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D6.1 OVERVIEW OF NEEDS FOR COMPETENCE CENTRES

Work Package	WP6, FAIR Competence Centre
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Dissemination Level

X	PU: Public
	PP: Restricted to other programme participants (including the Commission)
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Abstract

This report provides an analysis of the landscape of available competence centres with a focus on gaps in disciplines and features. In addition, we will present the expectations of the FAIRsFAIR project for the project's Competence Centre and needs raised by the community in surveys, interviews and workshops. Based on these results, we provide recommendations on advisory services, harmonisation and dissemination of outputs that the FAIRsFAIR Competence Centre could offer which will be the foundation for any future work carried out in work package WP6.

Versioning and contribution history

Version	Date	Authors and contributors	Notes
0.1	24.09.2019	Patricia Herterich (DCC)	ToC with draft notes
0.2	01.10.2019	Joy Davidson, Patricia Herterich, Angus Whyte (DCC)	Extended draft
0.3	09.10.2019	Joy Davidson, Patricia Herterich (DCC)	Draft further extended with survey results
0.4	04.11.2019	Laura Molloy (CODATA), Angus Whyte, Joy Davidson, Patricia Herterich (DCC), Brian Matthews, Gabin Kayumbi Kabeya (STFC)	Version for project review
0.5	17.11.2019	Ari Asmi (University of Helsinki), Yuri Demchenko (University of Amsterdam)	Project internal review of version 0.4
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1.0		Gerard Coen, Mustapha Mokrane (DANS)	Final edit and publishing

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Abbreviations and Acronyms

FAIR	Findable, Accessible, Interoperable, Reusable
EOSC	European Open Science Cloud
ESFRI	European Strategy Forum on Research Infrastructures
DARIAH	Digital Research Infrastructure for the Arts and Humanities
CESSDA	Consortium of European Social Science Data Archive
HEIs	Higher Education Institutions
ERIC	European Research Infrastructure Consortium
CODATA	Committee on Data of the International Science Council
PRACE	Partnership for Advanced Computing in Europe
OWCRI	Other world class Research Infrastructure
ARCD	Australian Research Data Commons
ENVRI-FAIR	ENVironmental Research Infrastructures building Fair services Accessible for society, Innovation and Research
ESCAPE	European Science Cluster of Astronomy & Particle physics ESFRI research infrastructures
PANOSC	Photon and Neutron Open Science Cloud
SSHOC	Social Sciences & Humanities Open Cloud
RDA	Research Data Alliance
DOI	Digital Object Identifier
GDPR	General Data Protection Regulation
CLARIN	Common Language Resources and Technology Infrastructure
RDM	Research data management

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Executive Summary

The overall objective of FAIRsFAIR is to accelerate the realization 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 single FAIR Data Stewardship Competence Centre which this report defines as a shared hub of expertise in implementing FAIR data stewardship principles, offering leadership, coordination and cataloguing services to connect relevant people, guidance, learning resources and curricula in different thematic areas.

Requirements for competence centres in general and a core competence centre for FAIR data stewardship in particular were identified by interviewing other members of the FAIRsFAIR project to understand their expectations for a core competence centre as well as the resources they will contribute to the knowledge base. Furthermore, we carried out a broad characterisation of current competence centres enriched with case studies of good examples for certain aspects of a competence centre. We created user stories for how stakeholders might interact with the competence centres and refined them through an open consultation answered by 106 people, interviews with EOSC clusters, and feedback gathered in workshops at the Open Science Fair 2019.

Based on the description of work and our research, we have identified the following priorities for competence centres in general and the FAIRsFAIR core Competence Centre in particular:

Advisory

- Create a catalogue of resources to support FAIR data stewardship
- Provide a help desk to support FAIR data stewardship
- Provide a networking tool to support FAIR data stewardship

Harmonisation

- Apply emerging standards to describe learning resources in FAIR data stewardship
- Encourage economy of scale through deploying the same tools and certifying services addressing FAIR data needs

Dissemination

- Develop training and guidance materials on FAIR data stewardship topics currently not covered
- Develop curation policies for the content aggregated and developed by the FAIRsFAIR Data Stewardship Competence Centre
- Deliver training on core competencies for FAIR data stewardship

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1. Introduction

The overall objective of FAIRsFAIR is to accelerate the realization of the goals of the EOSC by opening up and sharing all knowledge, expertise, guidelines, implementations, new trajectories, courses and education on FAIR matters. It seeks to establish a level playing field for all European member states (and beyond) when it comes to contributing data to scientific and scholarly communities and to re-using data from scientists and scholars elsewhere. All this is made possible by the coordinated effort of twenty-two partners spanning eight member states that are working together to define guidelines towards a FAIR approach to data and service management for data repositories across disciplines.

To support the emergence of a FAIR data culture, FAIRsFAIR aims to interact with a broad range of research communities to bring together best practice from a range of domains and establish a virtual Competence Centre providing access to advice, training and services.

No well-established definition of Competence Centre is found in literature. The European Network of Innovation Agencies states that "Competence Centres (CC) can be defined as structured, long-term research and innovation (R&I) collaborations in strategically important areas between academia and industry/public sector. They focus on strategic research agendas, support strong interactions between science and industry and provide truly collaborative research with a medium to long-term perspective."[1]

Within the context of Open Science, the EU Science hub defines competence centres as being "centred on analytical tools which can be applied to any policy area, bringing together in one place extensive expertise in this field. They offer training courses in the use of the tools for policy-making, advise on the choice of tools and also work directly with the Commission policy Directorates-General to apply the tools to the policy problems in hand".[2]

The EOSC-hub consortium also created eight competence centres as part of its research infrastructures to support users working with data. The project does not define competence centres, but they all share the objective "to co-design and co-develop services for these communities by mobilising generic services from the so called 'EOSC-hub common services' portfolio." (Sipos 2019)

Based on the commonalities across definitions, for the FAIR context we offer the following definition of a FAIR Competence Centre:

> *"FAIR Data Stewardship Competence Centre: A shared hub of expertise in implementing FAIR data stewardship principles, offering leadership, coordination and cataloguing services to connect relevant people, guidance, learning resources and curricula"*

1 Taftie. The European Network of Innovation Agencies (2016). Future Competence Centre Programmes. Report of the TAFTIE Task Force on Competence Centre Programmes CompAct. Available at https://www.taftie.org/sites/default/files/Taftie_TF_CompAct_Final_Report%20_LV.pdf

2 https://ec.europa.eu/jrc/en/knowledge

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In building its Competences Centre, FAIRsFAIR is adopting a mix of bottom-up and top-down approaches. The former is based on an assessment of research community requirements as expressed in the open consultation. The latter entails mechanisms that facilitate connections between stakeholders. The Competence Centre will therefore be an essential focal point of expertise that provides access to advisory services, promotes harmonisation and coordination across a variety of stakeholders, and disseminates training resources, opportunities and other useful resources. It will additionally direct requests from the community with sources of relevant expertise.

FAIRsFAIR is just one of many projects and initiatives currently working to foster a FAIR data culture (other examples include GO FAIR, OpenAIRE, etc.). FAIRsFAIR will not duplicate already existing efforts but will instead focus on identifying how best to make existing competence centres and their services and resources visible and enrich them to address additional competences needed to make data FAIR where suitable. FAIRsFAIR will prioritise the development of resources for communities currently lacking access to discipline-specific or generic support.

2. Scope and methodology

2.1 Approach

Given the very broad range of activities that a competence centre might carry out, the initial landscaping activity sought to:

- identify current competence centres and sources of generic and discipline specific expertise with regard to supporting FAIR data practices
- identify any gaps where particular disciplines do not currently have access to advisory services or training resources
- identify priority areas where the community feels more training and guidance resources are needed
- understand the community's expectations for a FAIRsFAIR Competence Centre and its offers.

