Report D1.9
"FAIR recommendations and cooperations report version 2"

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Glossary of terms

Item	Description
FAIR	Findable, Accessible, Interoperable, Reusable
EOSC	European Open Science Cloud
KExS	Knowledge Exchange Space
RDA	Research Data Alliance

Keywords

Ontology; FAIR principles; collaboration; FAIRSharing;

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Executive Summary

The FAIR principles provide a set of generic principles for data management and in particular for supporting machine-actionability toward automation of data management and data analysis pipelines. Ontologies are key elements for the implementation of interoperability in the context of the FAIR principles. OntoCommons aims at defining a semantic interoperability framework to support the documentation of industrial data with ontologies. This framework is key to integrate the FAIR principles within the context of industry.

This document summarizes our collaborative efforts to connect OntoCommons together with FAIR related projects within the EOSC landscape as well as our activities to raise awareness of the industrial partners on FAIR and the registration of the project outputs into the FAIRSharing registry.

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1. Introduction

The main objective of this task is to ensure close collaboration with the relevant initiatives toward FAIR data and FAIR ontologies to foster the uptake of relevant content within the OntoCommons project and disseminate the ongoing work in OntoCommons which could be either integrated into other projects or used as use-cases.

During the first period of reporting, the task created, in close collaboration with T1.4, the Knowledge Exchange Space (KExS) to enable cross-fertilisation between projects. KExS is primarily a regular workshop used as a discussion platform among the various initiatives and projects. The first KExS workshops have been successful in connecting with EOSC project producing outputs related to FAIR principles implementation (see D1.8 and D1.10 for more details).

The task also enabled the integration of a project output from FAIRsFAIR which lead to the creation of a first evaluation matrix of the level of compliance with the FAIR principles of the semantic artefacts identified in the landscape analysis performed by the T3.2 (Le Franc et al., 2022).

During the first period, we also connected extensively with the relevant initiative on FAIR and in particular GOFAIR foundation.

Based on these outputs, we defined a set of new objectives for the task 1.3:

- The continuation of the KExS meetings on a regular basis.
- The organisation of a FAIR workshop for OntoCommons in collaboration with GOFAIR and other related projects.
- The interaction with the new FAIR related EOSC projects
- The registration of OntoCommons relevant outcome into the FAIRSharing registry

We also considered creating a knowledge base of FAIR related project outcomes that could be useful for the OntoCommons. During the second phase of the project, we realised how arduous and resource consuming this activity would be and we decided to focus on the core objectives listed above.

2. Coordination activities

To foster close collaborations with other relevant projects, initiatives and working groups, we continued with the organisation of the KExS workshop (Knowledge Exchange Space for Data Management and Documentation). We also presented OntoCommons works related to FAIR in various workshop, ensure the presentation and the representation of OntoCommons in the context of RDA, GOFAIR and other related events.

2.1 KExS

One the main challenge faced by this task and task 1.4 is the constant evolution the EOSC and FAIR related projects. As the main objective of EOSC is to become “a web of FAIR data and services”, the implementation of the FAIR principles is at the heart of most of the projects funded in the context of

the INFRAEOSC calls. Each project focuses on various aspects of FAIR, at different level and for different communities. Despite the richness of this landscape, all these projects have a finite time span. During the course of OntoCommons many of these projects ended (e.g. EOSC Pillar[1], Ni4OS[2], FAIRsFAIR[3],...). This situation had a serious negative impact on the participation in the KExS. To compensate for this loss, we connected with the newly funded projects such as FAIR IMPACT[4], FAIRCORE4EOSC[5], FAIR-EASE[6],...

During the reporting period, we organized four KExS workshops and nine KExS Jour Fixe which are summarized in the table below. More details on the KExS events are provided in the associated deliverable D1.11 from task T1.4 in section 2.

