



MSP-REFRAM

Coordination and Support Action (CSA)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 688993.

Start date : 2015-12-01 Duration : 19 Months



DMS and DSS Beta version

Authors : Mrs. Macias aragones MARTA (IDENER)

MSP-REFRAM - Contract Number: 688993
Multi-Stakeholder Platform for a Secure Supply of Refractory Metals in Europe

Document title	DMS and DSS Beta version
Author(s)	Mrs. Macias aragones MARTA
Number of pages	19
Document type	Deliverable
Work Package	WP6
Document number	D6.5
Issued by	IDENER
Date of completion	2017-01-23 18:25:55
Dissemination level	Public

Summary

DMS and DSS Beta version

Approval

Date	By
2017-01-23 18:26:54	Mrs. Macias aragones MARTA (IDENER)
2017-01-23 19:15:34	Mr. BOURG STÉPHANE (CEA)

CONTENT

1. Introduction	2
2. The decision support system (DSS)	2
2.1. Introduction	2
2.2 Functional design	2
2.3 Application architecture.....	3
2.4 Implementation.....	3
2.4.1. Data Preparation	4
2.4.2 Software implementation	6
2.5 Tool description.....	6
2.6 Admin User Guide	8
3. The document management system (DMS).....	10
3.1. Introduction	10
3.2. Application Architecture	11
3.3. Implementation.....	11
3.3.1. Software implementation	12
3.3.1. Data preparation	12
3.4. Tool description.....	12
3.5. Admin User Guide	13
ANNEX I. DSS user guide	15
ANNEX II. DMS user guide	18

1. INTRODUCTION

An accurate plan for Knowledge Management (KM) is crucial in MSP-REFRAM, especially considering the project multi-actor approach, the cross-sectorial features of the information and the different areas where information will be handled (both inside the consortium at an internal level involving Expert Committees and project partners, and also outside the consortium involving target audiences). Therefore, in MSP-REFRAM a KM system is implemented as a set of infrastructures and tools that support project activities. They are more than information systems, since they provide a context that facilitates the creation, transfer and application of knowledge.

Thus, a Decision Support Tool and a Document Management System have been created in MSP-REFRAM as External Knowledge Management Tools. Generated knowledge in MSP-REFRAM project is retrieved through report format and stored after indexing. These reports are transformed and processed so that it can be properly used by the multi stakeholder platform and public audience. The knowledge is presented and accessible in two main ways: the Document Management System (DMS) and Decision Support System (DSS), being this the main result of the internal knowledge management activities, and being hosted with a free open access on the PROMETIA website.

This deliverable aims to report the methodology that has been followed to produce the Decision Support System and Document Management System for MSP-REFRAM information treatment, handling and use.

2. THE DECISION SUPPORT SYSTEM (DSS)

2.1. INTRODUCTION

The DSS will allow policy makers, citizens, industries, researchers and stakeholders to access directly the level of information of interest for them.

The purpose of the decision support tool is to organize the information generated in MSP-REFRAM project in an online application that allows different users to find useful information about refractory metals, either for general public just interested in enlarging their knowledge or for industrial or policy players who for example are searching for new processing solutions, new markets, or policy pathways.

2.2 FUNCTIONAL DESIGN

The DSS will have two sets of users accessing the platform. Administrators will access the application in order to include the contents of the application and, in addition, regular users (public audience) will access the tool in order to look for information.

For the administrator, the main functionalities required are:

- To upload new documents
- To create sets of information automatically from the uploaded documents
- To manually modify the content of the different sections of the application

For the regular users, the main functionalities needed are:

- To select any combination of materials, applications, sources, etc. i.e. to identify the information that they want to look for
- To show the requested information. It is provided as a text and a EU map showing places relevant to the selected information (e.g. if a user looks for Tungsten mines, those countries where mines are placed will be highlighted in the map).

2.3 APPLICATION ARCHITECTURE

The DSS has been designed so as to be flexible to be almost platform independent. ASP .NET core, the first linux-compatible version of the Microsoft SDK has been used for implementing the platform. The database of the application has been deployed in a relational database server using MySQL in its community edition.

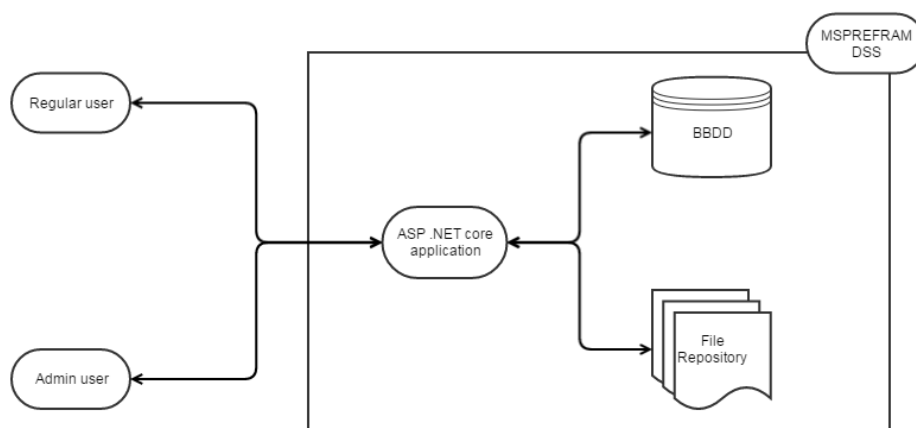


Figure 1: DSS software architecture

2.4 IMPLEMENTATION

In order to implement the MSP-REFRAM DSS, the first step was to perform a design of the application, deciding the functionalities required and putting strong efforts on defining the format and the metadata information that would be automatically processed by the application. In this way, the

development of the application could continue in two parallel flows, one for retrieving and preparing the information and the other for the software development. The figure below represents this process:

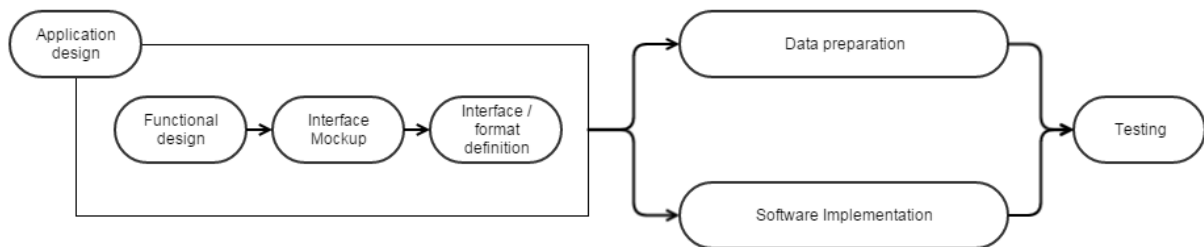


Figure 2: DSS Implementation work flow

2.4.1. DATA PREPARATION

The following flow-sheet was followed to effectively tagging the MSP-REFRAM generated information:

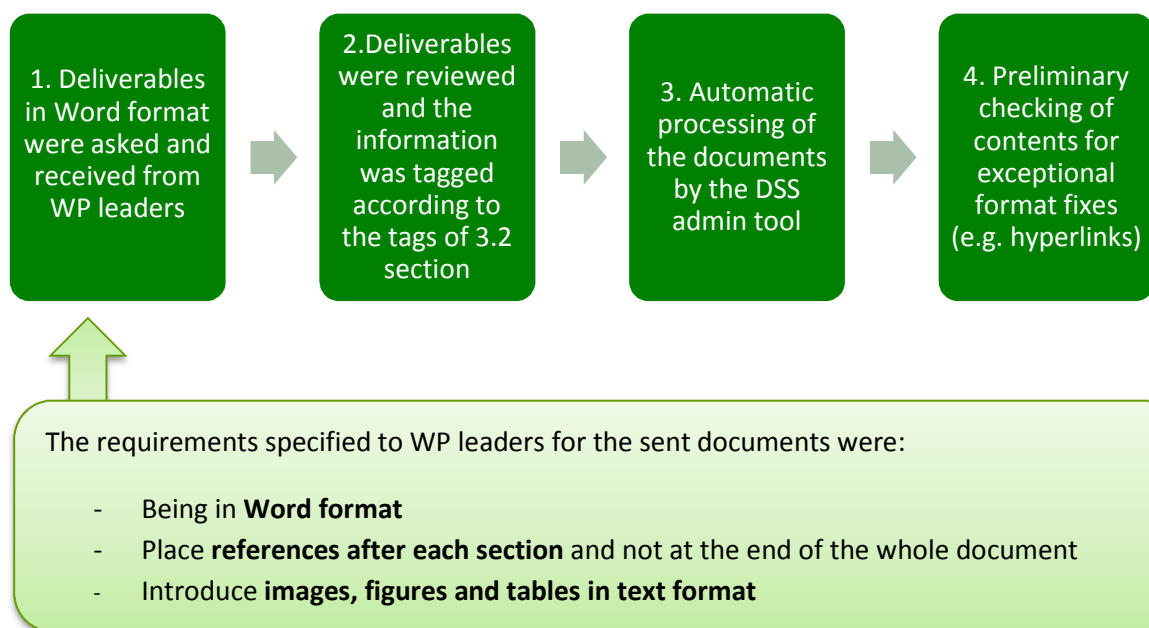
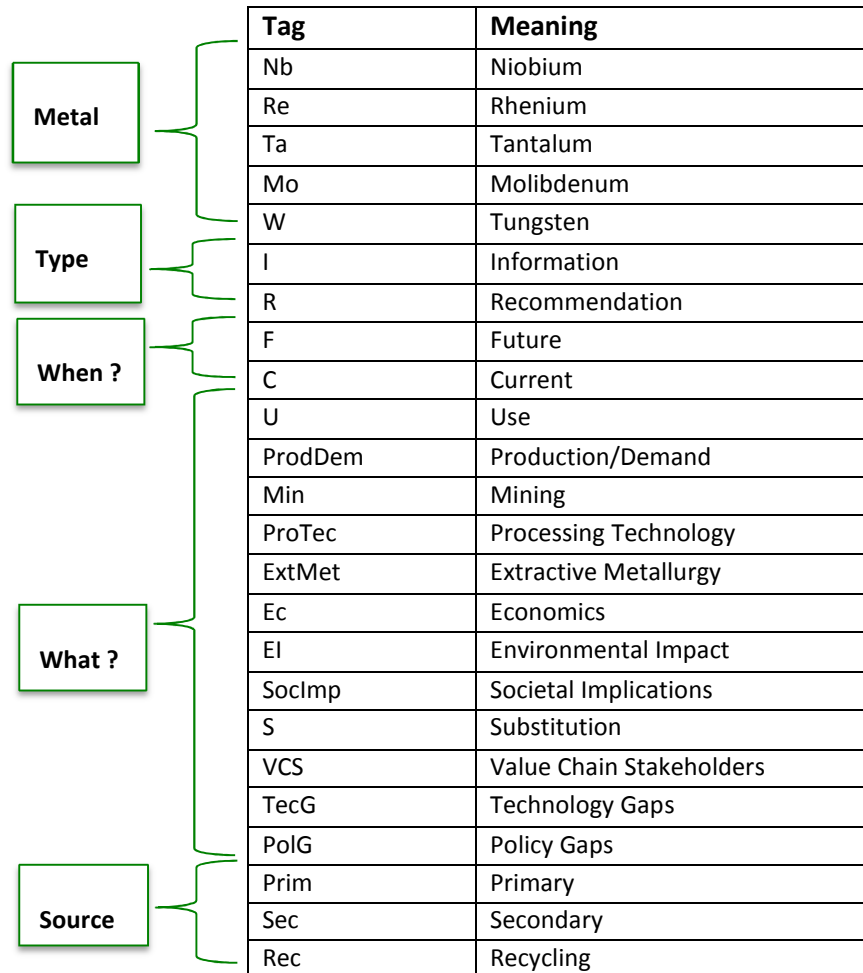


Figure 3: DSS tagging process

The following tags have been considered when selecting the information for the Decision Support Tool:



Tag	Meaning
Nb	Niobium
Re	Rhenium
Ta	Tantalum
Mo	Molibdenum
W	Tungsten
I	Information
R	Recommendation
F	Future
C	Current
U	Use
ProdDem	Production/Demand
Min	Mining
ProTec	Processing Technology
ExtMet	Extractive Metallurgy
Ec	Economics
EI	Environmental Impact
SocImp	Societal Implications
S	Substitution
VCS	Value Chain Stakeholders
TecG	Technology Gaps
PolG	Policy Gaps
Prim	Primary
Sec	Secondary
Rec	Recycling

Figure 4: Tags used for the DSS

Using these tags, the entire tag for a specific information inside a document would be:

Metal_Type_When_What_Source_Paragraph Number (1,2,3... if the information is divided in more than one paragraph not being immediately the next).

