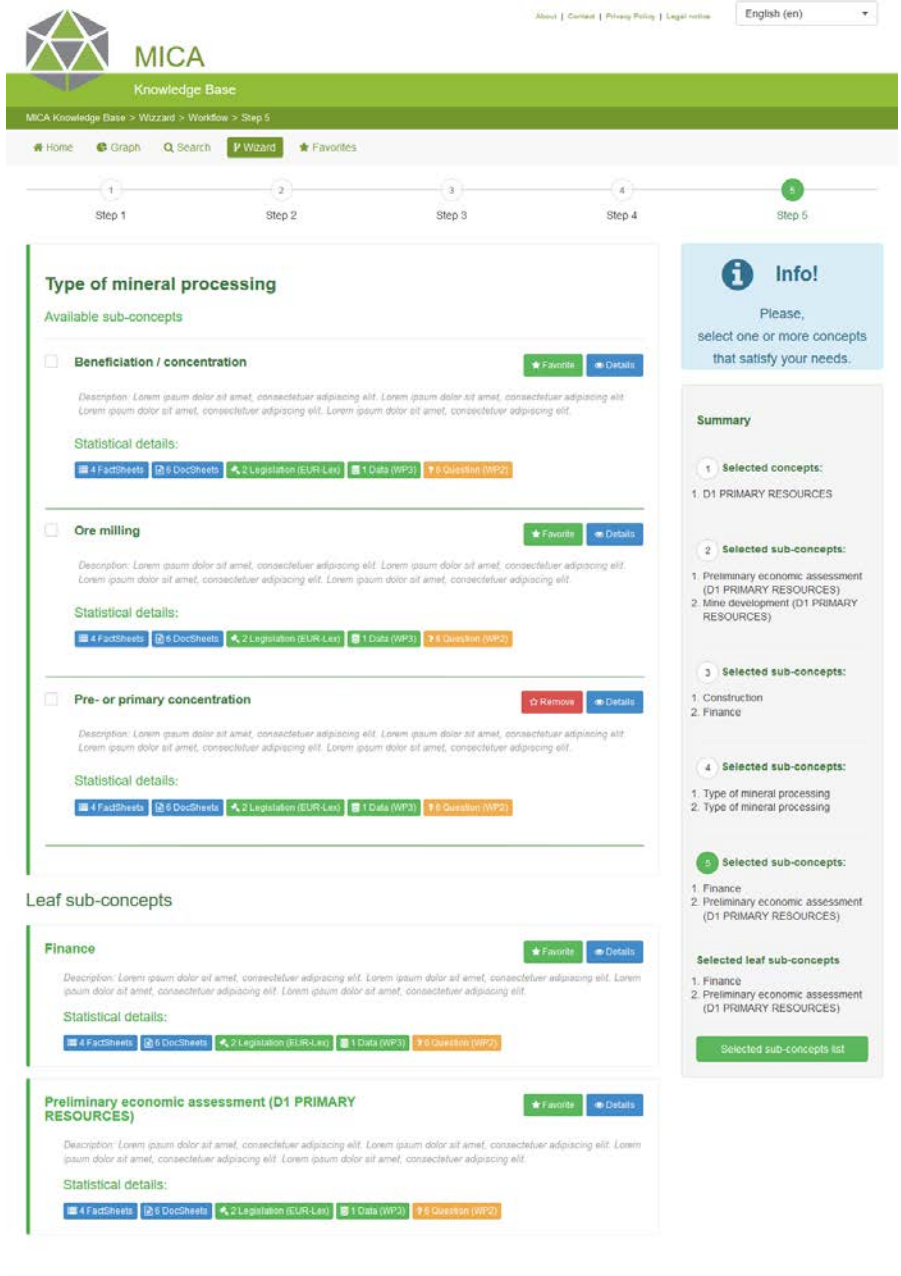
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Knowledge Base
MICA Knowledge Base > Wizard > Workflow > Step 5
Home
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Wizard
Favorites
Step 1
Step 2
Step 3
Step 4
Step 5
Type of mineral processing
Available sub-concepts
Beneficiation / concentration
Favorite
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Preliminary economic assessment (D1 PRIMARY RESOURCES)
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2. Mine development (D1 PRIMARY RESOURCES)
3 Selected sub-concepts:
1. Construction
2. Finance
4 Selected sub-concepts:
1. Type of mineral processing
2. Type of mineral processing
5 Selected sub-concepts:
1. Finance
2. Preliminary economic assessment (D1 PRIMARY RESOURCES)
Selected leaf sub-concepts
1. Finance
2. Preliminary economic assessment (D1 PRIMARY RESOURCES)
Selected sub-concepts list
MICA Knowledge Base
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Favorite concepts and sub-concepts

Type of mining operation (Construction)

Details | Remove

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Pre- or primary concentration

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Statistical details:

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Add more concepts | Download as Excel | Download as PDF | Create FlowSheet

Filter by:

Value/Supply Chain:

Nothing selected

Temporal:

Nothing selected

Spacial:

Nothing selected

Commodities:

Nothing selected

Concepts:

