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D6.3 ESTABLISHED COMPETENCE CENTRE FOR VARIETY OF COMMUNITIES

Work Package	WP6 – FAIR Competence Centre
Lead Author (Org)	Gabin Kayumbi- Kabeya (STFC)
Contributing Author(s) (Org)	Elizabeth Newbold (STFC), Angus Whyte (DCC), Linas Cepinskas (DANS), Laura Molloy (CODATA)
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Abstract

This report advances the establishment of a FAIR Competence Centre as outlined in the previous two reports from WP6 of FAIRsFAIR, D6.1 "Overview of needs for Competence Centre" and D.6.2 "Initial core competence centre structure", part of FAIRsFAIR WP6 deliverables which is concerned with the development of a competence centre as a model of engagement and support for research communities. Whilst the aforementioned reports focused, the first on the analysis of the landscape of available competence centres, and the second the set-up of the FAIR core competence centre, the present deliverable's emphasis is put on the description of operations of the core competence centre, including initiatives aiming to identify synergies and areas of harmonisation that are required to support knowledge base development.

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1.0	25.02.2021	Gabin Kayumbi-Kabeya, Elizabeth Newbold (STFC),	Content ready

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Abbreviations and Acronyms

CODATA	Committee on Data of the International Science Council
D6.1	FAIRsFAIR Deliverable 6.1Over of needs of competence centres
D6.2	FAIRsFAIR Deliverable 6.2 Initial Core Competence Structures
ENVRI-FAIR	Environmental Research Infrastructures building Fair services Accessible for society, Innovation and Research
EOSC	European Open Science Cloud
EOSC-5 TF	European Commission H2020 INFRAEOSC-05-2018-2019 projects task force
EOSC-Nordic	A new path to European research and innovation in Nordic and Baltic countries
EOSC-Pillar	Coordination and Harmonisation of National Initiatives, Infrastructures and Data services in Central and Western Europe
EOSC Synergy	European Open Science Cloud - Expanding Capacities by building Capabilities
ESFRI	European Strategy Forum on Research Infrastructures
ExPaNDS	European Open Science Cloud (EOSC) Photon and Neutron Data Service
FAIR	Findable, Accessible, Interoperable, Reusable
INFRAEOSC-5	European Commission H2020 INFRAEOSC-05-2018-2019
HEIs	Higher Education Institutions
Ni4OS-Europe	National Initiatives for Open Science in Europe
OER	Open Educational Resources
PaNOSC	Photon and Neutron Open Science Cloud
RDA	Research Data Alliance
RDA-ETHRD-IG	RDA Education and Training on Handling of Research Data Interest Group

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SRIA	Strategic Research and Innovation Agenda
SSHOC	Social Sciences & Humanities Open Cloud
WP	Work Package
WP3	FAIRsFAIR work package 3 - FAIR Data Policy and Practice
WP6	FAIRsFAIR work package 6 - Competence Centre

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Executive Summary

The overall objective of FAIRsFAIR is to accelerate the realisation of the goals of the EOSC by opening up and sharing all knowledge, expertise, guidelines, implementations, new trajectories, courses and education on FAIR matters. To support this, FAIRsFAIR is tasked to set up a FAIR Competence Centre which this report defines as a shared hub of expertise in implementing FAIR principles, offering leadership, coordination and services to connect relevant people, guidance, learning resources and curricula in different thematic areas.

The Competence Centre will serve as a nexus between the FAIRsFAIR project and the communities for two-way communication, and a source of knowledge about how FAIR competences can be enhanced in ways relevant to their research data practices. It will be open to all communities to access and contribute. FAIRsFAIR will focus its own content contributions on needs that other initiatives do not meet. Within this framework, the objectives of the work package are to:

1) Support a range of communities in their activities aimed at FAIR data uptake and compliance;
2) Promote harmonisation and coordination of efforts across communities, identifying opportunities for synergies and building on the progress of others;
3) Channel feedback from communities into other parts of the FAIRsFAIR project and the EOSC more generally.

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1 Introduction

Competence Centres are envisaged as a model of engagement and support for research communities, with the ultimate goal of providing the skills and training and related services that are essential for mainstreaming FAIR practices within a strong research data ecosystem that turns digital technologies into reality.

FAIRsFAIR WP6 objectives include working with research communities in developing a virtual Competence Centre which is a focal point of reference, a place to go for advice, training and services concerning FAIR data. Concomitantly, working toward the achievement of this goal will also include building up resources that constitute a central core of a knowledge base.

Following the previous two WP6 deliverables, namely D6.1 Overview of needs for Competence Centres[1] and D6.2 Initial core Competence Centre structure[2], which covered, respectively the analysis of the landscape of available Competence Centres, and the set-up of the FAIR core Competence Centre, the present deliverable focuses on describing the operations of the core Competence Centre. The report's emphasis is set on the engagement activities that have been supported by the FAIR Competence Centre in the course of the second year of the project, including leading initiatives involving multiple stakeholders in the topic of harmonisation.

The reader is reminded that we set to adopt an incremental approach (D6.2) whilst building the Competence Centre (online platform and knowledge base) in order to enable a constant review and assessment of the practicalities of the proposed structure and to update and make adjustments as necessary. That approach was made inevitable by the nature of the rapidly-changing landscape in which we are operating. To date, the FAIR ecosystem is a fragmented landscape of initiatives whilst somehow related one to the other, not always operating in converging efforts. Hence the need to avoid unnecessary duplications by holding ongoing consultations with the user communities, and ensure the approach undertaken meets the stakeholders needs.

Our objectives for the period covered by this report, essentially developed around the overarching goal of translating the structures described in D6.2 into operational mechanisms, are summarised as follows (D6.2 Future works):

1) Turn the online FAIRdata Forum operational and initiate engagements activities with communities whilst incrementally start building the knowledge base.
2) Leveraging on Competence Centre potentials, work with communities and identify synergies of collaborations converging towards the objectives of the FAIRsFAIR and specifically those defined for WP6

[1] Herterich, Patricia, Davidson, Joy, Whyte, Angus, Molloy, Laura, Matthews, Brian, & Kayumbi Kabeya, Gabin. (2019). D6.1 Overview of needs for competence centres. FAIRsFAIR. https://doi.org/10.5281/zenodo.3549791

[2] Newbold, Elizabeth, Kayumbi Kabeya, Gabin, Matthews, Brian, Davidson, Joy, Herterich, Patricia, Whyte, Angus, & Molloy, Laura. (2020). D6.2 Initial Core Competence Centre Structures (Version1.0_DRAFT). https://doi.org/10.5281/zenodo.3732889

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3) Contribute in addressing the existing gaps in skills whilst supporting the dissemination of training material

While the present work was kept as much as possible in line with most of the broad objectives above, some of them have been reviewed and updated to respond to the rapidly evolving FAIR landscape. In particular, a strong emphasis has been put on developing the online FAIRdata Forum to highlight the need expressed in initial works and surveys for an environment where community engagement could take place. In this report, we present the growing activities and interactions happening on the forum, including some technical features of the platform that help attain its goals.

Similarly, we present the accumulation of a body of material and information that are in practice building the knowledge base. At this stage however, it is worth pointing out that while the content of interactions happening on the forum and the material which links are included there are instantiations of elements of the knowledge base as conceptualised in D6.2, the formalisation of the entity "knowledge base" itself and details of its operational set-up (including structure, mechanism for populating, tests on metadata classification scheme, etc.) are still the object of on-going discussions at the time the content of this report was being compiled. The decision to review and update the initial objective of the creation of a knowledge base was primarily dictated by the need to avoid duplications with existing initiatives in a changing landscape. And also, as a corollary, the necessity to leverage on collaborations with communities from which to consequently derive additional content for our knowledge base. The latter content, added to the body of knowledge being generated in the forum are envisaged to help shape and formalise what constitutes the Competence Centre knowledge base. Additionally, we foresee the content of the knowledge base to also result from two interrelated activities:

- the collection and presentation of learning resources developed across the FAIRsFAIR project,
- and the harmonisation of metadata about training resources that have been produced by different communities.

The latter will result in a shared metadata collection, through ongoing collaboration with EOSC projects and coordination fora.

The objectives directly related to activities in the forum and the building of the knowledge base fall into the Advisory and Dissemination roles of the Competence Centre (D6.1). Instead, the work that stems from collaborations taking place with communities are mostly categorised in the harmonisation role.

The rest of the report is organised as follows:

- Section 2 Competence Centre Operations which encompasses 3 sub-sections describing the operations under 3 different perspectives corresponding to the 3 main roles of the Competence Centre, namely Advisory-Dissemination-Harmonisation;
- Section 3 Conclusions, a short summary that includes indications on directions to take in order to complete the remaining work.