For example, if the desired information to tag is the current production and demand of Niobium in the EU, and this information is not distributed in more than one part of the document, this information would be tagged as follows:

Nb_I_C_ProdDem_Prim_1

2.4.2 SOFTWARE IMPLEMENTATION

As mentioned before, the DSS has been implemented using ASP.NET core, specifically version 1.0.0-preview3-003215 of this SDK. The application make extensive processing of Microsoft Word documents and to do so the OpenXML SDK and Docx4j libraries have been used. Moreover, in order to properly extract the images from the source documents keeping the post-formatting processes done to them (i.e. cropping), unoconv (a library from OpenOffice) and imagemagick have been used.

The database has been designed in MySQL, including all the tables required for the proper operation of the platform. Automatic backup and network security safeguard procedures have been implemented as well.

2.5 TOOL DESCRIPTION

In the Decision Support Tool context, a **“tag”** has been defined as a label attached to some information for the purpose of identify the relevant information to be included in the tool and to be able to categorize and organize them in an easy and intuitive way, allowing the tool users to find the information required. According to Knowledge Mapping information, a first draft of the tool content was designed. An outline of the User guide would be as follows. Firstly, the user has to click on the metal whose information is required (Figure 5).

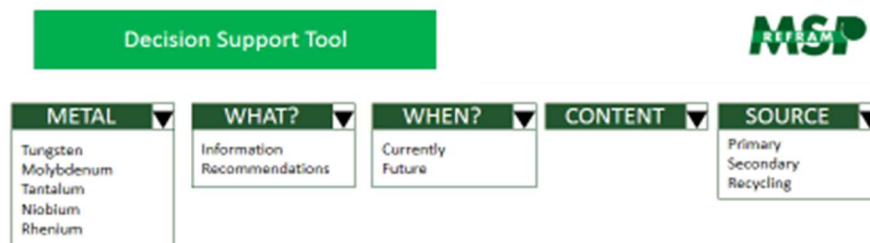


Figure 5: First view of the tags

Secondly, the user can choose between gain information about the metal, or to get recommendations about the future scenario of that metal (Figure 6).

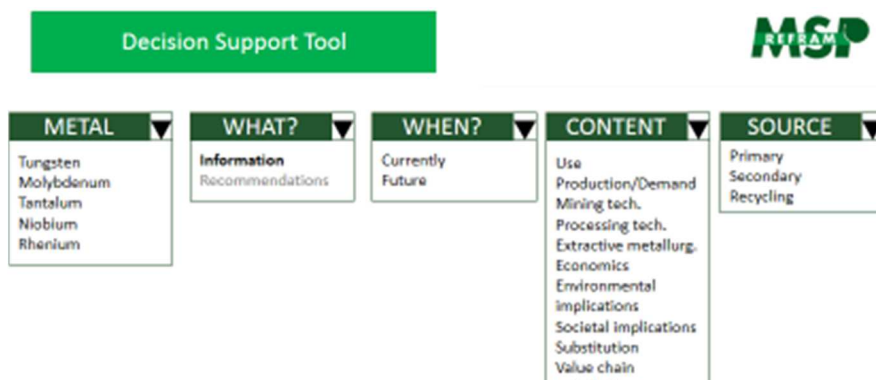


Figure 6: Information shown when an user clicks on Information, either on Currently or Future

If information is chosen, then the user has to click either current information or future information (estimations, innovations...). The information available per metal would be: Use, Production/Demand, Mining technologies, Processing technologies, Extractive metallurgy, Economics, Environmental implications, societal implications, Substitution, and Value Chain Stakeholders.

Finally, once the user has chosen what type of information is requested, they have to select the source type of the metal: primary sources, secondary sources, or recycling. In case of recommendations being chosen, only future information is available, and the user would have to choose between technology or policy gaps (Figure 7).

Moreover, the Decision Support Tool shows a map of Europe next to the resulting information, indicating the EU countries that appear in the text. For example, Germany is one of the countries in which Tantalum recycling takes place, so a map of Europe would appear with Germany coloured next when showing information about Tantalum recycling (Figure 8).

By this classification, all information generated in MSP-REFRAM is synthetized and exposed to public, generating value and proportionating an easy and integrated perspective of refractory metals in the European Union.

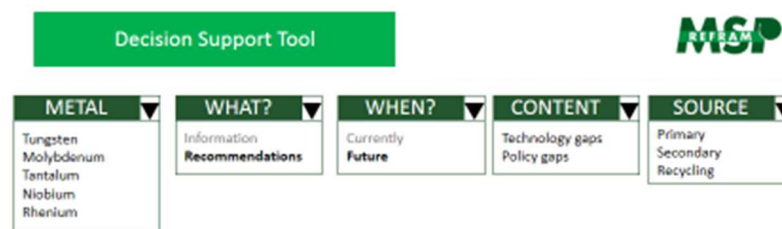


Figure 7: Information shown when a user click on Recommendations. In this option, it is only possible to click on Future information, and then the user have to choose between Technology or Policy gaps

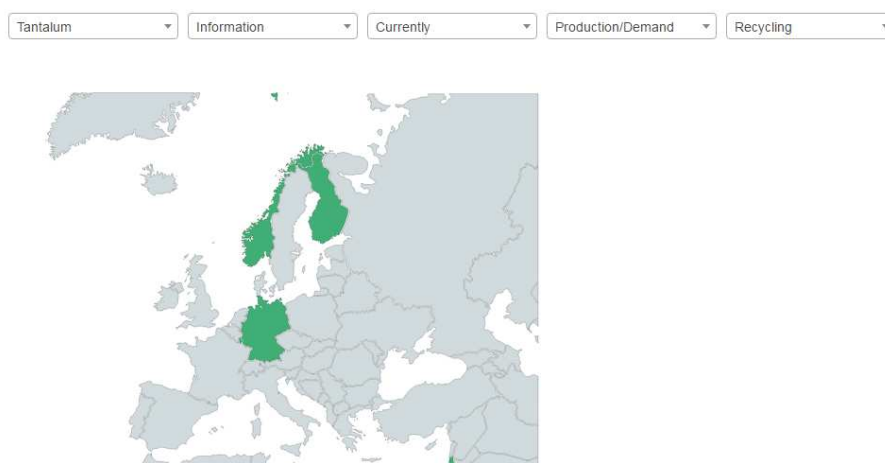


Figure 8: Map of Europe showing the countries that appear in the information resulting after tag selection

An official user guide that will be available in the DSS tool website is included in Annex I.