Building upon the findings of the desk-based research, open consultation, interviews and workshops, this assessment has drawn upon the findings of the related FAIRsFAIR landscaping activities that were carried out in parallel.[3]

3 The results from the other work packages will be made available in the following project deliverables:
- D2.1 Report on FAIR requirements for persistence and interoperability
- D3.1 FAIR policy analysis
- D3.2 FAIR data practice analysis
- D7.1 Report: FAIR Mapping analysis in European Higher Education

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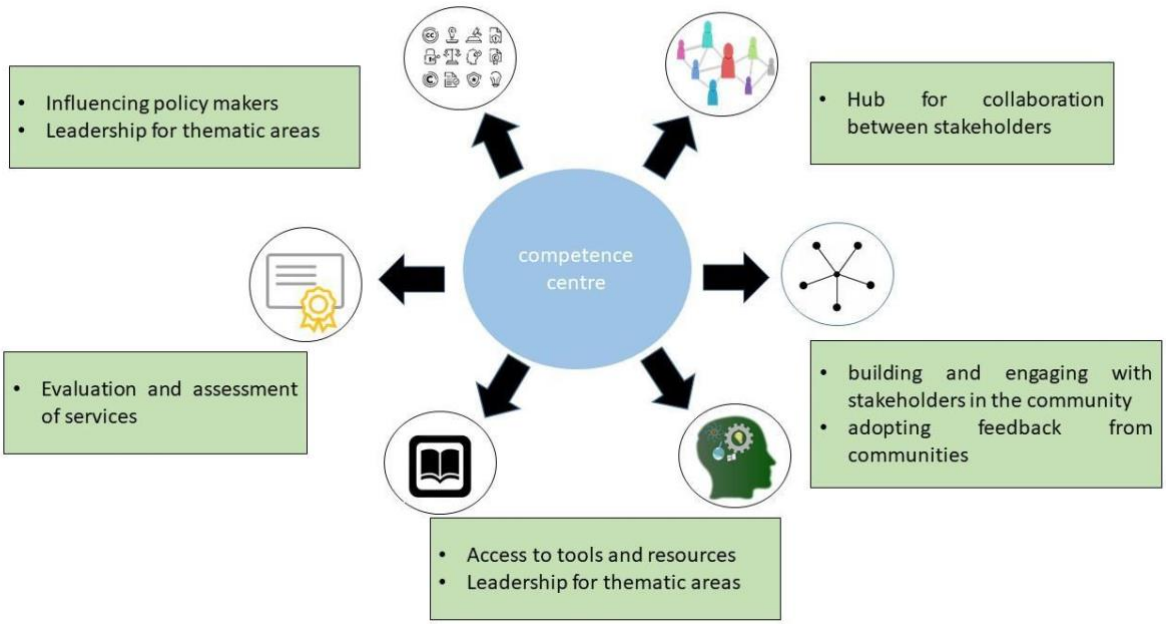

Figure 1: Summary of competence centres features

As part of our analysis we drew from work carried out by the Digital Preservation Europe Project (Lunghi et al. 2007) to define a set of features that a competency centres might provide (Fig. 1). These include:

- providing access to tools and resources
- providing leadership for a given thematic area
- building and engaging with other stakeholders in the community and adopting feedback
- providing clear communication with regard to the expertise represented by the centre, and making clear what the centre offers
- influencing policy makers (which the EU Science hub definition addresses through direct work with the Commission)
- carrying out regular evaluations of the centre's services and assessing its position within the community.
- creating an environment where stakeholders can come together in a non-competitive manner to develop new relationships and to learn from one another in an effective way.

2.2 Selected competence centres

The range of organisations and initiatives analysed was kept purposefully wide. We looked at 36 initiatives covering the following broad categories:

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- Competence Centres established through the EOSC-hub project: https://www.eosc-hub.eu/research-communities,
- Research Infrastructure Clusters (projects funded by the EC through its INFRAEOSC-04-2018 call),[4]
- selected individual Research Infrastructures, from those funded by the EC in the ESFRI roadmap, and others the EC refers to as "other World Class Research Infrastructures of pan-European interest' (OWCRIs),
- EOSC-related projects and community initiatives (E.g., FAIR Plus, OpenAIRE),
- national-level services,
- institutional level services.

2.3 Characterisation criteria

When characterising the initiatives selected, we looked at the following aspects:

- type of initiative offering the tools and/or services following the categories laid out above in 2.2,
- domain that is targeted,
- type of end user targeted (researcher, research support staff, policy makers, etc.)
- what tools and services are provided or announced,
- how the initiative is resourced.

Details on the full characterisation are available in Annex II. High level results from the desk research are provided in sections 4 and 5.

2.4 Open Consultation

To understand what the community expects from a competence centre and where might gaps exist, FAIRsFAIR held an open consultation between 2 August and 27 September 2019. The small-scale survey targeted members of the research support community in Research Infrastructures and Institutions, via ESFRI cluster contacts and relevant email lists and FAIRsFAIR's communication channels, aiming to consult respondents on their views and experiences in relation to implementing the FAIR principles. The open consultation questions were grouped under five broad themes: 1) practice 2) policy 3) repositories 4) skills and 5) competence centres.

This report will discuss the answers to four closed questions focusing on competencies and skills with options to add free text comments. The open consultation aimed to collect suggestions from the community on where training and guidance materials should be hosted to be most effective in supporting EOSC and reaching their target audience. Results will be

4 https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/infraeosc-04-2018

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discussed in section 7 of this report, the relevant open consultation questions are included in Annex I in full detail.

2.5 Interviews

In conjunction with the landscape analysis carried out in work package WP3 on policy and practice, we interviewed representatives of the EOSC Research Infrastructure Clusters to better understand the support requirements of the relevant domains with regards to FAIR data practices and their current sources of discipline specific tools, advice and guidance. The interviews with the Clusters provided insights into what the Research Infrastructures currently offer that could be promoted through the Competence Centre, and how FAIRsFAIR might contribute where support is currently lacking. These interviews are summarized in section 7.

2.6 Workshop at the Open Science FAIR 2019

The FAIRsFAIR project organised a workshop called "Making EOSC Training more FAIR"[5] at the Open Science FAIR 2019 in Porto, Portugal (16-18 September 2019). One part of the workshop was dedicated to discussing 'must have' functions of an EOSC Competence Centre, how these might be delivered, and how current practices need to change to help deliver an EOSC Competence Centre.

In addition, FAIRsFAIR coordinated a workshop called "Fostering a FAIR research culture: what works?"[6] during which the participants were polled to provide insights into what would be the 'must have' functions of an EOSC Competence Centre and how we might work together to deliver these functions.

Results from the workshop discussions are presented in section 7.

2.7 Input from other FAIRsFAIR work packages

To better understand the nature of planned FAIRsFAIR outputs and the potential requirements in relation to the FAIR Competence Centre, we interviewed work package leads. Expectations for the FAIRsFAIR Competence Centre by the project are summarized in section 3.

3. FAIRsFAIR's contribution to a Competence Centre for data stewardship

5 https://www.opensciencefair.eu/workshops-2019/making-eosc-training-more-fair

6 https://www.opensciencefair.eu/workshops-2019/fostering-a-fair-research-culture-what-works

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FAIRsFAIR will create tools and resources that should be included in the Competence Centre. This section provides an overview of the outputs that will be created in FAIRsFAIR work packages that are relevant to the FAIR Competence Centre as well as gaining insights into how the Competence Centre can improve the usability of project outputs by facilitating two-way communication between FAIRsFAIR and testing by the wider community.

3.1 WP2 - FAIR Practices: Semantics, Interoperability, and Services

Work package WP2 focuses on assessing technical aspects and standards that will enable semantic interoperability. WP2 will create recommendations on standards and the use of persistent identifiers to facilitate interoperability as well as developing case studies and guidelines to support implementation. The example implementations created by the project will also enhance reusability of linked data terminologies and ontologies and should provide a catalogue of tools that can be used to enhance interoperability of a variety of outputs.

WP2 will make these outputs available through the FAIRsFAIR Competence Centre and allow for any users to provide feedback on the material provided. It should also ensure that the material is of high quality and make selection criteria transparent. Furthermore, the Competence Centre should help end uses find experts or expert institutions that can provide advice beyond what is available through the Competence Centre.