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2 Competence Centre: Operations

2.1 Scope and overview

The Competence Centre operations reported hereinafter are to be contextualised within the frame of concerted efforts by multiple stakeholders in the purport of FAIRsFAIR goal which is to accelerate the realisation of the goals of the EOSC by opening up and sharing all knowledge, expertise, guidelines, implementations, new trajectories, courses and education on FAIR matters. As the project entered the crux of its second year, the landscape analysis conducted in the initial phase added to the enriching experiences derived from liaising with other FAIR stakeholders and communities, all within the context of a rapidly moving landscape of FAIR-related initiatives, have informed the Competence Centre work.

Work undertaken in the early stages of the project on establishing the need for competence centres and the landscaping survey (D6.1, D6.2) highlighted the many different communities and domain subject approaches to support.

In establishing a FAIR Competence Centre, we have looked to identify communities and domains that are less well supported and have focused on providing a generic, domain agnostic approach given that a) researchers will look to their own institutions for support and b) domain or subject specific centres will provide tailored support for their own community (for example through existing competence centres or domain specific learning platforms and training catalogues). With this in mind the FAIR Competence Centre is focused towards data stewards and other professionals engaged in supporting researchers with research data management irrespective of domain or working environment. We envisage most demand to come from data stewards (or related roles) working in HEIs who are establishing and supporting FAIR practices.

In relation to EOSC key priorities which include capacity building through supporting Knowledge/Education Hub (EOSC Executive Board, 2020), Competence Centre operations are focusing on community engagement by means of the forum, a place where knowledge is exchanged. Additionally, the operations included supporting training activities aiming at the provision of data skills, thus the Competence Centre's contribution in efforts that address the gap highlighted in the Turning FAIR into Reality report[3] and in FAIRsFAIR report on Recommendations on practice to support FAIR data principles (Molloy, Laura et al., 2020). Although the direction the forum is taking represents an important aspect in achieving the goals of the competence centre, it does not constitute the only pole of activities. The competence centre seeks opportunities for synergies across disciplines and communities, in its attempts to encourage harmonisation and avoid duplications.

In the following sections, we show how the operations are mapped onto the competence centre main roles (Advisory-Dissemination-Harmonisation), while addressing some of the key issues germane to the project goals.

[3] Turning FAIR into reality: Final report and action plan from the European Commission expert group on FAIR data https://op.europa.eu/en/publication-detail/-/publication/7769a148-f1f6-11e8-9982-01aa75ed71a1

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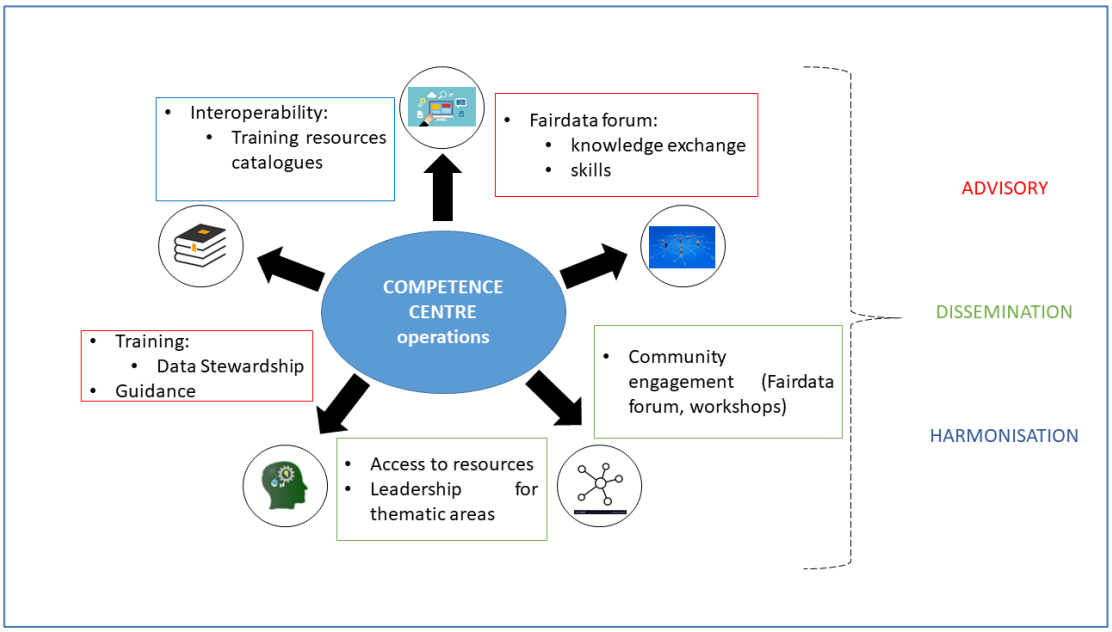

Figure 1. The operations are expanding along the 3 main roles of the FAIR Competence Centre as initially formulated in the project: Advisory (training resources, guidance, FAIRdata forum posts), dissemination (exchanges on the FAIRdata forum), and harmonisation (metadata interoperability)

2.2 Advisory

> *"Networking space to enable stakeholder collaborations and routing people to expertise in thematic areas" (D6.2)*

2.2.1 FAIRdata Forum

A central question in establishing a virtual competence centre is "*What form should it take and how can the function of the competence centre be delivered*?". Building on the concept that a competence centre is a shared hub of expertise that connects people and resources we have approached the practicality of creating a virtual competence centre through the development of an online space, the FAIRdata Forum[4]. As illustrated in Fig.1, the FAIRdata Forum is a core component of the Competence Centre. This is the place where operations related to community engagement, support to knowledge/skill transfer through training is concretely materialised. In addition to the links to a host of training materials, the posts on the forum are envisaged to contribute to and form part of a body of knowledge, thus shaping the forum as an important pole in the Competence Centre advisory role.

Description

FAIRdata Forum is based on Discourse[5], an application that is conducive for the characteristics needed in this platform and envisaged in the course of its development. Discourse is in fact an open-source discussion platform and mailing list management with built-in moderation and governance

[4] https://fairdataforum.org
[5] https://discourse.org

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systems that can be deployed on a cloud server. It is a widely-used application. A sizable number of academic and research communities (e.g. CERN[6]) are relying on Discourse-based forums for their engagement activities including the FREYA Project[7] that used it successfully for the PID Forum. Discourse has many useful functionalities that support two-way communication and a mechanism for engaging with communities. For example, Discourse Groups mechanism when associated with an appropriate use of permissions and tags can be used to create spaces for communities. The forum with its user-friendly interface is the place to quickly receive support while attracting a growing number of users.

It should be noted that a chat application could have served the purpose of an active space for discussions. However, whilst such applications can include search capability, chats present an inherent highly unstructured and ephemeral nature. Conversely, a forum has the advantage of presenting a more structured nature which makes it more suitable in this instance by providing context and hierarchy to the posts as well as being publicly available for reading without the need to register[8].

2.2.1.1 Operational structure

The forum is organised to operate following the structure described in Fig.2. The IT infrastructure is managed by STFC which hosts the site and handles the authentication process during users' registration. Currently, on registration, a new user's authentication is handled through IRIS-IAM which is the authentication service which allows institutional logins using eduGAIN[9]. However, other authentication options (e.g. Google, GitHub) are supported by Discourse and are being considered, to provide additional access to users.