2.6 ADMIN USER GUIDE

Admin user can add and modify the information fed to the DSS tool. To add the Word deliverables with tags in the DSS, the following steps have been followed:

- 1) Enter the admin address in a web browser and fill in the login information
- 2) Click on “Import New file” and select the deliverable to be uploaded. The admin user can also remove previously uploaded files (Figure 9).



© 2016 - MSP-REFRAM

Figure 9: View of the tool by the Admin User to upload a deliverable

Once the deliverable is uploaded, tags from the document are automatically imported by the tool and a list is created with all these tags. Then, the admin user has to select the tags that should be imported into the DSS and then click on “import” (Figure 10).

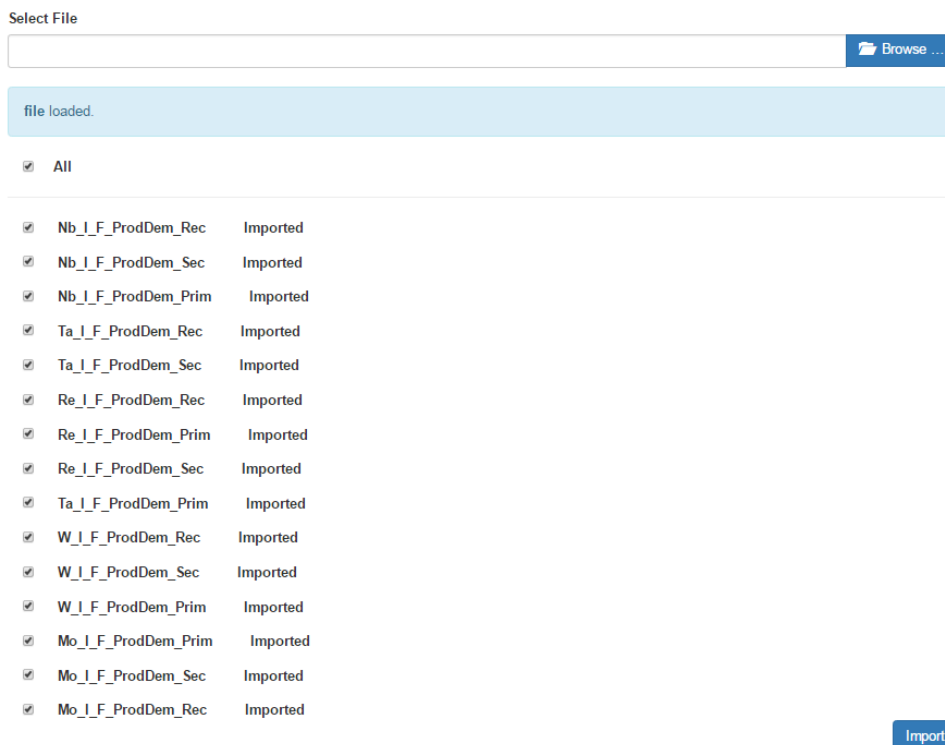


Figure 10: View of the Admin User of the DSS tool to import a deliverable containing tags

- 3) When the tags are imported by the admin user, a new list appear containing all the tags imported till the moment in the tool (Figure 11). The admin user has then the possibility of manually editing the format and the content of the information to be shown using a WYSIWYG (What You See Is What You Get) interface. (Figure 12).

Import new file

Show entries Search:

Combination	State	ACTIONS
Mo_I_C_ExtMet_Rec	Imported	Edit
Mo_I_C_ExtMet_Sec	Imported	Edit
Mo_I_C_ProdDem_Prim	Imported	Edit
Mo_I_C_ProdDem_Rec	Imported	Edit
Mo_I_C_ProdDem_Sec	Imported	Edit
Mo_I_C_ProTec_Sec	Imported	Edit
Mo_I_C_U_Prim	Imported	Edit
Mo_I_C_U_Rec	Imported	Edit
Mo_I_C_U_Sec	Imported	Edit
Mo_I_C_VCS_Prim	Imported	Edit

Showing 1 to 10 of 131 entries Previous [1](#) [2](#) [3](#) [4](#) [5](#) ... [14](#) Next

Figure 11: View of the DSS tool by the Admin User to see all the tags imported in the tool.

Back
Save

Mo_I_C_ExtMet_Rec Imported

Countries

Netherlands Russia

HTML

Recovery of Molybdenum

By far the largest use of molybdenum is in steels as an alloying element. It is therefore mostly recycled in the form of steel scrap. It is reported that 1/3 to 1/4 of the molybdenum used each year is recycled materials from the scrap [1].

Pre-treatments including grinding, sieving, shredding, cutting and sorting are used in recycling of molybdenum in the forms of steel scrap and others[2-3]. Such as in recycling of molybdenum in catalysts a spent catalyst was ground, sieved to a grain size not exceeding 0.20 mm, and agitated to provide homogenization, and then its elemental composition was determined and the characteristic particle size distribution obtained for the samples were measured with a laser particle microanalyzer [3].

The methods for extracting and recovery of Mo from the wastes include pyro-metallurgy, hydro-metallurgy and bio-metallurgy [4, 5]. Here the pyro-metallurgy method for extracting Mo from the wastes are outlined as the following.

Steel scrap

Commonly the steel scrap is recycled by re-melting the steel scrap, for example, in the Electric Arc Furnace (EAF). Before this re-melting is implemented, the scrap normally needs to be pre-treated to: (i) ensure that the scrap has suitable size which makes it possible to be charged into the furnace; (ii) ensure a homogenous composition of the scrap; (iii) remove the impurities from the scrap. The extent to which a pre-treatment procedure is needed for the scrap depends on the source of the scrap where it is generated:

- Revert scrap is generated in the steelmaking process. This scrap is relatively pure with known chemical composition; it normally can be directly charged into the EAF without further treatment, or at most just by cutting the scrap into suitable size.
- New scrap is generated in the manufacturing of products by steel mill customers and recycled by scrap collectors and processors. This scrap normally is also quite pure, the pre-treatment for this sample normally entails sorting/classification (magnetic and/or manual), cutting (if regarded as necessary) and removing the impurities.
- Old scrap or obsolete scrap is generated when the steel product's service life is ended. The old scrap comes from various products and the chemical composition of the scrap is dependent on the origin of the scrap and how the scrap is pre-treated. The pre-treatment of the old scrap normally includes the following procedures: (i) demounting/sorting (magnetic and/or manual); (ii) shredding/sizing in connection to the further sorting; (iii) removing of impurities (such as Cu, Zn, Sn, etc.).