Table 1 - List of the KExS events

Scheduled Date	Format	Agenda / Content
4 July 2023	Jour Fixe	OntoCommons 2nd Global Workshop Webinar: EOSC and Data Spaces Webinar: Data Spaces Support Centre
14 June 2023	Workshop	Presentation at the 2nd Global Workshop of OntoCommons on how TU Wien ISE trains the new generation of computer scientists to understand the challenges and tasks of industrial domains and apply data science knowledge (including semantic methods and ontologies for representing data) to other domains like chemistry, geoformation, water management, or non-technical domains like social sciences.
4 May 2023	Jour Fixe	Focus is on projects in the EOSC universe that are or were working on making data available (interoperable, findable, etc), and providing infrastructure for it. Update on projects: all participants present their status quo and next plans and what they might need from KExS (tour the table) Discussions, Conclusions, AOB
7 March 2023	Jour Fixe	Update on projects: all participants present their status quo and next plans and what they might need from KExS (tour the table) Discussions, Conclusions, AOB

[1] https://www.eosc-pillar.eu/
[2] https://ni4os.eu/
[3] https://www.fairsfair.eu/
[4] https://fair-impact.eu/
[5] https://faircore4eosc.eu/
[6] https://fairease.eu/

9 Sept. 2022	Jour Fixe	Collaboration on Workshop - NI4OS & OntoCommons/ KExS Presentation - FAIRsharing
5 July 2022	Jour Fixe	FAIRCORE4EOSC - General presentation FAIR Impact - General presentation FAIR Impact: Metadata and Ontologies – General presentation
10 May 2022	Jour Fixe	Update on projects: all participants present their status quo and next plans and what they might need from KExS (tour the table)
8 March 2022	Jour Fixe	Survey: EOSC TF "FAIR Metrics and Data Quality" and Q&A NI4OS Webinar and Q&A Discussion on Roadmap (Infrastructures)
8 Feb. 2022	Jour Fixe	EOSC TF "FAIR Metrics and Data Quality" FAIR principles - Yann Le Franc Discussion on OntoCommons Roadmap
11 Jan. 2022	Jour Fixe	Intro of OntoCommons Discussion on EOSC related services (existing and planned) Discussion on 2022 planning
3 Nov. 2021	Workshop	In context of the OntoCommons Horizontal workshop, a dedicated session entitled: "Establishing a Knowledge Exchange Space": Based on impulse talks from GOFAIR, the EOSC association and RDA, discussion how to build a sustainable collaborative environment with the different stakeholders and how it can support OntoCommons.
22 Oct. 2021	Workshop	The 2nd KExS workshop took place to establish contact with relevant stakeholders in the FAIR, EOSC, and RDA communities, with a first round of brainstorming on possibilities and avenues of collaboration.
1 July 2021	Workshop	The 1st KExS workshop included a short introduction of the OntoCommons Work Packages relevant for collaboration with the mentioned communities, followed by brief introductions of the projects and initiatives of the invitees. A dedicated session for discussions to identify and assess potential and future collaboration opportunities followed.

Several of the KExS workshop have been focusing on the implementation of FAIR Principles, the evaluation of FAIRness as well as semantics for FAIR. During these discussions, we had demonstration of tools developed by EOSC Pillar such as the Semantic Index (Domingues et al., 2023) which provides fast access to semantic artefact's concepts from multiple semantic artefact repositories. This service

architecture could potentially of interest of the OCES. Another example of cooperation triggered by the KExS is the short collaboration between OntoCommons and the Ni4OS project focused on Semantics. OntoCommons partners directly contributed to one the dedicated Ni4OS event. Unfortunately the INFRA-EOSC 5 a and b projects ended in 2022 but new projects such as FAIR IMPACT, FAIRCORE4EOSC and FAIR-EASE started the same year. We invited to present their ongoing activities and identified several points of overlap such as semantic mappings which are at the heart of both FAIR IMPACT and FAIRCORE4EOSC.

2.2 OntoCommons FAIR output presentation

In addition to this Knowledge exchange activity, the FAIR related work in OntoCommons i.e. the FAIR Evaluation Matrix developed in T3.2 based on FAIRsFAIR recommendations has been presented in two different workshops: the Agrohackathon 2022: FAIRness assessment (29-30/08/22)[7] and the FAIR IMPACT FAIRness Assessment Challenge in October 2023[8]. This simple question based matrix has been tested and used by different groups and showed its value in helping to identify the main adaptation to be done on semantic artefact to increase their level of FAIRness. A short introduction has been also given during one of the session of the EOSC Symposium in September 2023.