[6] http://cds.cern.ch/record/2729357?ln=en
[7] https://www.project-freya.eu/en
[8] https://blog.discourse.org/2018/04/effectively-using-discourse-together-with-group-chat/
[9] eduGAIN is a service that connects identity federations around the world, simplifying access to content, services and resources for the global research and education community. It enables institutions to easily and scalably support access to services globally – allowing control over user management

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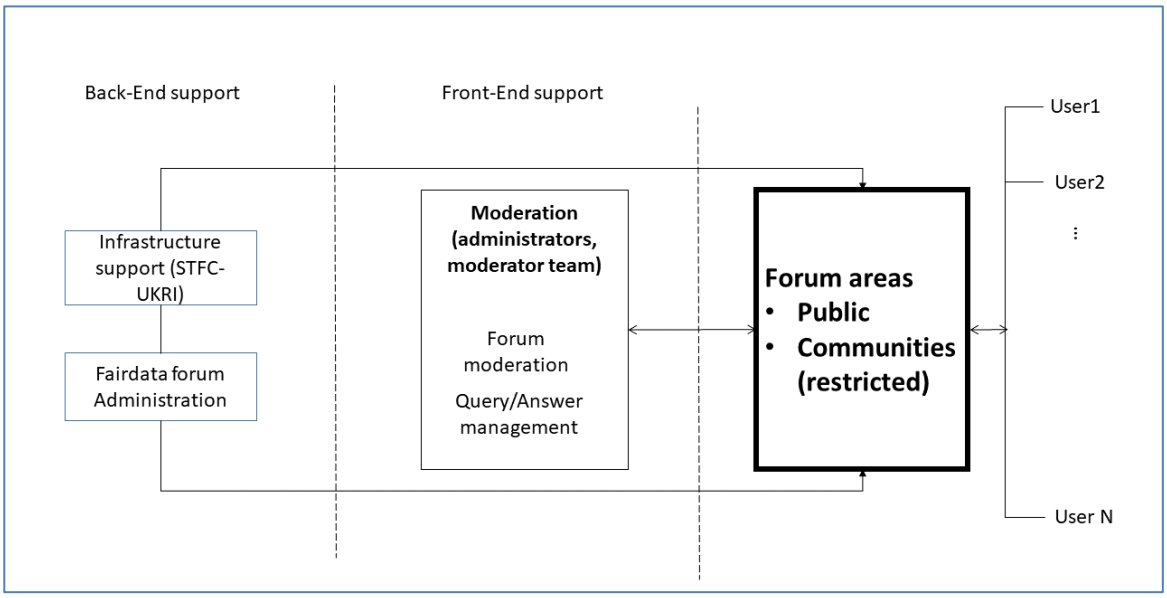

Figure 2. FAIRdata forum operational structure: the site is hosted by STFC-UKRI and authentication operates on instance of IRIS-IAM with possibility of EduGAIN login. An administrator role to oversee the routine tasks, assisted by a team of moderators. Public access and open for browsing, posting/editing rights for registered users.

The forum itself has:

- a forum administrator role with full permissions, for an oversight of the site. Discourse features make the day-to-day administration easy, once the site has been configured,
- a team of moderators with extended editing permissions, monitoring posts, managing groups of registered users,
- restricted areas: for registered users, assigned to various levels corresponding to specific area of access in the forum, with some restricted editing permissions,
- publicly accessible area: for non-registered users who can access the forum for browsing but not posting.

During the set-up of the forum, we considered some of the practical issues of sustainability should the forum prove to be successful. The issues of sustainability informed our decision when choosing the Discourse based software as it has a number of characteristics (including open source, easy administration, authentication service, integration with other platforms) that brings an advantageous portability. Whilst the functionalities of the Discourse software allow for integration within a website for reasons of future sustainability, we decided to host the forum on a separate domain and not integrate it into the FAIRsFAIR website. Additionally, by registering a domain name which is independent of the hosting organisation and project that enables the potential hosting and managing of the forum to be taken over in future, if required. The FAIRdata Forum can be accessed directly but there is also a link to the forum on the FAIR competence centre webpage[10]. Figure 3 shows a

[10] https://www.fairsfair.eu/competence-centre

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screenshot of the part of the landing page for the FAIRdata Forum. The page is set up with topic areas which are visible to anyone who visits the site.

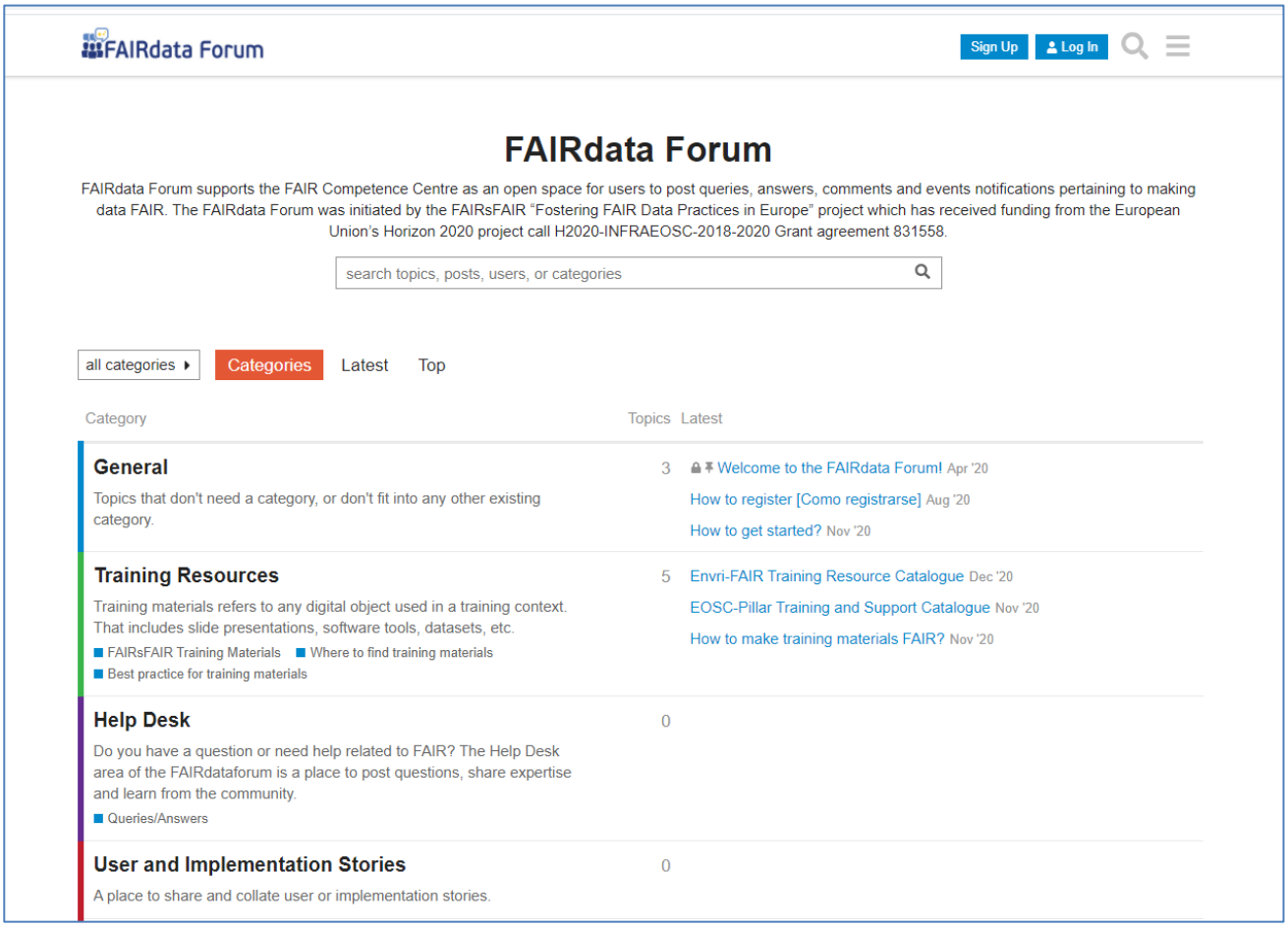

Figure 3. FAIRdata forum page as visualised by the public for browsing.

2.2.1.2 Communities

One important feature of the FAIRdata Forum is that Discourse allows the creation of distinct areas of restricted access where discussions, exchanges can take place whilst remaining compartmentalised from the rest of the forum. Using the forum's Groups mechanism, a central feature in Discourse, it is possible to set posting or viewing permissions on categories as well as group users together and allow them to use several functions of the software. We have used this inbuilt feature and in addition to the open areas we have created closed groups for specific communities, as described below and illustrated in Fig.4, not visible to other users or site visitors.

A well-combined use of Discourse categories, groups, topic, tags features in FAIRdata Forum make possible the idea of creating communities congregating around topics pertaining to their domains without necessarily sharing their discussions with all the entire community of forum users. This feature has been experimented with two training events supported by FAIRdata forum. For practical reasons related to the nature of the event, as well as an efficient management of the course

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attendees, having areas accessible only to those registered on the course was required. Those two communities are mentioned in the next section on training events.

Figure 4. shows a screenshot of a closed group would see which would not be visible on the public view. A user who has been assigned to a community will see and be able to participate in all the public topics but will additionally see the topic/information pertaining to the closed group(s) to which they are associated when they are logged in. Figure 5 is an example of the same feature, for higher-level user permissions.