Recovery of Mo from the steel scrap is normally carried out in the EAF, where the scrap is smelted and thereby Mo is largely recovered in the alloyed steel product.

Spent hydro-refining catalysts

The ways in which the spent hydro-refining catalyst is pre-treated depend on the processes of recovering metals (Mo in this case) from the catalyst. Normally, it includes the following:

- Roasting to eliminate the C and S contents (de-oiling and de-cooking) and/or to facilitate the transformation of the refractory metal oxide into other forms;
- Crushing/grinding to get fine materials;
- Leaching to get the soluble refractory metal-bearing compounds.

Figure 12: View of the DSS tool by the Admin User when edit option is selected

3. THE DOCUMENT MANAGEMENT SYSTEM (DMS)

3.1. INTRODUCTION

The DMS is a system that aids in the publishing, storage, indexing, and retrieval of documents. Usually, a Document Management System includes the following functions:

- Indexing: The index function will use metadata (data about data) used to identify the document so that it can be retrieved later. It can include keywords, date, author, etc.
- Searching & retrieval: The document management system's search function is one of its most important elements. Search functions will allow for searches by elements of metadata, or by

searching the actual document for keywords/phrases and using semantic analysis to determine relevance.

- Additional features such as multiple/customizable interfaces, workflow modules, file/format conversions, etc.

3.2. APPLICATION ARCHITECTURE

The DMS has been designed so as to be flexible to be almost platform independent. ASP .NET core, the first linux-compatible version of the Microsoft SDK have been used for implementing the platform. The database of the application has been deployed in a relational database server using MySQL in its community edition.

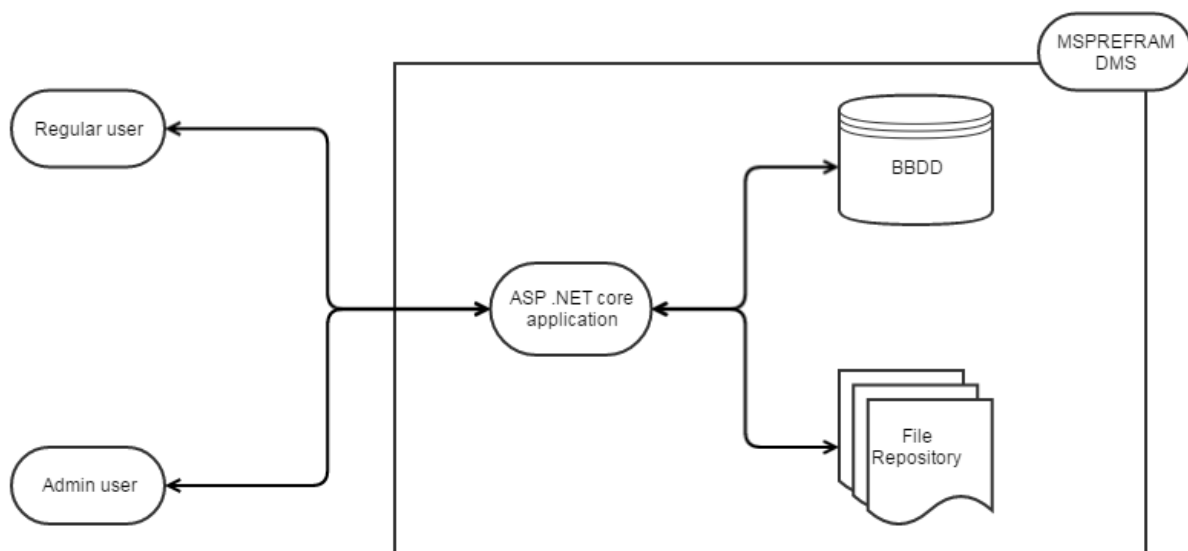


Figure 13: DMS software architecture

3.3. IMPLEMENTATION

To develop the DMS a regular software development process has been followed. First, the application was designed based on the user requirements and a graphic mock-up was prepared for its internal evaluation. Once approved, the software implementation of the platform took place. As soon as the platform was ready for testing, the admin user started uploading documents and the users evaluated the current version of the site.



Figure 14: DMS development work flow

3.3.1. SOFTWARE IMPLEMENTATION

The DMS has been implemented using ASP.NET core, specifically version 1.0.0-preview3-003215 of this SDK. The database has been designed in MySQL, including all the tables required for the proper operation of the platform. Automatic backup and network security safeguard procedures have been implemented.

3.3.1. DATA PREPARATION

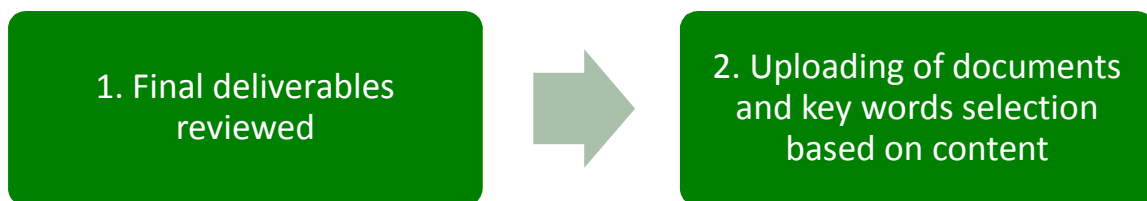


Figure 15: DMS data preparation flow

Each one of the published deliverables has been uploaded to the DMS, selecting the proper keywords and related information for its indexation and presentation. For example, for D1.1 about Current and Future Needs of Selected Refractory Metals in EU, the keywords added are: Current, Future, Tantalum, Rhenium, Niobium, Tungsten, Molybdenum, Supply, Demand, European Union, ITER fusion reactor, Refractory Metals, Raw materials, Applications, Suppliers, Demand by applications, Estimations, Exports, Imports, Balance, Reserves, Products.

3.4. TOOL DESCRIPTION

In the DMS a keyword is defined as a term used to retrieve documents in an information system such as a catalogue or a search engine.

In this way, when the user introduces the keywords in the tool, the tool searches automatically among all the keywords assigned to the deliverables and shows the list of deliverables that are related to such keyword.

For example, if the user desires to know the current deposits of Tantalum, the keywords “current”, “resources” and “Tantalum”, would link directly with the deliverable/s containing that information.