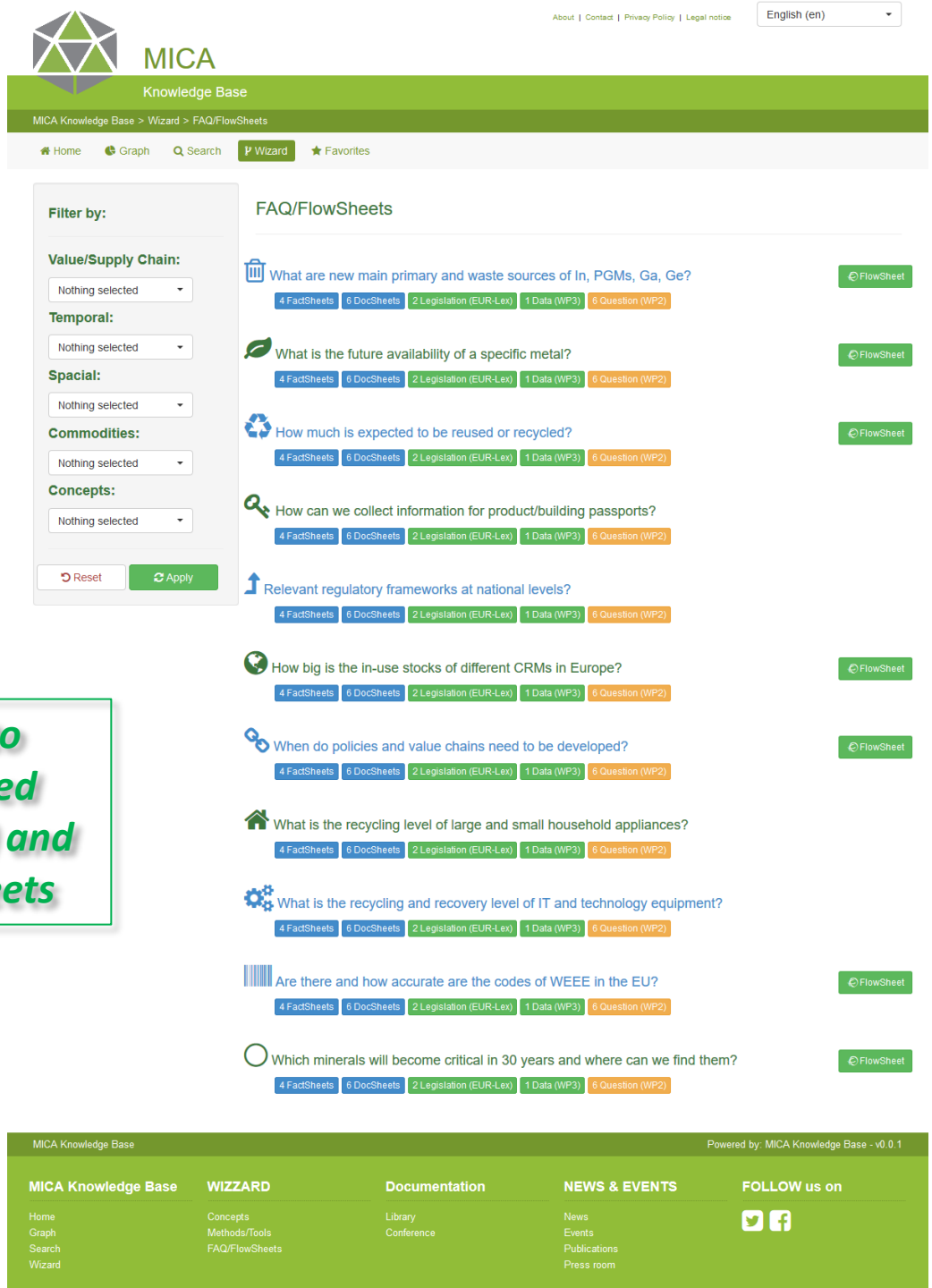
Nothing selected

Reset | Apply

Methods and Tools

- STEEP(LED) Analysis
- Trend Extrapolation
- Genius Forecasting
- Scenario Development
- Mine closure process (overview of different phases and actions)
- FSTest4 factsheet
- Permitting/Licensing at EU level
- FSTest1 factsheet
- Delphi Surveys
- Cross Impact Analysis
- SWOT Analyses
- Back-Casting
- FSTest3 factsheet
- Geological Maps
- Citizens' panel or Focus Groups
- Mind mapping
- Futures Wheel
- DPSIR Framework
- 2D – Predictive Mapping
- Causal Layered Analysis
- Morphological Analysis
- Environmental Risk Assessment (ERA)
- FSTest2 factsheet
- Serious Gaming
- Relevance Tree
- Life Cycle Analysis (LCA)
- Agent-based modelling (ABM) method

Direct access to methods and tools



Direct access to Frequently Asked Questions (FAQs) and related flowSheets

MICA Mineral Intelligence Capacity Analysis

Co-funded by the European Union

THANKS A LOT FOR YOUR ATTENTION!

Geoscience for a sustainable Earth
brgm

Daniel Cassard and the WP6 Team
d.cassard@brgm.fr