2.3 Coordination with RDA and GOFAIR

In parallel with these strong links created with existing EOSC/FAIR projects, the task constantly maintained a direct link with the Research Data Alliance which offer an international platform to increase the outreach on OntoCommons activities. This link has been established mostly through the RDA Vocabulary and Semantic Service IG (VSSIG) which was used as a platform to present and discuss OntoCommons work and to establish relations with the activities around the Material Science Interest Group (IG) and the newly created Material Science Working Group (WG) which was created following the RDA Birds of a Feather session organised during the RDA Plenary P20 in Goteborg (Sweden)[9]. A first set of links between RDA VSSIG and the Material Science WG will be established during the RDA Plenary P21, which will be held from Oct. 23rd to Oct. 26, 2023. In addition, during this plenary, OntoCommons will be involved in a Birds of a Feather session on mappings co-organised by FAIR IMPACT, FAIRCORE4EOSC and the EOSC Semantic Interoperability Task Force. This participation will allow the uptake and refinement of the mapping work done in WP2 and WP3 in a potential new Working Group.

Besides EOSC, many activities around FAIR were driven by the GOFAIR[10] Initiative as Thematic Implementation Networks and other related initiative such as the FDO forum[11]. Since 2021, the GOFAIR Foundation[12] went through a reorganisation and the IN have been rendered inactive, except

[7] https://agrohackathon2022.workshop.inrae.fr/

[8] https://fair-impact.eu/support-offer-1-fairness-assessment-challenge-datasets-and-semantic-artefacts

[9] https://www.rd-alliance.org/data-representation-materials-and-chemicals-based-harmonised-domain-ontologies

[10] https://www.go-fair.org/

[11] https://fairdo.org/

[12] https://www.gofairfoundation.org/

for the GOFAIR IN VODAN[13]. These changes had a major impact on the initially planned activity to create an industrial IN. Despite these changes, we continued engaging with the GOFAIR Foundation and invite them to present their activities in several OntoCommons workshops. In addition, one of the task partner recently became a GOFAIR Fellow to reinforce the collaboration and leverage OntoCommons as a potential industrial use-case for the Foundation.

3. Raising awareness industrial partners

One of the objectives of this task is to raise awareness among the project partners and more precisely the industrial partners to support them into their FAIR journey.

For this, we organised several FAIR related session during the reporting period and in particular a session on "FAIR domain ontology for industry" during the FOMI workshop (Formal Ontologies meet Industry, Sept.12-15 2022)[14], which was complemented with a training session on the "FAIR Implementation Profiles" in collaboration with the GOFAIR Foundation and a session on "Semantic interoperability and FAIR Semantics" during the Second Global Workshop[15] in June 2023.

The culmination point was the organisation of a full day session, entitled "FAIR Principles for industry", during the Berlin workshop entitled *Towards Materials and Manufacturing Commons - the enablers Digital Marketplaces, FAIR Principles and Ontologies*[16] held in April 2023.

The session was organised to provide a generic overview of the FAIR Principles, provide examples of concrete implementation of the FAIR principles in industry and their added value and then provide an overview of the ongoing effort in the relevant EU projects.

An entire day was dedicated to exploring how these FAIR Principles are applied in the industrial context, with five distinct sessions.

The two first sessions aimed at providing both a generic perspective on the FAIR principles and a more practical perspective with concrete examples of how the FAIR principles are implemented within industry, with examples from companies like Roche and BOSCH.

The subsequent session delved into the OntoCommons perspective on the FAIR principles and in particular the connection between FAIR and ontologies, particularly highlighting the criteria for achieving ontology interoperability and the evaluation of the FAIRness of ontologies.

The fourth part of the program aimed at providing a broad overview of the projects, initiatives, working groups and outcomes related to the European Open Science Cloud (EOSC). This covered the

[13] https://www.go-fair.org/implementation-networks/overview/vodan/

[14] https://ontocommons.eu/news-events/events/12th-international-workshop-formal-ontologies-meet-industry-fomi22#Program

[15] https://ontocommons.eu/news-events/events/second-global-workshop-ontocommons-addressing-challenges-industry-50-transition

[16] https://ontocommons.eu/news-events/events/towards-materials-and-manufacturing-commons-enablers-digital-marketplaces-fair

EOSC FAIR Metrics and Data Quality Task Force[17], as well as updates from the EOSC Semantic Interoperability Task Force[18], FAIRSharing[19], the FAIR Cookbook[20], FAIR Impact, and FAIRCORE4EOSC.

The final session of the event was dedicated to discussing FAIR resources within the framework of GO FAIR and in particular introduce the two approaches proposed to identify the relevant metadata for machine actionability (Metadata4Machine workshop[21]) and the relevant implementation practices in any domains (FAIR Implementation Profiles)

4. Publishing OntoCommons in FAIRSharing

4.1 Publishing OntoCommons resources in FAIRSharing

FAIRsharing stands as an informative and educational registry, dedicated to detailing and connecting community-driven standards, databases, repositories and data policies. The FAIRsharing team takes an active role in curating each resource, diligently overseeing updates contributed by the community to maintain the highest standards of accuracy and reliability. This ensures that all resources listed in the FAIRsharing registry are well-described and trustworthy.