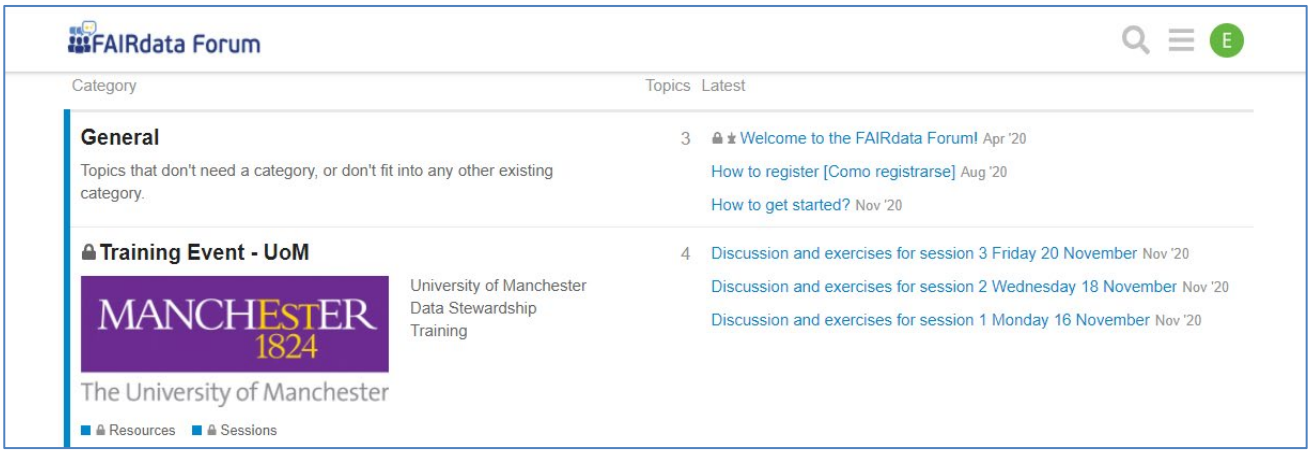

Figure 4. Discourse Groups mechanism: Example of a closed group for communities, on FAIRdata Forum.

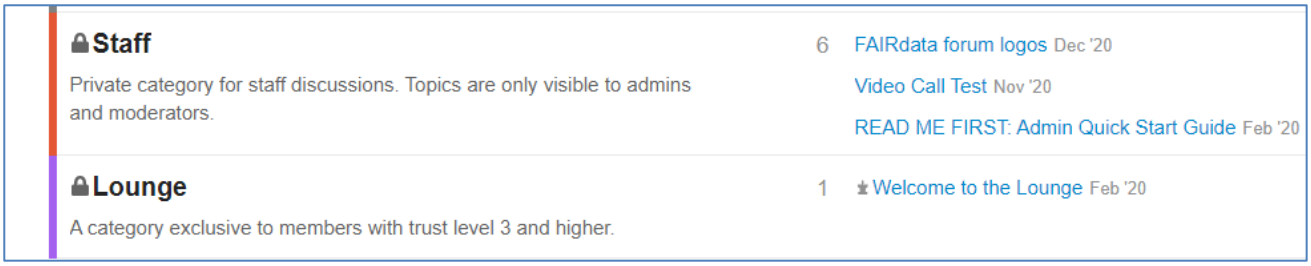

Figure 5. Discourse Groups mechanism: Closed group for administrator and users with high level rights

2.2.2 Supporting Data Stewardship Training events

The FAIR Competence Centre advisory role has also been met by working with communities in addressing the gap in skills, identified as a priority in Turning FAIR into Reality (Hill, T., 2019). Specifically, the forum has been used as a platform to support Data Stewardship training, in a concerted FAIRsFAIR-CODATA-RDA's effort.

The FAIRsFAIR-CODATA-RDA Data Steward Training is part of the FAIRsFAIR initiative, and one of its goals is to develop and provide a series of schools in this area and hence FAIRsFAIR is partnering with the CODATA-RDA schools to deliver training along the lines described by FAIRsFAIR's main goals. The two training events that have taken place in November and December 2020, supported by FAIRdata Forum have lent themselves to being an ideal initial test for the forum as a focal point of engagement

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activities, where users interact with experts and knowledge about FAIR matters is sourced and exchanged.

Future project deliverables will report in detail on the training and instruction activities. Instead, we focus on the support provided by the FAIRdata forum to the aforementioned events. We examine the data on the forum usage and consequently look at areas where the online community engagement could build a network of experts.

The first event was held in collaboration with Manchester University and the second, with the National University of Costa Rica. Two instances of closed groups were created to compartmentalise areas of the forum exclusively dedicated to the trainees of each event and made invisible to other users (except moderators).

While the second event (National University of Costa Rica) was outside the primary geographical space concerned in FAIRsFAIR, it was nevertheless an opportunity for outreach and constitutes an example of community engagement and wider impact of FAIRsFAIR. Working with this particular community highlighted different issues and the wider community has also benefited from Costa Rica's translation of some material into Spanish language.

By supporting those training events, the forum analytics has concomitantly allowed a first overview of the platform quantifiable activities which are reported in the following section.

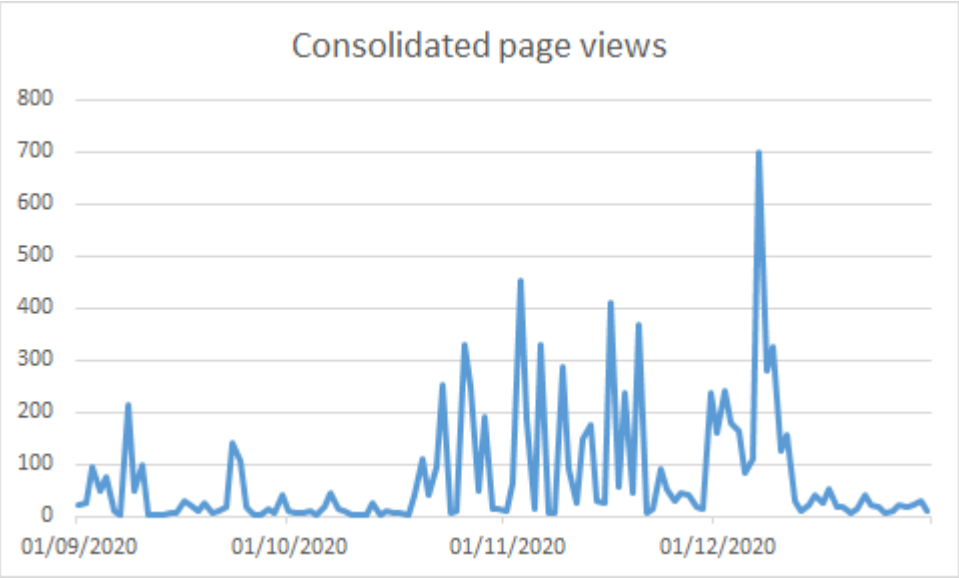

Figure 6 Consolidated pageviews. Data includes number of total page views for all visitors, logged-in and anonymous users.

The data extracted from the website indicate, as expected, numbers of consolidated page views (Fig.6), all peaking in correspondence with the training events that took place. The feedback received from the two events attendees has mainly highlighted:

- the forum as a useful resource and central location for the course materials and information

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- the need to streamline the registration process
- areas of improvement regarding the presentation of topics and consequently making navigation of the forum easier

The interpretation of the data extracted from the website activities, the feedback obtained from users who attended the training sessions and moderators are indicative of the relevance of the forum as a place for engagement. However, they also highlight the need for the forum to gain more traction and translate into more users to users and users to experts discussions. The two events supported by FAIRdata Forum have represented a real-life scenario test for community engagement and there is now scope for stepping-up efforts in publicising it, within and outside FAIRsFAIR project.

2.3 Dissemination

> "dissemination of training material and courses; enable sharing of best practices." (D6.2)

2.3.1 Knowledge Base: Approach

Dissemination constitutes the second main role of FAIR Competence Centre. During this period, in practice, it has been materialised through activities on the forum (collection of posts and exchanges) but also, by the provision of training material. Both are developing into becoming parts of building up the Competence Centre's body of knowledge.

While initially, the project WP6 DoW mentioned building up a knowledge base with general and community-specific parts and curating the knowledge base, it quickly became evident that there was a need to clarify the focus to concentrate on. The constraints imposed by the resources of the project (time and human experts), the need to avoid duplication in an already fragmented landscape, have all pointed WP6 to focus more on building up a knowledge base on FAIR training material and the steps required to work collaboratively with other initiatives to harmonise approaches.