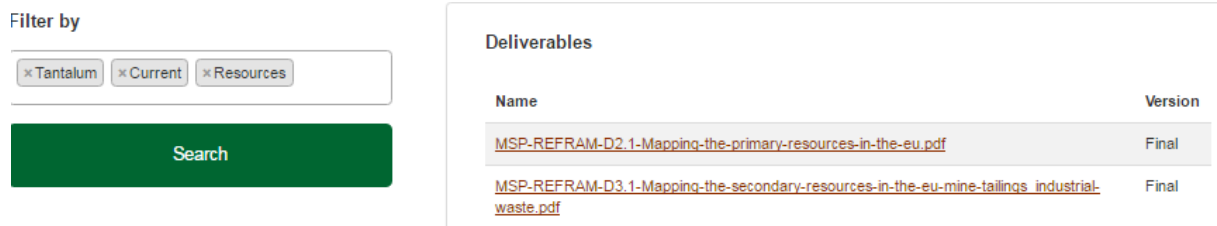


Figure 16: View of the DMS tool by the User showing the deliverables containing the keywords selected

Then, the user can click upon the deliverable name and the deliverable will be downloaded in the user computer directly. The deliverable version will be always the final one.

An official user guide that will be available in the DMS tool website is included in Annex II.

3.5. ADMIN USER GUIDE

Admin user can add and modify documents in the DMS. To upload a deliverable in the Document Management System the next steps have been done:

- 1) Go to [admin DMS access web page](#) and introduce the access credentials
- 2) Upload the desired deliverable and indicate the version (final) and keywords related to the deliverable, separated by comas.

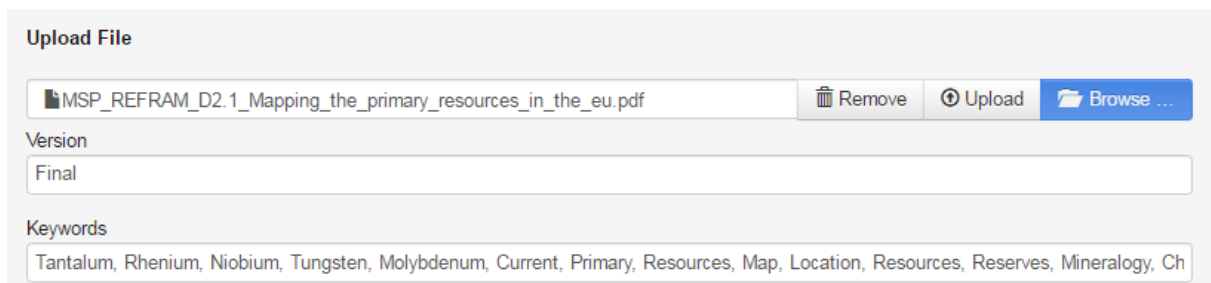


Figure 17: View of the DMS tool by the Admin User when deliverable and keywords are selected

- 3) If the admin user upload the deliverable, it is added to a list where all deliverables uploaded are shown, and the admin user has the possibility of downloading the deliverable from this list, editing it or deleting it. Also, when there are many deliverables in the list, the admin user can use the search tool to find the one required (Figure 18)

Deliverables

Show entries Search:

Name	Version	Keywords	Actions
MSP-REFRAM-D1.5-First-workshop-state-of-the-art.pdf	Final	FirstWorkshop,Presentations	Get Edit Delete
MSP-REFRAM-D2.1-Mapping-the-primary-resources-in-the-eu.pdf	Final	Tantalum,Rhenium,Niobium,Tungsten,Molybdenum,Curre...	Get Edit Delete
MSP-REFRAM-D2.2-State-of-the-art-on-the-recovery-of-refractory-metals-from-primary-resources.pdf	Final	Tantalum,Rhenium,Niobium,Tungsten,Molybdenum,Recov...	Get Edit Delete

Figure 18: View of the DMS tool by the Admin User when a deliverable has been uploaded

ANNEX I. DSS USER GUIDE

The Decision Support System has been constructed with the aim of easing the user the information acquisition about a specific topic in MSP-REFRAM. To use the Decision Support Tool, the user has to:

- 1) First, Go to MSP-REFRAM webpage (<http://prometia.eu/msp-refram/>) and click on Decision Support Tool.
- 2) Second, choose the metal whose output is required:

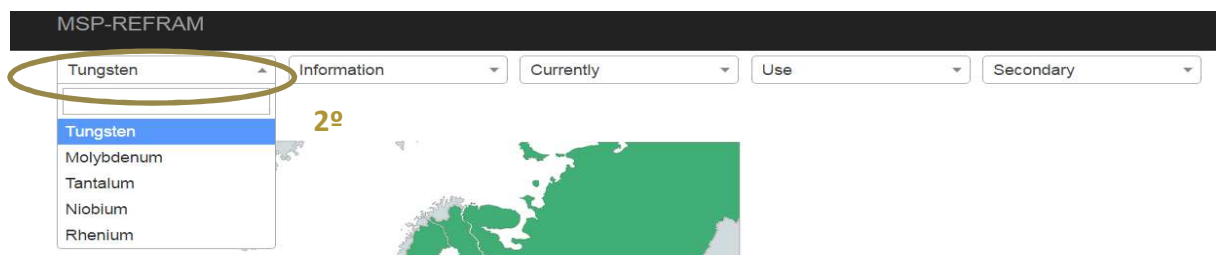


Figure 19: DSS user guide step 1

- 3) Third, click on “Information” or “Recommendations” depending on the answer expected:

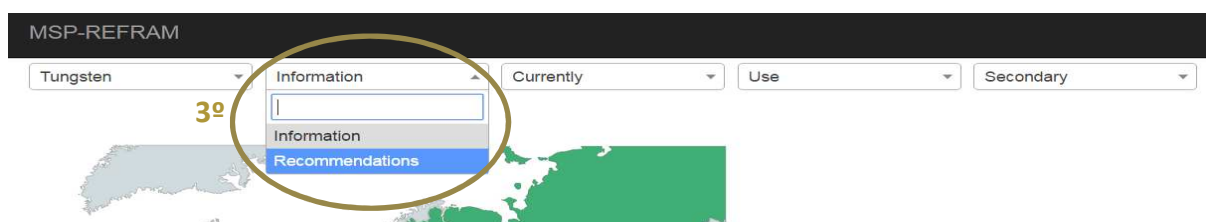


Figure 20: DSS user guide step 2

- 3.1) If “Information” is selected in third step, then click on “Currently” (if the information expected is for the present), or “Future” (if the information expected is for a foreseeable future):