At present, the registry encompasses a vast array of resources, comprising approximately 1657 standards, 2047 databases and 168 policies covering fields of social sciences, engineering, humanities and natural sciences. Within the registry it is possible to search any resource based on its type (whether it's a database, standard, policy or collection), subject matter, domain, name, usage licence, the organization responsible for maintaining the resource, the country of residence of the maintainers, and tags assigned by users.

FAIRsharing provides a platform for us to officially register selected OntoCommons resources, enhancing their visibility and recognition among both human users and automated systems, while also ensuring proper attribution within the OntoCommons community. The registry provides a way to comprehensively describe the resource and offers diverse options for capturing their interconnections, current status, and any new updates.

4.2 Identifying OntoCommons resources to be potentially registered in FAIRSharing

We engaged in a collaborative dialogue with the FAIRsharing team to determine which outcomes from the OntoCommons project could be appropriately registered within their registry, thus aligning with their resource requirements. Following our discussions, we reached a consensus to register three

[17] https://eosc.eu/advisory-groups/fair-metrics-and-data-quality

[18] https://eosc.eu/advisory-groups/semantic-interoperability

[19] https://fairsharing.org/

[20] https://faircookbook.elixir-europe.org/content/home.html

[21] https://www.gofairfoundation.org/m4m/

OntoCommons resources, specifically: the Linked Open Terms Methodology, IndustryPortal and the OntoCommons ontology catalogue.

We also considered the inclusion of additional resources such as Ecosystem Knowledge Graph, Ontology Harmonization and Domain Ontology Development. However, these resources were not yet fully developed and refined for registration. The Ecosystem Knowledge Graph will be registered to the FAIRsharing once its dedicated homepage contains more comprehensive details, including detailed description of the resource's purpose and its intended applications. Presently, this registration is temporarily constrained due to challenges faced by the team in maintaining the GitHub page for personal reasons. Once these issues are resolved, the Ecosystem Knowledge Graph will be seamlessly integrated into FAIRsharing.

Furthermore, we contemplated the registration of ontologies, namely TRIBONT and RGOM, but found that they are better suited for registration within a FAIR Ontology registry.

4.3 Registering the resources

4.3.1 The registration process

The registration process commences with an initial consultation with the FAIRsharing team, during which the individual resources are assessed for their suitability for registration. We gather specific details about these selected resources together with theirs authors, along with their intended resource type according to FAIRsharing guidelines. The FAIRsharing registry specifies metadata requirements for each resource type outlined by the FAIRsharing team. Among these metadata fields, some act as primary criteria to determine a resource's suitability for inclusion in FAIRsharing, while others are requested during the registration process. For instance, common metadata elements include the resource's description, homepage, usage license, relevant publication for citation, year of creation, and the maintaining organization, among others.

Subsequently, the FAIRsharing team undertakes a comprehensive evaluation of this provided information about each of the selected resource and offers feedback regarding the suitability of registration or requests for supplementary data.

After the resource's eligibility for FAIRsharing registration has been verified, it can be officially entered into the repository. Additionally during the registration, for resource types such as repositories, unique metadata fields are mandated to account for conditions specific to this type of registry. These may include access conditions, data curation practices, data preservation policies, data versioning protocols, and more. Once the registration has been finalized, it undergoes evaluation by the FAIRsharing team, after which it is categorized as an valid resource.

4.3.2 OntoCommons ontology catalogue

The OntoCommons ontology catalogue has been officially registered within FAIRsharing as a resource falling under the "Knowledgebase and repository" category. This classification was chosen because it serves as a comprehensive repository of existing domain ontologies that are pertinent to the OntoCommons project and its associated use case topics. Link to the resource in FAIRsharing : https://fairsharing.org/5022