Research undertaken in the EOSC Pilot Project (in the report on training workshops D7.4[11]) highlighted the functions that EOSC should prioritise to help communities put FAIR principles into practice, (Fig. 7) including:

- Pointers to training and guidance materials offered by infrastructures, institutions and EOSC service providers
- Pointers to training events offered by infrastructures, institutions and EOSC service providers
- Certify the training materials and events offered to check they meet community needs, and that skills gaps are filled.
- Guidance on finding repositories certified as trustworthy, and data certified as FAIR
- Collate information on community requirements for FAIR services and resources
- Document issues and debates about implementing FAIR principles in practice;

The following functions were assigned the highest scores: "pointers to training and guidance material", "training events", "collate information on communities". Much has already been achieved

[11] D7.4: Report on Training Workshops https://eoscpilot.eu/sites/default/files/eoscpilot_d7.4_submitted.pdf

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in relation to these functions which can be built on. As outlined below we aim to work in liaison with other projects and initiatives to build a knowledge base that in part will consist of FAIRsFAIR training resources, e.g. those coming from the CODATA-RDA Data Science and Stewardship Schools. Additionally, the forum with its role as a place for content-generating engagement and signposting to resources, represents a first instance in building a hub of material being collated within the Competence Centre.

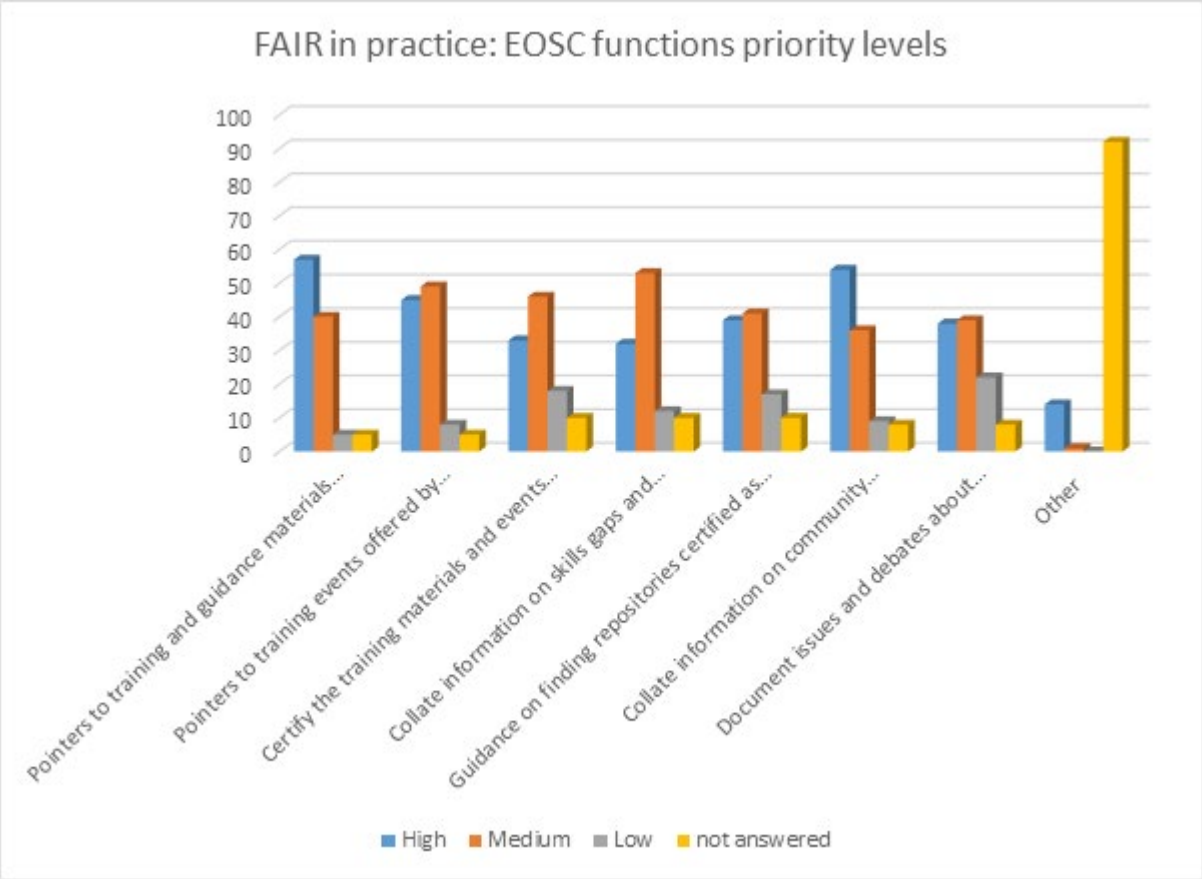

Figure 7. Results from surveys conducted whilst identifying communities needs in addressing skills gaps (D6.1)

As various FAIR-related initiatives grow, with a concomitant rapidly-developing supporting knowledge bases, there is need to provide communities with training material that start from a common denominator base, while simultaneously maximising the usage of existing training material. However, the development of a FAIRsFAIR knowledge base should also recognise the need for different communities to further customize material to fit to their own specificities.

In the next phase of the project, joining efforts with the rest of the project work packages, we will look at building on preliminary work and exploring avenues to structure the content of the knowledge base. Expanding the latter will also include material derived from communities identified in current and future collaborations.

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2.3.2 Making Training Materials FAIR

The EOSC SRIA document (EOSC Executive Board, 2020) highlights how "there is fragmentation in training resources and the quality and FAIRness of training and learning resources remains a challenge" something which we have looked at within the competence centre and is informing our work. Figure 8 (Whyte, A. *et al*, (2020)) illustrates the steps needed to make training materials FAIR, not just within FAIRsFAIR but collectively in the wide EOSC landscape.

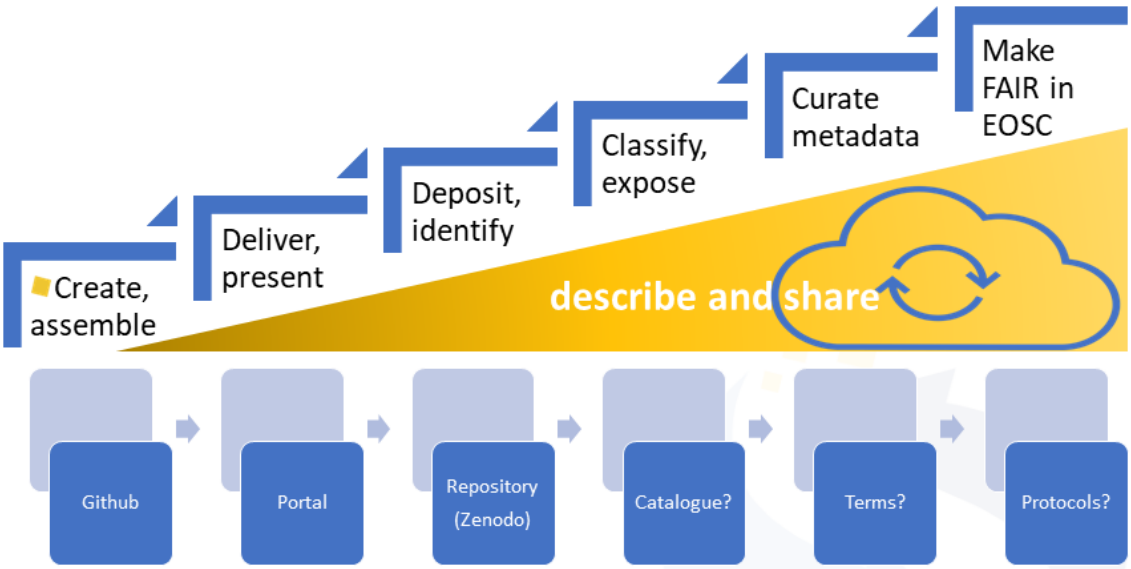

Figure 8. Steps to make training resources FAIR -in FAIRsFAIR and collectively- (Whyte, A. et al, (2020)).

Within the project we have so far established the first three steps in Figure 8 (Whyte, A. *et al*, (2020)), to ensure sustainable access to training materials created in the project. As part of our commitment to openness and the FAIR principles we have reviewed different options and approaches to the further three steps, which require harmonisation with related EOSC projects. These are considered in the next section.

Given the need to consider future sustainability and the desire to avoid duplication of effort, we decided we would make use of existing infrastructures and services. To this end, we concluded that we would use the Zenodo repository as the initial stage in making our training materials FAIR.

There are two main categories of the training materials:

- Materials that are produced/developed to be re-used and shared beyond the initial target audience
- Materials that are available for re-use/inspiration but have not been explicitly designed for re-use beyond the initial purpose

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To aid this, we have recently developed practical guidance in the form of a checklist (Table 1) for depositing training materials in Zenodo, a multi-disciplinary open repository. The aim of the checklist is to encourage the FAIRsFAIR project partners to deposit their training materials in Zenodo for long-term access and sustainability beyond the time of the project as a first step towards making these materials as FAIR as possible.