3.2 WP3 - FAIR Policy and Practice

FAIRsFAIR work package WP3 aims to produce practical recommendations to support policy enhancements and to support different communities of practice to produce and use FAIR data. To this end, the FAIRsFAIR Competence Centre should be able to expose machine readable policies to APIs in support of automation- for example for use by machine actionable data management plans (DMPs). In addition, the Competence Centre should support the aggregation of external and FAIRsFAIR generic and domain specific guidance, tools and resources and make these easy to find for end users including researchers, data stewards and repository staff. Task 3.3, on embedding FAIR data practice in research culture, will produce case studies and guidance material that should be annotated and made available through the Competence Centre, along with others aggregated from resource collections curated elsewhere, including other competence centres. WP3 will also develop metadata crosswalks which will need to be made visible and usable by the Competence Centre.

3.3 WP4 - FAIR Certification

FAIRsFAIR work package WP4 supports the certification of trustworthy repositories and will establish a European network of trustworthy repositories enabling FAIR data. This network will require that the Competence Centre facilitates two-way communication between FAIRsFAIR and the repository community. In addition, the work package will create FAIR certification training materials, a tool to identify relevant trustworthy certified repositories as well as tools and guidelines to support the assessment of FAIR data held in trustworthy repositories.

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All these outputs should be made available through the Competence Centre which should support user testing and a means of collecting feedback from the community. A core function of the Competence Centre should be providing access to experts. This could be facilitated through a forum, knowledge centre or a help desk where stakeholders can submit queries. The pool of experts providing advice should not only be drawn from members of the FAIRsFAIR consortium but rather from the wider network of FAIR expertise that exists among the many related initiatives across Europe.

3.4 WP5 - Engagement, Communication and Uptake

Work package WP5 provide stakeholder engagement and coordination, as well as supporting communication channels. The Competence Centre should as much as feasible provide support to as wide a range of stakeholders, both in domains and in roles, with the support of WP5 to interact with those stakeholders. The Centre should also encourage interaction by stakeholders with the material provided, contributing as well as receiving. The Competence Centre platform should be made available via the common FAIRsFAIR website platform and form a hub for providing advice to stakeholders.

3.5 WP6 - FAIR Competence Centre (Training)

FAIRsFAIR WP6 is developing and supporting the competence centre within FAIRsFAIR Also as part of its programme of work it is has the role of developing and delivering training material suitable for research practitioners and data stewards. There should be close synergy between these two aspects of the work package. The Competence Centre platform should include a conduit for making online training modules available, both provided by the project and from partner projects. And the training material delivered in WP should reflect the material which is collected within the competence centre. Ideally, the centre should be so arranged that user seeking training could select and organise training modules through the centre suitable to their needs, to form a bespoke training package. This will be supported by using the terminology of the terms4FAIRskills initiative, as below.

FAIRsFAIR WP6 is supporting the terms4FAIRskills initiative, which is developing a terminology for FAIR data stewardship competences. A key use case for this terminology is to facilitate the annotation, discovery and evaluation of FAIR-enabling materials (e.g. training) and resources, such as those to be made discoverable through the Competence Centre. There is current interest and/or participation in this initiative from several other EOSC projects, including EOSC-life, ENVRI-FAIR[7], and SSHOC, and from the ELIXIR network. The Competence Centre should therefore enable users to retrieve learning resources from different disciplinary sources that are about similar FAIR data activities and meet similar learning objectives.

3.6 WP7 - FAIR Data Science and Professionalisation

7 http://envri.eu/envri-fair/

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FAIRsFAIR WP7 will look at FAIR data science and professionalisation of roles to support FAIR data creation. To do so, the work package will develop a competence framework to support education and development of dedicated roles to support FAIR that will be made available through the Competence Centre. In addition, the work package will create a snapshot of FAIR courses provided across Europe that will be a resource in the Competence Centre. To complement the current landscape, the work package will create model courses and curricula enriched with training documents and resources to train researchers as data stewards.

To enhance the research carried out by work package WP7, the Competence Centre should focus on supporting communities that do not currently have access to support. The FAIRsFAIR Competence Centre should also go beyond the big research communities and their infrastructures to focus on the long tail of scientific research. The support offered by the Competence Centre should be tiered to provide help at several levels to a wide range of stakeholders - researchers, but also data stewards and data services support staff.

4. Characterisation of current competence centres

Following our analysis of 36 organisations and initiatives, current competence centres can be categorized into seven major groups:

- Research Infrastructure initiatives
- catalogues of resources
- funded projects
- networks
- national infrastructures
- individual institutions
- commercial providers.

About a third of the competence centres analysed are associated with **EOSC-hub projects or are ESFRI Research Infrastructures**. They serve researchers and data stewards in their specific disciplinary communities with a range of tools, training and discipline specific standards. ESFRI landmarks such as DARIAH, CESSDA and ELIXIR are mature and well-established networks of expertise in their disciplines. They already provide trusted support to members of their communities and are a natural first point of contact for researchers seeking to better understand how to make their outputs FAIR and to find domain specific guidance on using services that support FAIR research practice.

Some of the competence centres are comprehensive **catalogues of resources** developed and maintained by the community and often point to training materials, resources or other useful guidance. They are either aimed at researchers directly or at data stewards or curators looking for materials they can reuse and adapt for their own training offers. These competence centres tend to vary in their sources of funding, some are grassroot initiatives, others have been supported through project funding. A key risk associated with these resources is their

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longer-term availability as it is unclear how the access to the resources will be sustained once the funding has ceased and how updates will be supported.

About a third of the initiatives looked at are **collaborative projects** usually funded by a research funder for a certain period of time. These projects create material or provide expertise tailored to dedicated stakeholders (target audiences are most often researchers) but sustainability and responsibility for hosting the resources beyond the project lifetime are often unclear or are taken on by one of the project partners on a voluntary basis. This can be risky as the longer-term sustainability can often be linked to a single individual within an organisation (e.g., the project PI). One of the collaborative projects examined evolved to become a **dedicated network** - the Data Curation Network (DCN)[8] - where collaborating partners have committed to working on the project beyond the period of initial funding and are investigating a sustainable business model. The DCN targets data stewards and curators aiming to enhance their capacity to offer support to researchers in curating datasets deposited in repositories where disciplinary expertise is required. Curation of datasets should happen throughout the life cycle and is thus an increasingly important skill for FAIR data stewardship and thus, the network benefits partnering institutions through the development of their staff's professional skills.

Some national funders have financed organisations that are internationally acclaimed in their expertise and the wide range of services they provide. **National level services** are for example available in Australia, the UK (e.g. the UK Data Service focused on social science data, or the NERC data centres focused on environmental sciences), and the Netherlands (through Data Archiving Network Services (DANS)). In addition, some national funders have established shared services that address specific needs such as management of sensitive data, e.g. Norway and the UK. Although these services are nationally targeted and usage is usually restricted to users affiliated with the country, their host institutions are often involved in international collaborations on a variety of topics to ensure they maintain their role as a source of leadership in their fields.

Commercial providers also provide many elements of competence centre services directly to researchers and data stewards. Many commercial providers aim to provide services that are free at the point of use and accordingly many have developed business models where chargeable infrastructure services are paid at the institution level (examples are Figshare[9] or Mendeley Data[10]). In some cases (e.g., DMPonline FAIRDOM[11]) the institution is able to combine generic services with local training and institutionally specific guidance to contextualise the resources for the local end users. Some publishers (e.g. Springer Nature) are now working to establish competence centres on FAIR data that are tied in with their publishing services. This approach might be attractive to researchers that need help at a

8 https://datacurationnetwork.org/
9 https://figshare.com/
10 https://data.mendeley.com/
11 https://fair-dom.org/

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specific stage of their research life cycle however there are risks with competence centres being too tightly coupled with other commercial services.

5. Characterising practical examples

This chapter looks in more detail at examples of good practice to identify approaches that the FAIRsFAIR Competence Centre may wish to emulate or adapt. This section has been structured around the five key service areas used to characterise current competence centres: training and catalogues of training resources, tools, guidance and advisory services, catalogues of tools, services or policies, and standards.

In addition to listing generalist and discipline specific examples of competence centres providing specific services under these three headings, we also identify gaps in the existing landscape that the FAIRsFAIR Competence Centre will seek to address. This is complemented by a FAIRsFAIR use case describing how the existing services and material might be incorporated into the FAIRsFAIR Competence Centre as well as an exemplar showcasing one of the services in more detail.