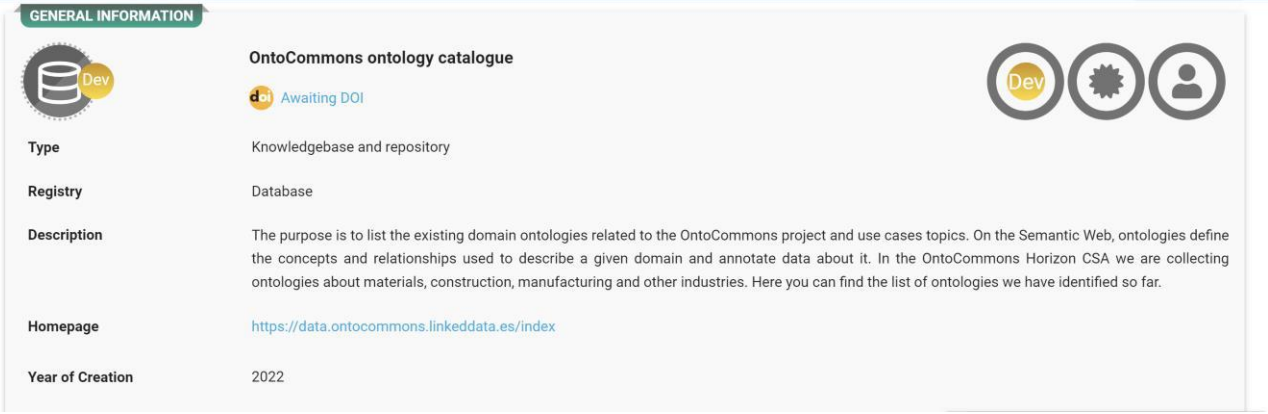

Figure 1 - Screenshot of the OntoCommons Ontology Catalog record in FAIRsharing

4.3.3 Linked Open Terms (LOT) Methodology

The registration of the Linked Open Terms (LOT) methodology within FAIRsharing was categorized under "Reporting Guidelines." This classification was chosen because LOT constitutes an industrial methodology specifically designed for the development of ontologies and vocabularies. Link to the resource in FAIRsharing : https://fairsharing.org/4951

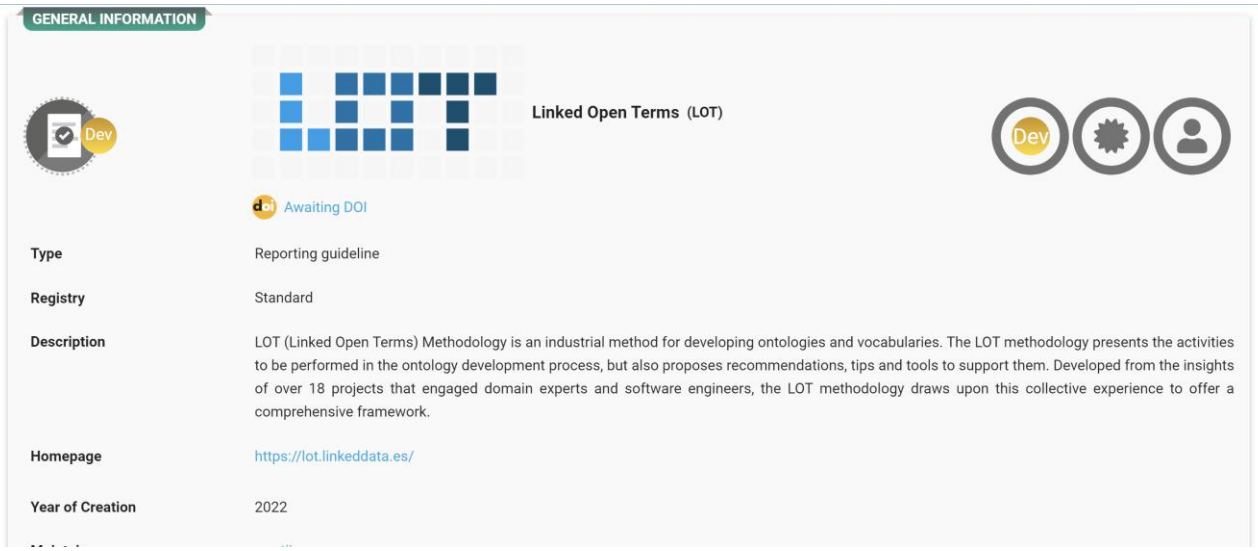

Figure 2 - Screenshot of the LOT methodology record in FAIRsharing

4.3.4 IndustryPortal

IndustryPortal has been officially registered within FAIRsharing under the resource category of "Repository." This categorization was made due to its role in providing enduring access to semantic artefacts. Link to the resource in FAIRsharing : https://fairsharing.org/4952