This checklist has been adapted from "10 simple rules for making training materials FAIR" by Garcia L., Batut B., Burke M.L., et al. (2020). The objectives of this checklist are to encourage the FAIRsFAIR project partners to deposit their training materials in Zenodo for long-term access and sustainability beyond the time of the project as a first step towards making these materials as FAIR as possible. To facilitate better use of Zenodo, the questions with an * refer to the repository's website.

Describing digital objects with structured metadata is fundamental to making them FAIR. Regardless of the type of object, adding appropriate, standardised metadata will help make them both machine and human readable.

Table 1: Checklist for depositing training materials in Zenodo

FAIR principles	Steps[12]	Key questions	Y	N	Notes
R e u s a b l e	1. Plan to share your training materials online. 2. Keep your training materials up-to-date.	• Have you considered which material or parts of this material could be helpful to others?			Consider how the material should be organised in a collection to help others discover it. Most but not all materials will relate to an event, such as a webinar, workshop or training course. If this covers more than one speaker or topic consider creating a collection to describe this context, and upload the material for each in a separate record. In some cases, not all material may be available, e.g. speaker notes, references to related material, or information about the context of the training. Think in advance what could be most useful to your audience and consider adding anything that is missing.
		• Have you considered if you will need to keep your material up to date?			Sometimes material does not need to be updated (e.g., material from a one-off event). If you do not plan to update the material, provide a timestamp of the last update/last version in your material.
F i n d a b	3. Improve findability of your training materials by properly describing them.	• Have you specified the community which you wish your upload to appear with in Zenodo?*			Select FAIRsFAIR and/or other additional communities that may be relevant for your domain or audience.

[12] Garcia, L., Batut, B., Burke, M. L., Kuzak, M., Psomopoulos, F., Arcila, R., Attwood, T. K., Beard, N., Carvalho-Silva, D., Dimopoulos, A. C., Del Angel, V. D., Dumontier, M., Gurwitz, K. T., Krause, R., McQuilton, P., Le Pera, L., Morgan, S. L., Rauste, P., Via, A., Kahlem, P., … Palagi, P. M. (2020). Ten simple rules for making training materials FAIR. *PLoS computational biology*, *16*(5), e1007854. https://doi.org/10.1371/journal.pcbi.1007854.

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l e	4. Give your training materials a unique identity. 5. Register your training materials online.	• Have you chosen the upload type?*			You can choose from multiple options. If you choose "lesson" as your upload type, make sure you have relevant information, such as learning objectives and instructions to make it reusable for others. If your material is a publication, make sure you select the type of the publication. Other activities/exercises can be selected as "other".
		• Have you reserved a Digital Object Identifier (DOI)?*			It is possible to upload more than one file associated with each DOI. It is up to the "file owner" to decide how to group their training files. If you wish to have all of them separated, you can add a "txt" file with the link to other materials or in the description field (and related identifiers). The files, however, should be grouped to present the content needed for someone in the target audience/domain to achieve the described learning objectives.
		• Have you selected the publication date?*			This should be the date you upload them, or if they have already been made public then use that date.
		• Have you entered the title?*			
		• Have you entered the author information?*			
		• Have you described your material (metadata)?*			Here you can provide instructions on how to use your material. For trainings/workshops, you may want to include an outline/programme of a previous training, the dates of the training, and the format of the training (e.g., virtual, face-to-face), the target audience for the training (e.g., researchers in a specific domain, PhD students, data stewards).
		• Have you properly cited any resources you have based your material(s) on?			If the material includes any reference to resources created by other people, it is important that these other authors have authorised the use of their text, imagery or other contributions. Short quotes from academic research or other publications can normally be used with a clear citation. If your material is heavily based on someone else's work or ideas, even if you are not directly quoting, it is good practice to provide citation to their work. For images, designs, audio, video, or other original works, if their contributions are freely available online under a licence from the original author or their representative which permits reuse, this should be clearly indicated in your resource. If their contributions are not available under a licence that permits reuse, even if you can locate them online, you must seek permission to reuse their material and indicate this has been done in your resource. If this is not possible, you must remove their contribution from your resource before depositing in Zenodo or uploading

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					anywhere else. Read more about licencing in section 6, below.
		• Have you specified the language of the material?*			
		• Have you entered the keywords best describing the material?*			Depending on the subject of your material, you may want to include the following terms, such as best practice, curation, data management plan, data steward, FAIR, research data management training, metadata etc. For a comprehensive overview of relevant subject terms, you may want to consult the CASRAI Research Data Management Glossary https://casrai.org/rdm-glossary/
		• Have you provided any other additional notes for users (optional)?*			Additional information, not provided elsewhere needed to understand the materials, e.g. software required, a quiz, an HTML version, a print version of an online course.
		• Have you specified grants which have funded your research?*			FAIRsFAIR "Fostering FAIR Data Practices In Europe" has received funding from the European Union's Horizon 2020 project call H2020-INFRAEOSC-2018-2020 Grant agreement 831558.
		• Have you specified identifiers of related publications and datasets*			
		• Have you specified subjects from a taxonomy or controlled vocabulary?*			Note that each term must be uniquely identified (e.g., a URL).
A c c e s s i b l e	6. Define access rules for your training materials.	• Have you selected the access right for using the material?*			In FAIRsFAIR we normally use Open Access.
		• Have you specified the licence which explains the conditions of using your material?*			In FAIRsFAIR we normally use Creative Commons Attribution 4.0 International. Before saving any material in Zenodo, you need to ensure that the material meets the requirements for this licence. This can be checked with the authors and contributors. You should provide licensing information throughout all the material, such as Attribution Generic (CC-BY). When reusing someone else's contributions in your resource, remember that you **cannot assign rights that you do not hold yourself**. So you cannot make material available under a CC-BY license, for example, if the

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					original authors of even a small part of your resource have not allowed that level of openness in their own licence.
I n t e r o p e r a b l e	7. Use an interoperable format for your training materials.	• Have you used a community-endorsed format for your publication?*			In FAIRsFAIR we normally upload the text documents in HTML, PDF, and PPTX versions. Common formats for training material can be found on https://journals.plos.org/ploscompbiol/article/figure?id=10.1371/journal.pcbi.1007854.t001 Preferred formats for data overview available on DANS (Data Archiving and Networked Services) website: https://dans.knaw.nl/en/about/services/easy/information-about-depositing-data/before-depositing/file-formats
		• Have you provided the version of the material (optional)?*			Mostly relevant for software and datasets[13].
R e u s a b l e	8. Make your training materials (re)usable for trainers. 9. Make your training materials usable for trainees.	• Have you provided any other additional notes for trainers and trainees (optional)?*			As stated earlier, you can provide a "txt" readme file with clear instructions on how to use the material. For trainings or workshops, you may want to include an outline/programme of a previous training. The minimum requirements that are not covered in Zenodo, but should be specified in the training material description (metadata) are: learning outcomes, target audience, required resources, structure and duration, date of last revision, and contact details. An overview of suggested metadata for training materials can be found here https://journals.plos.org/ploscompbiol/article/figure?id=10.1371/journal.pcbi.1007854.t002

We decided not to include the rule "Make your training materials contribution friendly" into our checklist as we leave it up to the user to adjust and adapt the training material for their specific needs.

Working with the instructors and preparing materials for deposit has provided insight into the practicalities of applying the principle of FAIRness to training resources and the support that is required.

An example of materials uploaded using the checklist can be seen here: Davidson, Joy. (2021, February). Developing and Implementing a Research Data Policy. Presented at the FAIRsFAIR-CODATA-RDA Data Steward Training Series, virtual: Zenodo. http://doi.org/10.5281/zenodo.4561728.

[13] Whilst version of material is optional, Zenodo has the functionality to assign versions when a new version of an object is uploaded creating a DOI that refers to all versions.

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2.4 Harmonisation

> *"to consistently describe resources relating to FAIR data stewardship; provide leadership in harmonisation of policies, tools and resource" (D6.2)*

One of the aims of the Competence Centre is to collaborate with communities on training materials and contribute to developing standards for describing these. With this end in mind we have looked at the issues relating to making our own training materials FAIR as described above, and are contributing to joint initiatives that address the problems of a fragmented landscape specifically addressing the core issues of classification and exposure of metadata as being the most challenging but highest priority to the interoperability of training resource catalogues.

Harmonisation of cataloguing standards and processes is one of the main aims of a Collaboration Agreement between FAIRsFAIR and the INFRAEOSC-5. A number of Task Forces have been established for that collaboration, including the EOSC-5 TF Training and Skills. Establishing a shared catalogue for training resources is one of its primary aims. To address that, the various approaches being taken by individual projects were discussed in a workshop that FAIRsFAIR co-organised with the Task Force in October 2020.[14]

In parallel with FAIRsFAIR and the above initiatives, the project EOSC Future, which is under negotiation in response to the INFRAEOSC-3 call is likely to include implementation of a catalogue of training resources, as an enhancement to the EOSC Portal. This work is expected to start in 2021.