5.1 Training and catalogues of training resources

Overview	There are a range of initiatives offering catalogues of training resources or providing training material and events. They address a variety of stakeholders from researchers to data stewards or data curators that would use the resources in their own training.
Generic examples	DMT Clearing House, FOSTER, ARDC, Data Curation Network (working on disciplinary support), LIBER, Research Data Netherlands
Disciplinary examples	PARTHENOS (humanities), GOBLET (bioinformatics), PRACE (computing), ELIXIR TeSS (life sciences), CESSDA (social sciences)
Gaps	Generic examples are mainly aimed at data stewards or data curators, researchers are covered by disciplinary services that are not available for all disciplines. For most resources provided, it is unclear how they are curated, that is for catalogues how often any information is updated, and which criteria are used to select material for inclusion. With best practice and tools developing constantly, updates to material to ensure quality control and gain trust from users can become crucial.
Emerging activities	ELIXIR TeSS provides the option to browse training material and also lists training events and allows users to create training workflows to visualise learning and training needs.

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FAIRsFAIR use case	The training material and catalogues should be reviewed by the FAIRsFAIR Competence Centre for inclusion. The Competence Centre should provide clear policies on how it will keep content up to date to ensure latest best practice is reflected. The FAIRsFAIR Competence Centre could also investigate providing a sustainable platform and host some of the content for the long term.
Exemplar	'TeSS is ELIXIR's training platform, providing a one-stop shop for trainers and trainees to discover online information and content, including training materials, events and interactive tutorials. For ELIXIR Nodes, TeSS provides opportunities to promote training events and news, and to contribute to a growing catalogue of materials; for trainers, the portal offers an environment for sharing materials and event information; for trainees, it offers a convenient gateway via which to identify relevant training events and resources, and to perform specific, guided analysis tasks via customised training workflows[12].' 'TeSS also provides a subscription feature to help users to stay informed about courses, workshops and conferences of interest to them. The service may be customised by selecting the relevant filters and initiated via the subscribe button. Users may choose to receive email notifications about upcoming events or have them automatically added to their preferred calendar application.'[13] 'TeSS is committed to the FAIR principles: making data findable, accessible, interoperable and re-usable. As such, all content in TeSS is available under the CC BY 4.0 licence, and can be accessed through our API and widgets. The TeSS codebase is also available to re-use under the BSD Licence, and can be found on GitHub.'[14] TeSS employs bioschemas.org, an extension of the schemas.org community standard for semantic tagging of web resources with metadata terms. Bioschemas includes terms for learning resources, and content providers to TeSS, e.g. ELIXIR nodes, use these in their sites to tag materials and events. TeSS then aggregates learning resources from the participating sites, providing a semi-automated approach to cataloguing those available for the bioscience community. The EOSCpilot project concluded that such an approach should be given further consideration in any EOSC catalogue of learning resources.

12 https://tess.elixir-europe.org/about
13 https://tess.elixir-europe.org/about#events
14 https://tess.elixir-europe.org/about/developers#api

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5.2 Tools

Overview	Tools to support FAIR data management and publishing are varied and range from tools supporting the collection of data (such as survey software) to infrastructure supporting the (secure) storage of data and tools to support the analysis of data such as access to cloud or high performance computing, electronic or computational notebooks and services to facilitate data sharing. They are all aimed at use by researchers but as some of these tools and services are quite expensive to provide, access might be restricted.
Generic examples	Norway TSD & Nettskjema (available to Norwegian research institutions only), DANS, EOSC Hub[15], EOSC Marketplace[16]
Disciplinary examples	DARIAH (humanities), CESSDA (social sciences), ELIXIR (life sciences)
Gaps	A significant number of tools need implementation as a service to be useful which cannot be provided by an individual, so institutions or infrastructure providers need to provide these. If there is no disciplinary or institutional service available, finding a generic - maybe even free to use - service is difficult.
Emerging activities	EOSC Hub Competence Centres for implementations of available tools for their communities. SSHOC Marketplace[17] listing tools, services, repositories and other resources created or used throughout the project.
FAIRsFAIR use case	The FAIRsFAIR Competence Centre could link to the disciplinary services listed in the EOSC Portal and provide for institutions that would like to offer services in the EOSC. In addition, a curated list to open source or otherwise available services for researchers that are not affiliated with an institution that provides them access might be useful.
Exemplar	Norway TSD – Service for Sensitive Data, is a platform for collecting, storing, analysing and sharing sensitive data in compliance with the Norwegian privacy regulation.[18] TSD is developed and operated by the University of Oslo and is a part of NorStore, the national infrastructure for handling and storage of scientific data.

15 https://www.eosc-hub.eu/services
16 https://marketplace.eosc-portal.eu/
17 https://www.sshopencloud.eu/marketplace
18 https://www.uio.no/english/services/it/research/sensitive-data/about/

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	The Norway TSD service can be integrated with Nettskjema, a tool for designing and managing data collection using online forms and surveys. The forms are available through most browsers and submitted data are transmitted fully encrypted to the TSD service. It can also provide access to high performance computing resources[19] and is integrated with tools to edit video and audio files as well as software to anonymize and analyse data where licences allow making those available to users.[20] The service is free to members of the University of Oslo and chargeable to other interested users.[21] High level descriptions of the technical set up are publicly available[22], details of the infrastructure cannot be published openly but are made available upon request in case someone wants to set up a similar service in line with privacy regulations in their country. The service set up is regularly reviewed by a so-called Council of Changes.

5.3 Guidance and advisory services

Overview	Guidance and advisory services are closely linked to training, however there are some organisations that provide standalone guidance to researchers as their primary users but also organisations that want to set up their own services.
Generic examples	DCC, DANS, forschungsdaten.info, Research Data Netherlands, Data Curation Network (cross- disciplinary support), OpenAIRE network of National Open Access Desks
Disciplinary examples	The Data Curation Network is providing disciplinary curation support for datasets deposited in repositories.
Gaps	There are no competence centres that explicitly advertise disciplinary advisory services across the full research data life cycle. Research Infrastructure services might cover this as part of the tailored training they offer or guidance they provide around tools and services provided.
Emerging activities	The Dutch National Coordination Point on research data management (RDM) has conducted a feasibility study on establishing a Data Curation Network for the Netherlands. (Slouwerhof et al. 2019)

19 https://www.uio.no/english/services/it/research/sensitive-data/use-tsd/hpc/index.html
20 https://www.uio.no/english/services/it/research/sensitive-data/use-tsd/software/
21 https://www.uio.no/english/services/it/research/sensitive-data/access/prices/index.html
22 https://www.uio.no/english/services/it/research/sensitive-data/about/tsd-risk-analysis-03-2017.pdf

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FAIRsFAIR use case	The FAIRsFAIR Competence Centre can highlight experts and organisations that provide guidance and advice beyond the material that is available through the Competence Centre.
Exemplar	The Data Curation Network (DCN) has been created in 2016 bringing together data librarians from six US universities to assess their local services and understand the benefits of a community-led network to curate research data The DCN provides the training, coordination, and technical infrastructure to seamlessly connect expert data curators across the network with all types of data sets for robust curation. (Johnston et al. 2018) The standard workflow carried out by a DCN curator consists of the following six steps: C - Check files and metadata U - Understand and run files R - Request missing information A - Augment metadata T - Transform file formats E - Evaluate for FAIRness In addition to curating datasets from the repositories that are part of the network and providing workshops to train new curators in person, the DCN creates resources to help other institutions to curate a variety of resources. Those data curation primers are shared openly on GitHub under CC-BY 4.0 licences[23]; checklists are shared on Google Drive under the same licence.[24] Initial efforts have been funded by the Alfred P. Sloan Foundation and this, outstanding challenges are finding ways to turn the DCN into a sustainable community effort. This is done by increasing the number of institutions that contribute resources and exploring a variety of financial models.

5.4 Catalogues of tools, services or policies

Overview	With a variety of tools and services developing, it is difficult for individuals to keep track of any new offers. Catalogues of tools, services and relevant policies are thus crucial sources for all stakeholders if they are updated regularly.