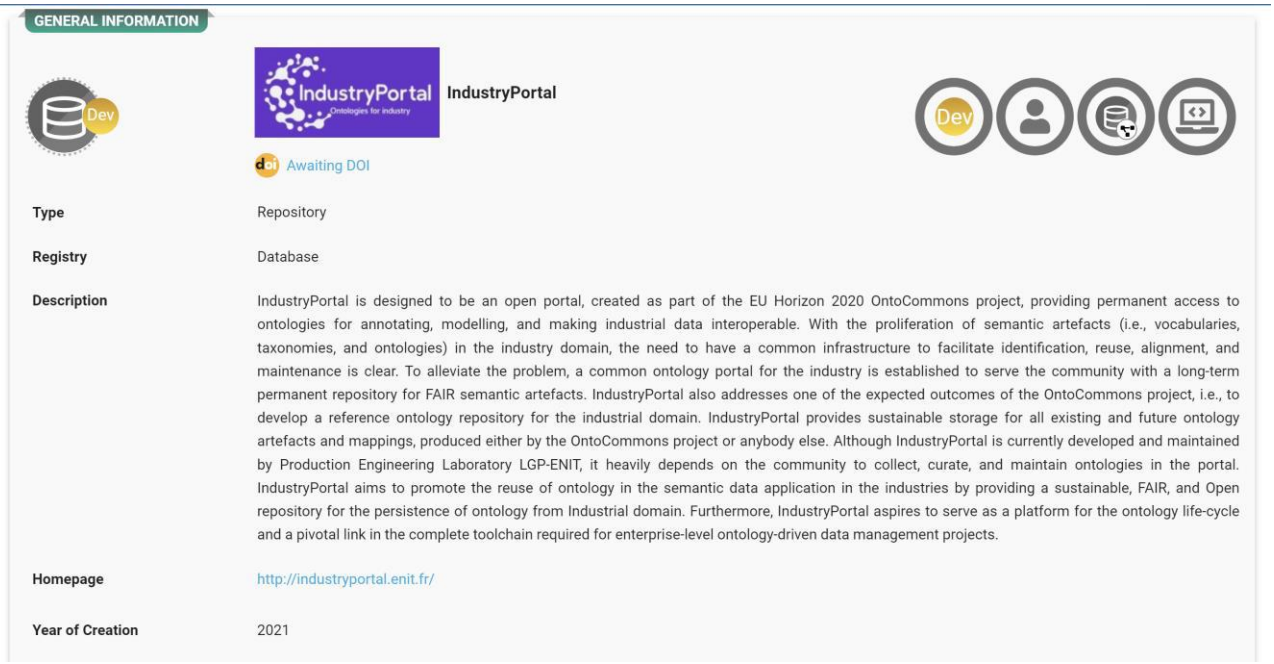

Figure 3 - Screenshot of the IndustryPortal record in FAIRSharing

5. Contributing to expert groups

In addition to the engagement with the various projects and initiatives, we also engaged directly with existing international expert groups to integrate OntoCommons outputs in their work and also to provide major connection to OntoCommons. These direct contributions were done by the partner e-Science Data Factory, who is actively contributing to the FAIR Digital Object forum as co-chair on Semantic Working Group, to the EOSC Semantic Interoperability TF as Task Force member and to the WorldFAIR Cross Disciplinary Interoperability Framework Working Group as an expert member. .

6. Conclusions

Despite the constantly evolving FAIR and EOSC landscape the task has been quite successful in establishing close connections with most of the relevant projects for OntoCommons. These connections led to direct collaboration and also to the integration of external project outputs to enrich OntoCommons outputs. In addition, these close connections allowed to disseminate OntoCommons outputs to a broader audience.

Through these interactions, the task managed to raise the awareness of the OntoCommons partners and in particular the industrial partners on the importance of the FAIR principles and the ongoing activities at European and international level, they should follow and reuse.

The task also contributed to the sustainability and the FAIRness of some OntoCommons outputs by registering them within the FAIRSharing registry. This integration will allow to connect these outputs with related initiatives, standards contributing to build a knowledge base of resources for the Material Science and Manufacturing community.

Finally, through the engagement of the partners into external group of experts, the task managed to integrated OntoCommons outputs into the ongoing work of these groups. This insures both a broader dissemination but also extends the influence of OntoCommons into EOSC and FAIR related working groups. By doing, the task contribute to some extend to the sustainability of the project outputs.

7. References

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Yann Le Franc. (2022). OntoCommons D3.2 - Report on existing domain ontologies in. Zenodo. https://doi.org/10.5281/zenodo.6504553