Preparatory work for the EOSC catalogue of training resources has also been carried out by the EOSC Board Working Group on Training and Skills. Chapter 5 of the Working Group report (European Commission 2021) makes recommendations towards 'building a trusted and long-lasting federated knowledge hub of learning and training resources and related tools'. FAIRsFAIR contributed to these recommendations, and will continue to work with the EOSC-5 TF Training & Skills to build on this report and its recommendations, along with others including the OpenAIRE-facilitated Community of Practice for training coordinators.[15].

2.4.1 Classification and description

2.4.1.1 Terms4FAIRskills

Within the Competence Centre operations, the dissemination of training material carries with it an emphasis on findability and subsequently a consistent description of materials is paramount. In this regard, it is worth mentioning the work on classification and description conducted by the Terms4FAIRskills[16] initiative, to which FAIRsFAIR is contributing.

[14] Workshop on Training Resources Catalogues Interoperability, October 2020 organised by FAIRsFAIR and EOSC-5 Training and Skills https://www.fairsfair.eu/events/training-resource-catalogue-interoperability-workshop

[15] https://www.openaire.eu/cop-training

[16] https://terms4fairskills.github.io/

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The aim of Terms4FAIRskills is to create a formalised terminology that describes the competencies, skills and knowledge associated with making and keeping data FAIR. The completed terminology will be of use for:

- Discovery - it should facilitate the annotation, search and evaluation of FAIR-enabling materials and resources;
- Design - it will assist the creation and assessment of stewardship curricula;
- Formalisation - the terminology will enable the definition of job descriptions and CVs with recognised, structured competencies; and
- Training - to help trainers who teach FAIR data skills, researchers who wish to identify skill gaps in their teams and managers who need to recruit individuals to relevant roles.

It is particularly in the area of annotating training materials that the FAIRsFAIR competence centre is working with the Terms4FAIRskills initiative. The training materials being annotated are, inter alia, those from the RDA-CODATA Schools of Research Data Science data stewardship training events in collaboration with FAIRsFAIR. At the time of writing, FAIRsFAIR WP6 and the EOSC Co-creation fund are providing valuable support to the development of the terminology. Practical feedback on usability of the terminology[17] and a couple of different tools which can be used to annotate online materials, is gathered through a series of hackathons in partnership with other relevant European organisations including CINES, ELIXIR-FR, ELIXIR-NL, and the Digital Curation Centre. Terms were identified in pre-FAIRsFAIR development activity with the European research data community through a series of workshops, and definitions in approximately one-third[18] of the current terms are drawn from the CASRAI Glossary[19]. It should be noted that the terminology does not attempt to provide a complete metadata resource for training materials. It is a lens or focus on descriptive terms specifically for FAIR skills, rather than terms relating to, for example, Open Science, specific disciplines or other epistemological perspectives, and in this way is complementary to other WP activity. The current phase of activity will produce a trial or 'minimum viable product' version of the terminology. It is hoped that this collaborative agile development approach, including members of the WP6 team, can continue to develop this resource and can continue to gather feedback on the use of the terminology in practice including via an implementation story with selected training providers as part of the work of WP3.

2.4.1.2 RDA Education and Training on Handling of Research Data Interest Group

RDA Education and Training on Handling of Research Data Interest Group (RDA-ETHRD IG)[20] has two strands of work currently being undertaken by 'focus groups' to which FAIRsFAIR are contributing. One focus group is aiming to define minimal and extended metadata for training materials, and another is characterising training materials repositories. These focus groups of the RDA-ETHRD-IG started work in June 2020, which was timely as these issues are aligned to the actions that we were starting to consider in our work. Joining and contributing to the RDA-ETHRD-IG, as with Terms4FAIRskills described above, provides a positive example of where the WP6 team is working

[17] https://github.com/terms4fairskills/FAIRterminology

[18] The exact figure fluctuates as the terminology is edited and refined.

[19] https://casrai.org/rdm-glossary/

[20] https://www.rd-alliance.org/groups/education-and-training-handling-research-data.html

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collaboratively on synergetic initiatives, enabling greater insight into the topic than could be achieved otherwise.

The work of the RDA-ETHRD-IG is a significant step in addressing the issue of fragmentation in the adoption of metadata standards for Open Educational Resources (OER) by the communities providing training in research data management. A minimal list of terms is being narrowed down from a long-list of those used by existing catalogue services to describe training resources according to published OER standards (currently LRMI/DCMI, IEEE LOM, and the bioschemas training materials profile), regardless of subject area or domain. The approach being undertaken is to identify the terms required to fulfil a shortlist of user stories. The user stories address different perspectives and contexts that need to be considered to make materials FAIR.

The three main user categories can be briefly summarised as:

- Learners - who are end users of training materials mainly looking for materials for their own use and training needs.
- Trainers - who may be creators of materials but also re-users of materials acting in an intermediary role providing training.
- Training Providers - who provide services such as catalogues or training materials and are making these materials available for wider discoverability and use.

Different user groups are not mutually exclusive and may of course overlap in their needs. In parallel to the minimal metadata the group is also considering the extended metadata which more fully describes a resource in order that it may be reused.

2.4.2 Interoperability: training resource catalogues

As highlighted in the EOSC report (EOSC Executive Board, 2020), a key point is that there is fragmentation in training resource provision and the quality and FAIRness of training and learning resources. Metadata associated with learning resources is available in many formats. Interoperability in spite of diverse standards being used is therefore an acute problem when dealing with metadata about learning resources. That remains a challenge in a fragmentation landscape of training initiatives. More details about research in this field can be found in M. Nilsson's work "From Interoperability to Harmonization in Metadata Standardization (Nilsson, M. (2010)).

FAIRsFAIR is continuing to work towards a consensus on how to share metadata about training resources, at least on a pilot basis, with the other EOSC projects that are setting up catalogues. In that optic, FAIRsFAIR organised a workshop in October 2020 to identify current approaches of its direct stakeholders, the EOSC disciplinary clusters and EOSC-5 projects. The main goals were to:

- Understand how projects that are aiming to offer publicly accessible training resource catalogues intend to make the metadata harvestable and FAIR, using what standards and harvesting/ publishing mechanisms, and what policies for selecting, curating and updating their metadata;

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- Aim to find agreement on practical collaborative steps towards interoperability between catalogues, to make training resources FAIRer for our target groups and stakeholders.

Jointly organised with the EOSC-5-TF Training & Skills, the agenda focused on the current and planned approaches the projects were planning.

2.4.2.1 Summary of approaches:

Whilst training is a component in all the EOSC-5 Projects and for the EOSC disciplinary clusters there are a range of approaches to the provision of training resources and materials. Approaches split into three main approaches: training catalogues of curated metadata, training registries and training platforms. Some projects are developing both training catalogues and training platforms.

In the workshop we heard the approach of three projects that are developing training catalogues, that provide curated metadata of training resources via training resource catalogues (ENVRI-FAIR, SSHOC, ESOC-Pillar), one initiative that is a training registry providing metadata for training resources (EOSC Life/ELIXR TeSS) and the approach to a training library from EOSC-Nordic.

ENVRI-FAIR training catalogue (https://trainingcatalogue.envri.eu/), has been populated with an initial list of training resources and materials related to FAIR data principles and materials related to research data management. The initial list of circa 40 resources is being added to as new training materials are available. The materials are manually curated and a customized profile of IEEE LOM has been developed and applied. The profile consists of 27 metadata elements.

SSHOC Training Discovery Toolkit (https://training-toolkit.sshopencloud.eu/), focus is on a collection of material to support SSH trainers, with a focus on train-the trainer materials, and generic topics such as Open Science and research data management. The catalogue is manually curated and they are currently looking at how to align metadata with other initiatives e.g. the work of the RDA-ETHRD-IG.

ESCO-Pillar (https://eosc-pillar.d4science.org/web/eoscpillartrainingandsupport/catalogue) focus is on resources for data stewardship and research data management support. They have looked for existing metadata schemas and vocabularies that are used in similar or related projects (including the work of FAIRsFAIR Initial Core Competence Structure).

The EOSC-Pillar catalogue is one component in the EOSC-Pillar training and support offering and is part of a larger virtual research environment. The catalogue has many manifestations including a catalogue for guest users via the web and a catalogue for curator and known users (via the virtual research environment).