23 https://github.com/DataCurationNetwork/data-primers
24 https://datacurationnetwork.org/resources/resources-2/

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Generic examples	EOSC Hub, JISC RDM Toolkit, EOSCpilot policy toolkit
Disciplinary examples	PRACE (computing), LIBER (research libraries), FAIRsharing (originally focused on life sciences with aims for broader coverage), DARIAH (humanities)
Gaps	While a variety of initiatives provide useful catalogues of tools and policies, it is often unclear how these are updated and what the collection and curation policy behind the resource is.
Emerging activities	FAIRsFAIR work packages and their landscaping activities create new overviews of tools, policies and services.
FAIRsFAIR use case	Existing catalogues are really useful resources that the FAIRsFAIR Data Stewardship Competence Centre should link to or aggregate. Building on existing resources, the FAIRsFAIR Competence Centre should be transparent in how it aggregates resources and develop strategies for keeping its content up to date. The Competence Centre should make use of terminologies such as terms4FAIRskills to facilitate interoperability of the resources catalogued.
Exemplar	Fairsharing.org is a 'curated, informative and educational resource on data and metadata standards, inter-related to databases and data policies'. The service helps to 'guide consumers to discover, select and use these resources with confidence, and producers to make their resource more discoverable, more widely adopted and cited'[25]. They provide services to a broad range of stakeholders including researchers, developers and curators, publishers, librarians and trainers, funding bodies and societies and alliances. They currently hold 1326 standards, 1295 databases and 123 policies.[26] Any content within FAIRsharing is licensed via the Creative Commons Attribution ShareAlike license 4.0 (CC BY-SA 4.0). While its contents are currently mostly oriented to the life sciences, FAIRsharing is broadening its scope and aims to cross discipline-specific boundaries. In addition to cataloguing resources produced by others, RDA FAIRsharing WG produced a set of recommendations to guide the users and producers of standards, databases and repositories on how to best select and describe these resources; and to guide funders and publishers on how to recommend them in data policies.[27]

25 https://fairsharing.org/

26 Numbers as of 28.10.2019

27 https://www.rd-alliance.org/group/fairsharing-registry-connecting-data-policies-standards-databases-wg/outcomes/fairsharing

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	Using community participation, they curate information on standards employed for the identification, citation and reporting of data and metadata, via four standard subtypes: data policies, databases, standards and data collections. They also mint a DOI for each metadata record. (Sansone et al. 2019) In addition, they recommend that journals and publishers encourage authors to cite the standards, databases and repositories they use or develop by referring to the 'how to cite this record' statement, found on each FAIRsharing record, which includes a DOI. The recommendation also includes the notion that funders should recognize standards, databases and repositories as digital objects in their own right.[28] FAIRsFAIR and FAIRsharing are exploring ways to collaborate and avoid duplication of effort

5.5 Standards information

Overview	Providing and developing easy to use guidance and information about community standards is key to facilitate interoperability and wide adoption of good practice.
Generic examples	OpenAIRE, ARDC
Disciplinary examples	FAIRplus (life sciences), FAIRsharing (focus on life sciences with an expanding remit), Enabling FAIR Data (geosciences), CESSDA (social sciences), Goblet (bioinformatics), CLARIN (linguistics), DARIAH (humanities)
Gaps	Disciplines that currently do not have a dedicated competence centre providing guidance on the development and adoption of standards are physical sciences.
Emerging activities	FAIRsFAIR's work package WP2 will create additional guidance to facilitate interoperability of standards for describing research data and making them more FAIR.

28 The FAIRsharing Registry and Recommendations: Interlinking Standards, Databases and Data Policies https://rd-alliance.org/group/fairsharing-registry-connecting-data-policies-standards-databases-wg/outcomes/fairsharing

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FAIRsFAIR use case	The FAIRsFAIR Competence Centre should aggregate already existing standards and make them available alongside other resources. In addition, case studies and examples of applying these standards could be provided.
Exemplar	OpenAIRE is a socio-technical infrastructure for scholarly communication and Open Science. For over ten years it has been supporting Open Science at national levels via its network of experts from key national organisations (National Open Access Desks – NOADs) who support policy development for Open Science within the research realm. One of the major outputs from OpenAIRE are their interoperability guidelines for repository managers to expose publications, datasets and CRIS metadata via the OAI-PMH protocol in order to integrate with OpenAIRE infrastructure.[29] While the guidelines are not standards in themselves, they build on existing standards such as the DataCite metadata standard in the case of data archives[30] or CERIF for Current Research Information Systems and standardised OAI-PMH implementations. The guidelines can be commented on on GitHub[31] where they are hosted under a CC-BY licence. The OpenAIRE infrastructure is used by the European Commission and other funders for reporting on funded projects and their alignment with Open Access and Open Data policies which makes the guidelines de-facto standards. OpenAIRE provides several aggregator and dashboard services on top of the outputs they harvest from repositories which can be used by a variety of stakeholders.[32] In addition to these technical services, OpenAIRE also provides training resources for infrastructure providers as well as researchers themselves.

Based on our definition and the services characterized, hosting a data repository is not in itself a key feature of a competence centre. However, guidance on choosing the right repository or data centre to deposit and share data, as well as guidance on how to use those data centres is a common feature of a competence centre.

6. User stories for a FAIRsFAIR Competence Centre

29 https://guidelines.openaire.eu/en/latest/index.html#
30 https://guidelines.openaire.eu/en/latest/data/index.html
31 https://github.com/openaire/guidelines
32 The full OpenAIRE service catalogue is available at http://catalogue.openaire.eu/search

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The Turning FAIR into Reality report (European Commission Expert Group on FAIR Data 2018) has identified eight stakeholder groups that we expect to interact with the Competence Centre. Below are some user stories illustrating how these interactions could play out.

Research communities
As an academic researcher and member of my research community I want to find helpful resources to make my research data FAIR. in order to share my data in the most effective way and comply with my funder's research data policy.
As a researcher in industry I want to easily find FAIR tools and data in order to use them in my research.

*As a **data steward** I want to find up to date and detailed resources in order to support my colleagues in making their research data and other outputs FAIR.*
*As a **data service provider** I want to get an overview of any features and standards I need to add to my service in order to facilitate making outputs FAIR and become a trusted service provider to my community, through the EOSC*

*As a **publisher** I want to understand latest practices and recommendations on making data FAIR in order to align my services and author guidelines and support a FAIR publishing ecosystem.*

*As a **policy maker** I want to get an overview of FAIR data policies that other funders have put out as well as tools and training available to researchers in order to comply with policies requiring research outputs to be FAIR.*

*As **coordination forum** I want to see which resources are available and ensure my outputs to be available through the Competence Centre in order to understand where there are gaps in services and guidance and make sure efforts are used in the best possible way.*

*As **research funder** I want to see funded research outputs exposed in the best possible way in order to achieve value for funding money.*

*As **institution** I want to understand the service landscape and best practice applied by others and find resources to support my researchers and services in order to create robust FAIR data and promote best research practice.*

*As **standards body** I want to understand how standards are used at the moment and where best practice is developing in order to identify updates required to standards to fill gaps or align with organically grown best practice developments.*

These user stories and the characterisation of selected competence centres, aid interpretation of the results of the open consultation survey, interviews and workshop feedback to help refine the user stories into concrete recommendations for the FAIRsFAIR Competence Centre.

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7. Open consultation, interview and workshop results

7.1 Open consultation results

As noted in the methodology, the small-scale survey was targeted toward research support staff and intended to provide qualitative rather than quantitative data to augment desk research. The survey was open from 2 August to 27 September 2019 and answered by 106 people.

The anonymised and aggregated open consultation data has been deposited in the FAIRsFAIR community in Zenodo and is openly available for use by third parties (Davidson and Whyte 2019).

Responses were provided by representatives of a wide range of organisations. The majority of responses were received from staff working in Universities (44%) followed responses from Research Infrastructure staff (30%), Research Performing Organisations (10%) and 'other' (9%). Those selecting 'other' included financing organisation, think tank; University Medical Center; Funding bodies, e-infrastructures, Institute of Technology; Cross-disciplinary trustworthy digital repository; cluster of Research Infrastructures; not-for-profit organisation.

The majority of the 106 responses to the open consultation came from across Europe. The majority of responses were received from respondents based in the UK (19%), followed by the Netherlands (13%), Germany (12%), Finland and France (9% each), Ireland, Italy, Spain and Sweden (5% each). The majority of responses came from countries that currently demonstrate a relatively high engagement with Open Science and the FAIR principles.