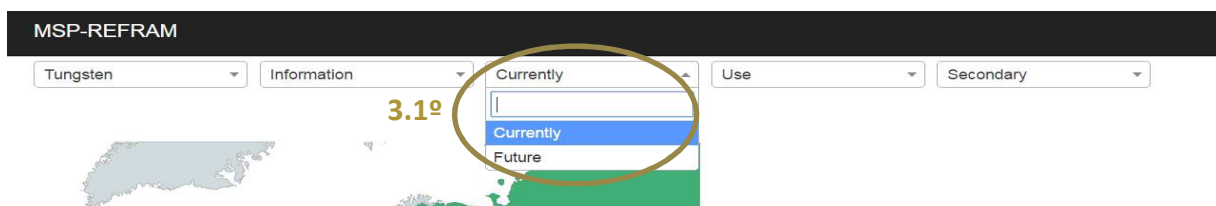


Figure 21: DSS user guide step 3

3.1.1) Then, click on the type of information expected. The options are: “Use”, “Production/Demand”, “Mining”, “Processing Technology”, “Extractive metallurgy”, “Economics”, “Environmental implications”, “Societal implications”, “Substitution” and “Value chain stakeholders”.

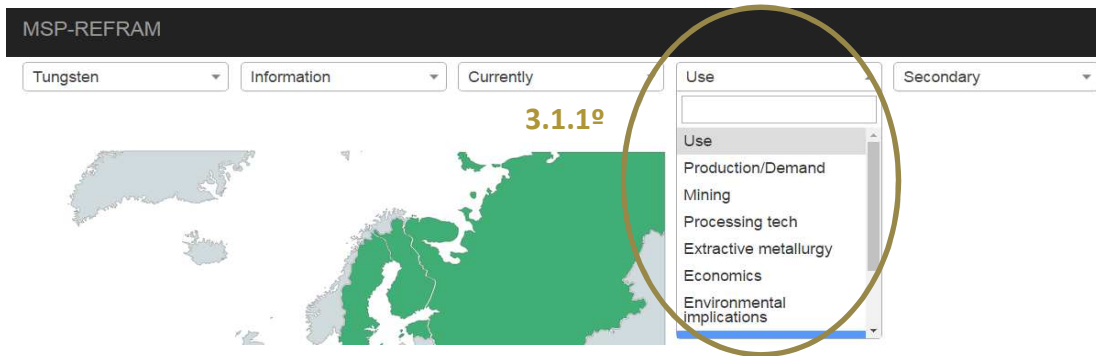


Figure 22: DSS user guide step 4

3.2) If “Recommendations” is selected in third step, the option available is “Future”, so click on it:

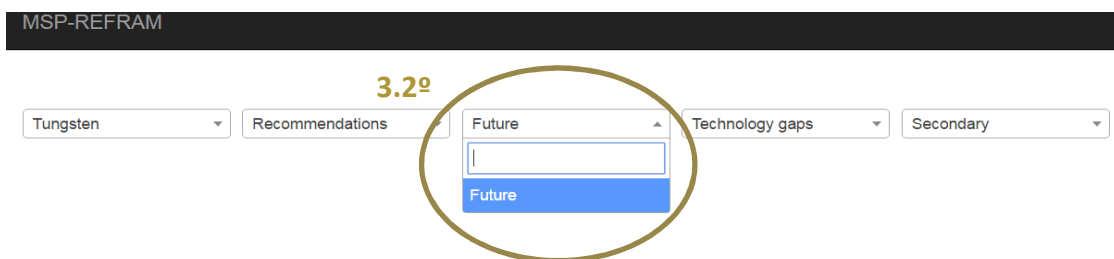


Figure 23: DSS user guide step 5

3.2.2) Then, there are two possible type of recommendations: “Technology gaps” or “Policy Gaps”. Click on the one preferred:

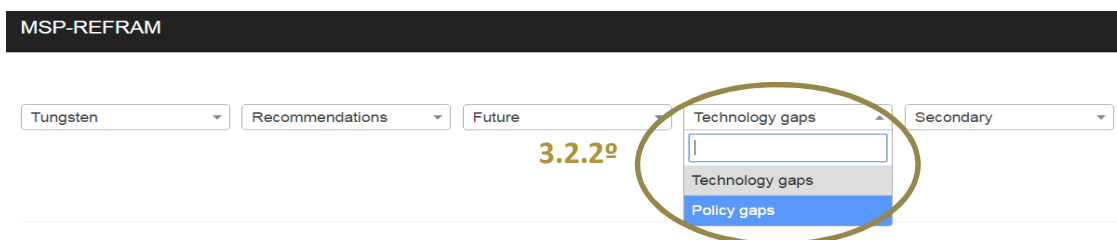


Figure 24: DSS user guide step 6

4) Finally, choose the metal source whose output is expected: “Primary”, “Secondary” or “Recycling”:

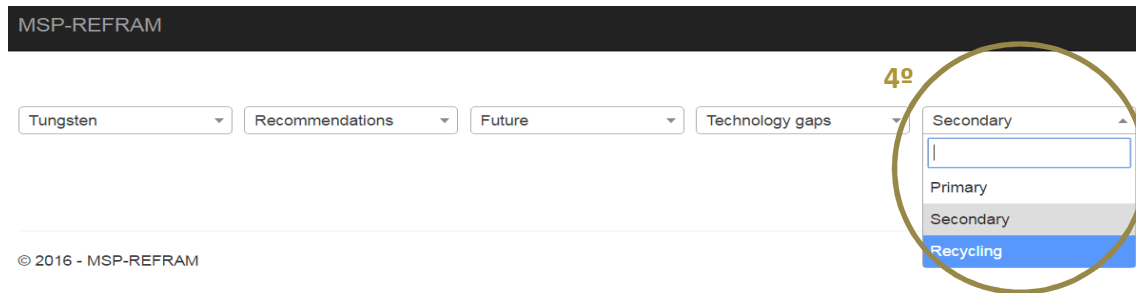


Figure 25: DSS user guide step 7

Once you click on the source type, the output of the combinations selected will appear automatically. Moreover, when an EU country is mentioned in the information/recommendation output, a map of Europe with that country coloured will appear:

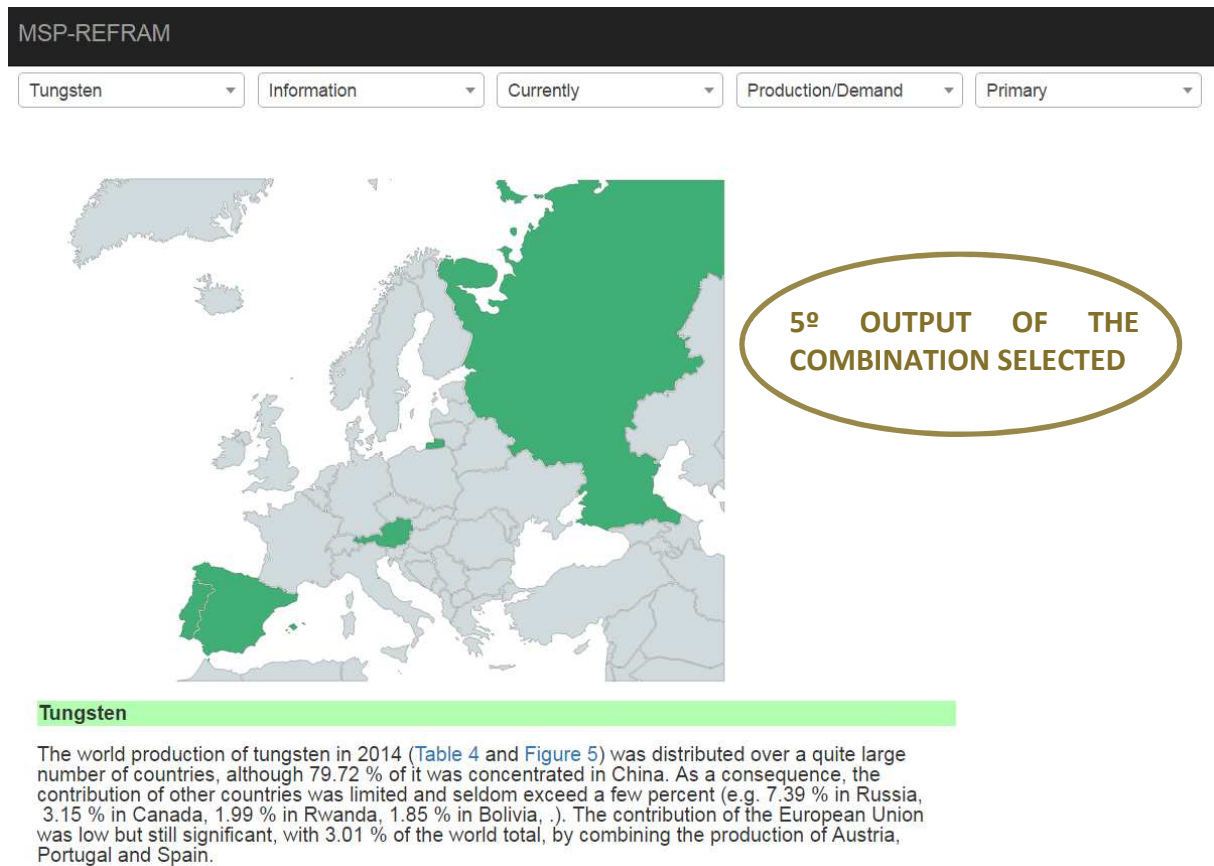


Figure 26: DSS user guide step 8

ANNEX II. DMS USER GUIDE

The Document Management System has been constructed with the aim of allowing the user to download all the public deliverables generated in MSP-REFRAM project. To ease the process, the user must introduce keywords related to the information required, and the deliverables containing those keywords will appear to be downloaded. This is a very easy process:

- 1) Go to MSP-REFRAM webpage (<http://prometia.eu/msp-refram/>) and click on Document Management System.
- 2) Once inside the application, there is a search tool on the left, and the deliverables list on the right. The deliverables can be downloaded on the right directly without doing a search, clicking upon them, but if specific information is required, the search tool is recommended.

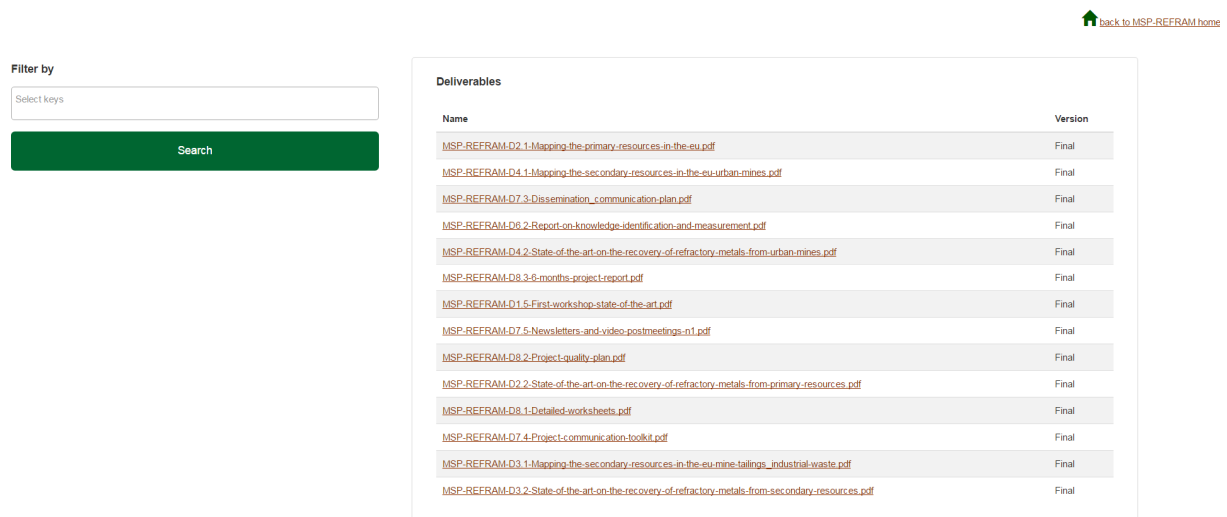


Figure 27: DMS user guide step 1

- 3) To use the search tool, keywords which describe best the content desired must be included. To that aim, click on “Select keys” on the left, choose the keywords from a drop-down list and click on search. There is no limit of keywords. The keywords can be right directly in the square but they have to be anyway added from the list. If a keyword is written and it does not appear, it means that keyword is not valid. To remove a keyword, just click on the cross on the left of a keyword square.



Figure 28: DMS user guide step 2

- 4) After clicking on search, the deliverables assigned to the keywords selected will appear on the left of the page, and just clicking upon the deliverable name, it will be directly downloaded in the computer.



Figure 29: DMS user guide step 3

- 5) When the use of the application is finished, click on the house icon on the right corner to return to MSP-REFRAM web.



Figure 30: DMS user guide step 4