The **ELIXIR Training Portal Tess** (https://tess.elixir-europe.org/) is a registry that aggregates and disseminates training events and materials. It is a well-recognised approach to a catalogue and sharing of training events and materials and is the most established of the training catalogues. It pulls training event information from 23 countries involved in ELIXIR as well as from training providers outside ELIXIR (currently there are 45 content providers for training materials). There are currently

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circa 1485 training materials in the registry. The metadata is automatically scraped as it would be impossible to fulfil the functions through manual curation given the range of providers and geographic coverage that TeSS collects materials from. TeSS uses bioschemas (https://bioschemas.org) which exploits the schema.org metadata model for marking up resources and training materials can be annotated using the Bio-schemas TrainingMaterial profile. TeSS is a partner in terms4FAIRskills initiative.

ESOC-Nordic are developing a knowledge hub (https://www.eosc-nordic.eu/knowledge-hub/) as a virtual centre for competence sharing as part of this they have a dedicated training section with a training library (https://www.eosc-nordic.eu/knowledge-hub/training-library/) bringing together different forms of materials including webinars, videos, presentations and articles. Items in the training library are tagged by media type, stakeholders and with keywords. At the time of writing the materials in the training library are all produced from within the project. The wider collection of materials in the knowledge hub includes reports, guidelines and recommendations developed by the project.

EOSC-Synergy, Ni4OS (https://training.ni4os.eu/) and PaNOSC (https://pan-learning.org) are not developing training resource catalogues but are developing e-learning platforms based on Moodle (https://moodle.org) open-source software. The ExPaNDs project are working in close collaboration with PaNOSC and will be contributing materials to the pan-learning learning platform and are additionally starting to develop a training resources catalogue.

These approaches are described according to five main steps discussed at the workshop. Namely:

1. create and assemble

Produce training resources for client, target group, their curriculum, organisational requirements, professional development needs etc, drawing on source materials and services.

2. deliver and make accessible

Provide a learning experience for the target group using the training resource by coordinating its provision using relevant human and technical infrastructure, e.g. trainers, training communities of practice, and computational or networking resources.

3. deposit and identify

Submit training content and context description (e.g. course details, training notes) to a repository that provides a persistent identifier and minimal metadata to enable resource discovery and citation.

4. classify and expose metadata

Add metadata that is sufficiently descriptive of the training resource to enable its reuse, using terms from open standards recognised in the education and training community.

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5. curate according to harmonised policies e.g. classification, quality, certification.

The discussions that took place have led to a series of proposed steps towards harmonizing metadata on training resources. FAIRsFAIR is currently discussing with partner projects from the disciplinary and thematic communities a pilot involving the following activities. These aim to provide successor projects with a sustainable resource, consisting of metadata describing a test bed of training materials, plus recommendations and lessons learned from exchanging this metadata between at least two existing catalogues.

FAIRsFAIR is proposing to facilitate agreement towards a harmonised approach, in a follow-up workshop scheduled for April 2021, and through discussion with other groups including the RDA ETHRD Interest Group, EOSC-5-Task Force on Training & Skills, and OpenAIRE Community of Practice for training coordinators. Our envisaged next steps are informed by a consultant's report, Harmonizing Metadata for Exchange of FAIR Training Materials,[21] and are as follows:

1. Establish a collection of training resources in the Zenodo repository, as described above (section 2.3). This will comprise FAIRsFAIR trainings plus invited contributions from the main disciplinary groups and cross-domain communities of practice represented by the INFRAEOSC projects (and including at least one domain under-represented in these projects, such as Engineering). *This will be led by FAIRsFAIR, with contributions sought through the the EOSC-5 Task Force on Training & Skills.*
2. Collaborate with the RDA ETHRD-IG sub-group to establish a minimal set of terms for training resources, representing a super-set of relevant standards from the Open Educational resource community (as described above in section 2.4.1); and collaborate with the terms4FAIRskills initiative towards its first release. *In both cases this will be through ongoing in-kind contributions to these groups.*
3. Further collaborate with the above stakeholder to establish a minimal metadata application profile, including semantic mappings of the terms encoded in RDF. This application profile should be based on a broad vocabulary such as schema.org or Dublin Core Metadata Terms, as these are used directly by several specialized schemas in use (e.g. schema.org by BioSchemas, Dublin Core by DCAT). *Led by FAIRsFAIR and the EOSC-5-TF Training & Skills, potentially in collaboration with the RDA-ETHRD IG (to be confirmed)*
4. Establish a RDF data store for metadata described according to this profile, and provided by partners, that performs semantic search and provides a user interface or API for data ingest. *Led by FAIRsFAIR, potentially in collaboration with the RDA-ETHRD IG and the EOSC Futures project (both to be confirmed).*
5. Using this RDF data store, enrich the metadata stored in Zenodo with the minimal terms (which will overlap with generic metadata held by Zenodo), applying terms4FAIRskills to describe the competences addressed in each set of materials. *Led by FAIRsFAIR in collaboration with terms4FAIRskills.*

[21] Barker, Phil, & Whyte, Angus. (2020, December 21). Harmonizing Metadata for Exchange of FAIR Training Materials (Version 1.1). Zenodo. http://doi.org/10.5281/zenodo.4434615

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6. Retrieve the relevant metadata from the RDS data store and import this into catalogues in accordance with their selection and curation policies. *Led by FAIRsFAIR in collaboration with EOSC-5-TF, partnering catalogue providers and/or EOSC Futures*
7. Report on the technical and organisational challenges we find in mapping between metadata standards used by participating catalogues, and between their approaches to resource selection, quality assessment, aggregation and curation. The report will propose how these may be addressed in successor projects or EOSC groups. *Led by FAIRsFAIR in collaboration with EOSC-5-TF, partnering catalogue providers and/or EOSC Futures*

Most of these steps depend on further consensus and contributions of effort by others. These are outside of FAIRsFAIR control and, as such, there is some risk that they will not be achievable in the project timeframe.

As a fallback, and as a useful exercise in its own right, FAIRsFAIR would in Step 2 build the testbed from materials accessible from currently available catalogues. In Step 3 we would create new descriptions of the resources based on a selection of the RDA-ETHRD-IG terms, crosswalking between at least two standards used by the source catalogues. In Steps 6 and 7 we would define a crosswalk between standards used by two catalogues and apply it to the metadata testbed.

3 Conclusions

In the present report, we elaborated on the operations of the Competence Centre which structure and objectives have been outlined in the previous deliverables D6.1, D6.2. The development, testing and usage of the FAIRData forum has focused a substantial amount of work thus reflecting the importance this online platform has played in the implementation of the Competence Centre's roles.

Based on the constructive first indications from the FAIRData forum users on how they envisage the forum features to better serve its purpose, and the assessment of the forum website usage by the communities during the training events as presented in this report, there is a scope for further growth in the course of the project's third year. Building upon the current dissemination work, in the next steps we need to grow the user base of the FAIRData Forum (and by default the FAIR Competence Centre) beyond the initial pilot community of users, via promotion to encourage communities to join and actively participate in discussion.

Additionally, delving into the synergies identified by FAIRsFAIR WP6 and working in a number of collaborations with EOSC-projects, the EOSC Board Working Group on Training and Skills, the Terms4FAIRSkills initiative, and organisations such as RDA and CODATA, the report presented the continuing work undertaken on how to share metadata on training materials, their description and annotation, and the characterisation of their repositories.

A key element of the case for a harmonised approach to cataloguing training materials, based on a minimal metadata application profile, is to enable federated approaches to cataloguing and discovery. We anticipate that the EOSC Portal will offer a common access point for search and discovery, underpinned by a machine-actionable layer of metadata that is aggregated from the providers of the resources. These providers are best placed to create and deliver the training

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materials, and have shared interest in pooling the curation and management of information about them, to better support discovery and reuse.

An emphasis in this report has been put on the steps required for harmonisation and making training materials that are sourced from a variety of communities FAIR, rather than on the content of those materials. We are aware that not all communities (whether disciplinary or thematic) already have support or training materials relating to FAIR that are designed to fit their needs, and this remains to be addressed in FAIRsFAIR (e.g. by other WPs). However, it is also important to ensure that communities of all kinds have low barriers to entry, both as providers of their own training materials and as reusers of materials shared by others.

We will look at the sustainability of the Competence Centre and possible long term solutions for where it can add value and role in the EOSC landscape. Sustainability is reliant on uptake by the community and a demonstrable need. However, from previous works (D6.1, D.6.2) and the on-going efforts reported here in D6.3, the synergies identified by WP6 are revealing the pertinence of the FAIR Competence Centre in the current landscape. The final phase of the project will shed more light on the question of its sustainability.

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