All responses are given equal weight in the analysis, although some responses represent individual views, while others were submitted as a collective response on behalf of an EOSC project. A number of clusters responded this way in addition to being interviewed.

Respondents identified with a variety of roles, 49% indicated that they fill several roles at their institutions. Of the 51% of respondents that have a single role, the majority (14% of all respondents) working in research support and liaison followed by policy makers or senior managers (11% of the 106 respondents) and data stewards or research data librarians (9% of total answers).

For WP6, the main aim of the consultative survey on FAIR policy and practice was to better understand how FAIRsFAIR could effectively respond to stakeholder needs. The open consultation asked respondents to indicate whether their host organisation currently provides in-house support to researchers for putting FAIR into practice. Of the 106 respondents who provided an answer to this question, about two thirds do offer support services. This makes the opinions about competence centres particularly relevant as the service and knowledge existing in these organisations should be reflected in the Competence Centre and any gaps should be addressed by any content or expertise made available.

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Main information resources to find support to make research outputs FAIR are institutional support teams and their help desks which was mentioned 90 times followed by informal information gathered from peers which was mentioned 68 times and Research Infrastructure support staff and resources mentioned 66 times. Less often consulted were disciplinary bodies or professional associations (mentioned by 25 respondents), funding bodies (25) and publishers (23). In addition, respondents highlighted trusted data repositories as sources for information to support making research outputs FAIR.

When asked for the top 3 sources consulted by researchers in support to make their data FAIR, most researchers will get in touch with institutional services to get help (mentioned 79 times), use a search engine trying to find useful resources (mentioned by 60 respondents) or contact a relevant Research Infrastructure (45 mentions). A full breakdown of answers is available in Fig. 2.

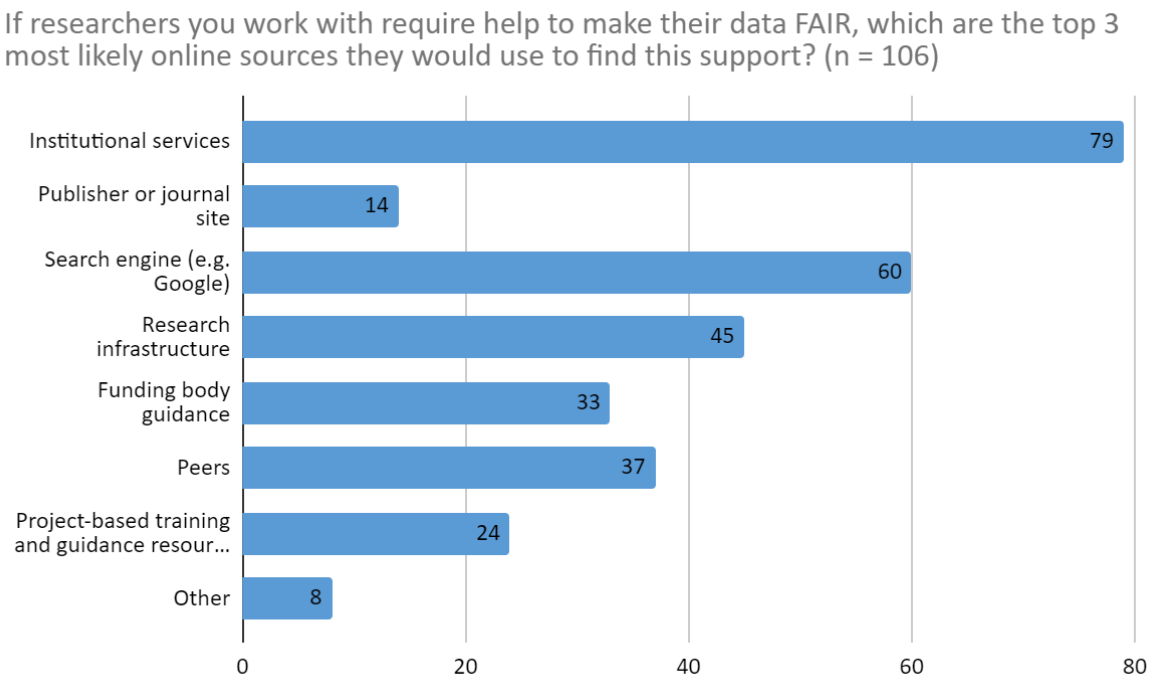

Figure 2: Top 3 online resources used to find support for making data FAIR

Other mentions are trusted domain repositories that are seen as reliable sources.

The open consultation also asked how guidance and material out there should be pooled together to be most effective in supporting EOSC and researchers making their research outputs FAIR.

- 62 respondents see identifying people able to respond to discipline-specific questions from researchers about making data FAIR as most effective solution.
- Aggregating already existing training portals was selected 52 times.
- 48 respondents chose “manually selecting and curating training and guidance resources” as an effective way to bring resources together.
- 41 survey respondents also saw aggregating training offers automatically from selected providers as useful.

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Furthermore, 14 respondents suggested other ideas ranging from the certification of training material and events to gathering community feedback e.g. through crowdsourced curation or running a forum similar to stack exchange[33].

When asked which function the EOSC should prioritise to help putting FAIR into practice, 'pointers to training and guidance materials offered by infrastructures, institutions and EOSC service providers' was ranked highest (57 mentions as high priority), followed by 'collate information on community requirements for FAIR services and resources' (54 mentions) and 'pointers to training events offered by infrastructures, institutions and EOSC service providers' (45 mentions). Lowest priority - including counts where the question was not answered - was given to 'document issues and debates about implementing FAIR principles in practice'. Figure 3 provides an overview of all answers given to that survey question.

33 https://stackexchange.com/

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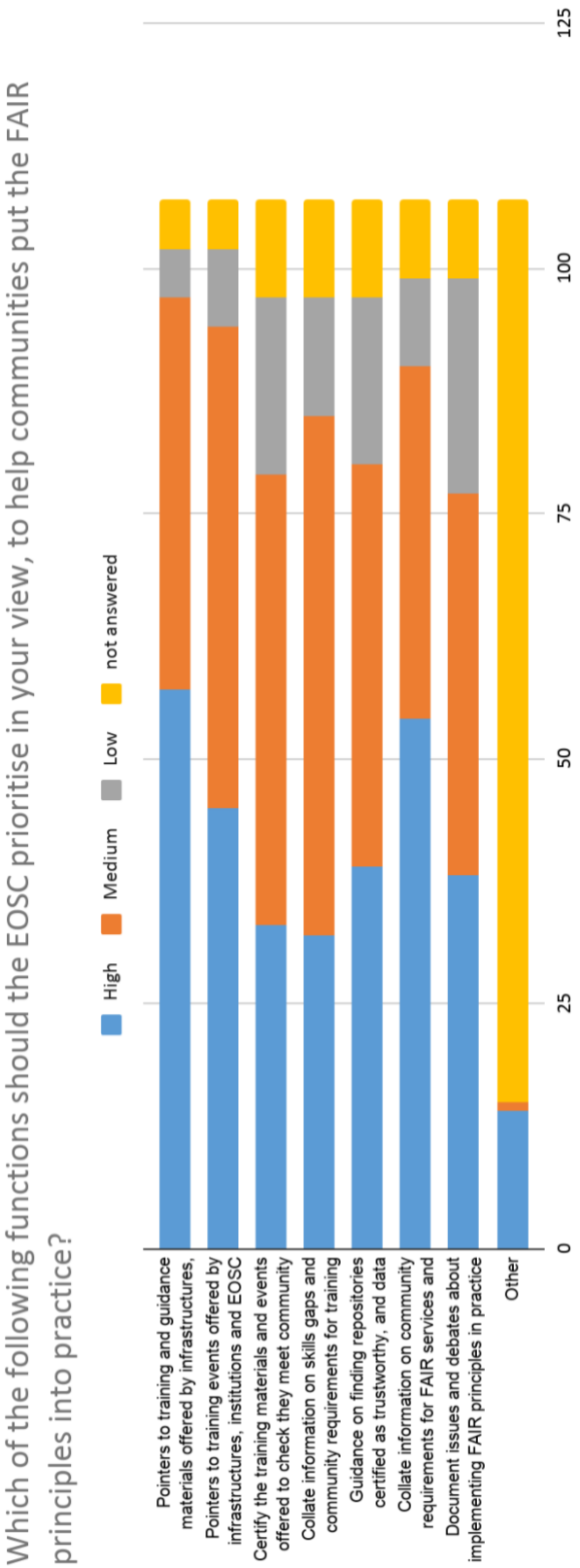

Figure 3: Relevance of EOSC Competence Centre functions as envisaged by surveyed institutions. The columns report the level of priority assigned to each function, by the institutions surveyed.

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The scale of prioritisation reported in Fig. 3 was consistent across all the surveyed institutions (universities, research infrastructures, research performing organisations, private companies, government and local government organisations).

However, it should be noted that although the lowest priority, as mentioned above, was given to '*document issues and debates about implementing FAIR principles in practice*', the interviews (Section 7.2) instead appeared to strike a slightly different note. In fact, most respondents stressed the need to circulate material from other research communities, on good practices in implementing FAIR principles. Such material is expected to serve as examples or templates in their own implementation of FAIR principles. This apparent discrepancy needs further investigation in the course of the project.

7.2 Results from interviews with EOSC clusters

The FAIRsFAIR work packages WP3 (Data Policy and Practice) and WP6 (Competence Centres) collaborated on the interviewing of a range of stakeholders in the European research data landscape in autumn 2019, including EOSC and ESFRI-supported 'cluster' projects. The aim was to understand the current position in regards to FAIR data in order to understand the priorities, policies and practices at that time.

This summary sets out the key findings of these interviews on support for researchers. Other themes from the discussions relating to policy and practice are included in D3.2 Data practice landscape analysis.

Support for researchers

It is important for FAIRsFAIR to understand the current levels of support, guidance, training opportunities and tool provision currently available for researchers when learning about or dealing with FAIR data. Interview participants were asked to discuss the support, guidance and/or tools they made available and of which other sources they were aware.

FREYA[34] and ENVRI-FAIR reported current or imminent work respectively on the development of such resources, but in the case of FREYA it is for researchers, focuses on ensuring the use of persistent identifiers (PIDs) is incorporated in appropriate training offerings and includes exploration of different modes of training to meet their needs such as wikis, and face-to-face training. In contrast, it is anticipated that the ENVRI-FAIR resources will be for Research Infrastructure staff. ExPaNDS[35] also emphasised the lead taken in their research domains by RI staff rather than researchers themselves in making data FAIR, noting that this functions as long as researcher users supply sufficient metadata for the RI to make the resulting data FAIR. PanOSC[36] reported that a range of resources and tools for the user – such as upload tools, DOIs, log books and institution licences – are made available but that they are aware that

34 https://www.project-freya.eu/Plone/en
35 https://www.panosc.eu/related-projects/expands/
36 https://www.panosc.eu/

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training is needed in order that internal (RI staff members) and external (researchers) are able to use these resources effectively to analyse data, to make data FAIR and to be able to advocate for FAIR data.

ESFRI cluster project 'Social Sciences and Humanities Open Cloud' (SSHOC) contains a work package focused on the development of intensive, targeted training led by CLARIN, on specific themes, including data protection and GDPR; data stewardship and RDM; data citation; data science for the social sciences and humanities (SSH), heritage science, and text mining for SSH. The training materials produced by the CESSDA were also noted, as well as the EC Parthenos project training materials for arts and humanities. Also in the humanities, FREYA noted the DARIAH-DESIR winter school taking place in December 2019[37], but noted the difficulty of maintaining such a labour-intensive training opportunity as a regular event. In terms of formal curriculum opportunities for the domain, participants emphasised the value of ensuring that data can be more FAIR by the use of PIDs (FREYA) and the value of recognising technicians and RI staff contributions to research – for example, ways to recognise datasets built and other metrics for those within RIs, alongside the creation of journals and conferences for these specialisms, to encourage the sharing of practices (ENVRI-FAIR).

Whilst competence centres for FAIR data were seen as useful innovations by participants, and potentially offered improved findability of relevant assets and an authoritative view on good practice illustrated by use cases from different research domains (PanOSC), there was no indication from most participants that they were active participants in such an initiative. In the case of FREYA, whilst the details of future offerings are not yet clear, their own contributions include making sure their training materials are well represented on the EOSC-Hub training catalogue.

Participants were asked to identify any gaps that still existed in the current EOSC-hub and ESFRI cluster landscape that FAIRsFAIR could usefully address. FREYA showed appetite for more support for arts and humanities-focused research in general, and hoped that some EOSC-hub or ESFRI cluster activity might deliver this. Support for repositories and standards is addressed in SSHOC WP3 'Lifting technology and services in the cloud'. This work aims to leverage existing FAIRness to enhance discoverability, and to improve means of access to sensitive data. As part of this, some support from FAIRsFAIR to amplify work at GESIS[38] on sensitive data access could be valuable. FAIRsFAIR could also make useful contributions to SSHOC work on heritage science data, and the ethics of FAIR data – particularly in 'dual use' research, and could use the FAIRsFAIR Competence Centre activity to promote materials and outputs with cross-disciplinary relevance to the social sciences and humanities. At a more macro level, ENVRI-FAIR identified the need for a coordination action across all current FAIR-related projects to attempt some harmonization and clarification of which project is doing what and how current parallel FAIR initiatives can effectively work together.

37 https://desirschool.sciencesconf.org/

38 Leibniz Institute for the Social Sciences https://www.gesis.org/en/home

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7.3 Discussion from the workshop at the Open Science Fair 2019

The workshop on 17 September 2019 was attended by 40 Open Science Fair participants.

Breakout group discussions were recorded on post-it notes and by note-takers. Responses were also invited through the live polling site Mentimeter[39] and covered must have functions of an EOSC Competence Centre as well as options for collaboration to deliver the Competence Centre. A key part of the discussion centred around training and guidance resources needed and where they should be hosted to be effective.

The workshop identified the following gaps in training and guidance resources:

- training on how to use EOSC/ EOSC specific guidelines, how do you use the technical infrastructure, how to connect your own service to EOSC,
- disciplinary gateways,
- a platform focussing on open educational resources.

Main focus should be on everything related to EOSC related projects and any training facilitated through EOSC. There are already existing resources that should be aggregated, and the clusters could provide input on how these should be integrated. In addition, several entry points should be provided to cater for a variety of disciplines or expert level. Attendees also mentioned that they would appreciate quality control and peer review by experts or the opportunity to rate resources. Standard metadata describing any resources should be provided.

A key concern seems to be sustainability beyond the project funding as well as responsibility for keeping the resource up to date or curating content that is out of date.

In addition to online training and resources, face to face interactions were also identified as being important. This could be achieved through local support offices and their staff disseminating any materials and information locally and potentially also in the local language. They can also enrich the Competence Centre resources with information on national funding requirements and run workshops that teach researchers how to use a service provided by EOSC or any of the clusters.

The workshops at the Open Science Fair also asked attendees to identify “must have” functionalities of a competence centre. Main features mentioned were:

- an overview of training materials and courses
- a database of experts per country
- easily understandable content and clear navigation
- certification of training materials/trainers e.g. the carpentries model; guidelines for curricula building, followed by EOSC skills and competence frameworks like FAIR4S for FAIR data stewardship[40] and issues and debates about implementing FAIR,

39 https://www.mentimeter.com/s/f5c2144d27acfad7eda1e6ee46526187/f81106826fde

40 https://eosc-fair4s.github.io/framework

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- community engagement (giving researchers the possibility to interact with each other) and networking,
- metrics/ a feedback mechanism to continuously improve the Competence Centre.

The workshop also discussed how the Competence Centre could collaborate with other initiatives. It will be key to reach out to already existing competence centres e.g. on national level and take advantage of the already existing networks. Attendees suggested online collaboration sessions and using collaboration networks to ensure efforts are not duplicated and all relevant resources will be included.

8. Recommendations on initial FAIRsFAIR Competence Centre

8.1 Opportunities for synergies and collaboration

Overall, there are a variety of organisations and initiatives available that address aspects of competence centres. Resources providing training material are available for a variety of disciplines and there are several sources for general training and guidance material. However, the community would find it useful if the training resources could be aggregated with standardised metadata - especially in terms of when it was last updated - and if certification for training and training material will be provided.

There seems to be a good coverage of tools and associated competence centres available and several EOSCHub projects are working on implementing tools for their specific disciplines and creating tailored solution based on central offers. In addition, those initiatives are also working on standards to support making data FAIR.

Guidance and advisory services are offered as mainly generalist services, however there might be disciplinary advice given as part of the other services offered such as tools and training that is not an obvious offer. Many of the central “hubs” also provide useful lists of tools, standards or policies.

The FAIRsFAIR Competence Centre will be part of a landscape of competence centres and other initiatives that provide access to material and resources. Recommendations and gaps identified in this report can also be the basis to prioritise work for other competence centres.

One opportunity for collaboration will be the EOSC Portal[41] (shown in Fig. 4) which already provides an access point to EOSC services and resources that the FAIRsFAIR Competence Centre can align or integrate with.

41 https://www.eosc-portal.eu/

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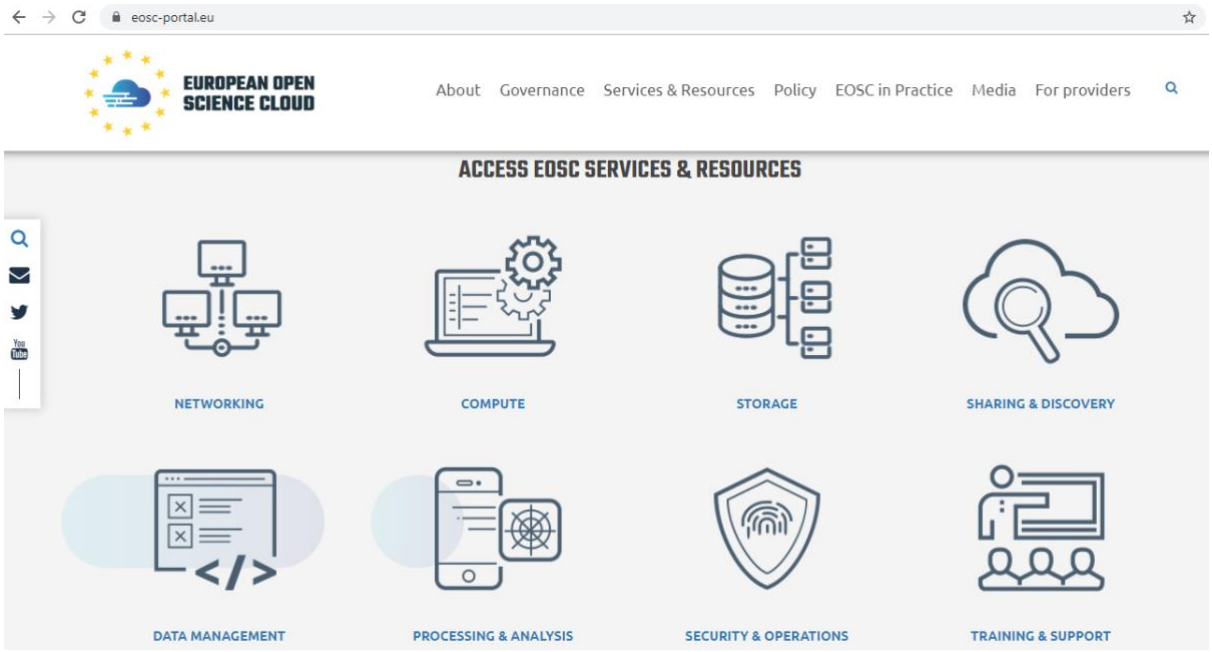

Figure 4: Screenshot of the EOSC portal and the way it presents services to the end user

A key part of the EOSC FAIR landscape are the ESFRI cluster projects[42] which could provide input into the FAIRsFAIR Competence Centre to ensure their work is reflected accordingly and the Competence Centre provides a useful complementary service to the cluster projects. Input could be organised via e.g. a formal advisory group.

In addition to collaborating with core EOSC initiatives, the FAIRsFAIR Competence Centre should also reach out to national competence centres and initiatives that could provide insights into national adoption of tools and resources, work on translations of material developed by FAIRsFAIR and disseminate any resources at local workshops, events, and networks.

8.2 Recommendations

Based on the exemplars, survey and interviews, we propose the following recommendations for an initial FAIRsFAIR Data Stewardship Competence Centre implementation, aligned with the major areas of work identified in the description of work for this work package:

Advisory

Recommendation A1: Create a catalogue of resources to support FAIR data stewardship

The FAIRsFAIR Competence Centre should provide a central catalogue of resources around the key areas that the project is working on:

- training - provide an overview of training resources aligned with the competency and skills framework as developed by work package WP7,

42 https://www.eosc-hub.eu/eosc-hub-and-esfri-cluster-projects

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- tools - provide a catalogue of tools and examples where they are used alongside with guides to implement these tools (e.g. any prototypes developed by work packages WP2 and WP4),
- policies - provide an overview of policies, templates and policy recommendations as analysed by work package WP3.

Recommendation A2: Provide a help desk to support FAIR data stewardship

While providing an opportunity to network in general is helpful, some users of the Competence Centre will be looking for expert help. Thus, the Competence Centre should offer a way to match queries relating to FAIR data stewardship to relevant experts from (e.g.) FAIRsFAIR partners and collaborating EOSC projects based on an initial assessment by a help desk function. In the short term the scope of queries might be limited to the topics the project outputs are addressing, as a means to identify the feasibility of offering a sustainable network of FAIR data experts drawing on the disciplinary expertise in Research Infrastructures.

Recommendation A3: Provide a networking tool to support FAIR data stewardship

The FAIRsFAIR Competence Centre should become the central place to learn about making research outputs FAIR and discuss issues with others. A networking platform could be modelled on e.g. the PID Forum[43] provided by the FREYA project.

Harmonisation

Recommendation H1: Apply emerging standards and recommendations to describe learning resources in FAIR data stewardship

In the interest of describing learning resources consistently, and ensuring they are FAIR for search engine crawlers as well as for people looking to browse available resources, the FAIRsFAIR Competence Centre should build on leading efforts e.g. in life sciences to tag, aggregate and promote training resources in non-discipline-specific terms. It should also apply the current work in terms4FAIRskills to develop a terminology for describing the content of these resources using terms covering FAIR data stewardship activities.

Recommendation H2: Encourage economy of scale through deploying the same tools and certifying services addressing FAIR data needs

Though it might not host any services, the FAIRsFAIR Competence Centre can leverage economy of scale within EOSC by providing use cases, case studies, implementation guidelines, recommendations and certification of tools and services addressing FAIR data needs in order to encourage their adoption and the exchange of knowledge around them. Thus, those services can be improved through an increased user base and FAIR challenges can be addressed in the best possible way.

43 https://www.pidforum.org/

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Economy of scale can also be achieved through the FAIRsFAIR Competence Centre collaborating with other competence centres on their approaches.

Dissemination

Recommendation D1: Develop training and guidance materials on FAIR data stewardship topics currently not covered

Following the landscape analysis and gaps identified, FAIRsFAIR should develop training and guidance material on any topics or tailored at audiences that are not already addressed by existing resources.

Recommendation D2: Develop curation policies for the content aggregated and developed by the FAIRsFAIR Data Stewardship Competence Centre

To ensure that any content linked to by the FAIRsFAIR Competence Centre stays relevant, the FAIRsFAIR Competence Centre should develop a content policy and accompanying strategy to ensure any links and resources get reviewed regularly and either removed from the Competence Centre or the metadata is updated with a comment reflecting why a resource is not recommended any longer.

Recommendation D3: Deliver training on core competencies for FAIR data stewardship

In addition to providing a virtual network, the FAIRsFAIR Competence Centre should also deliver some face-to-face training (e.g. through the CODATA/RDA Schools of Research Data Science). The Competence Centre could also look into certifying training on these core competences in collaboration with work package WP7.

If the FAIRsFAIR Competence Centre runs its own website, it could provide several entry points for users. Based on the layout of the RRI Toolkit[44] which presents two different starting points to get to information, we suggest a layout as follows:

44 https://www.rri-tools.eu/

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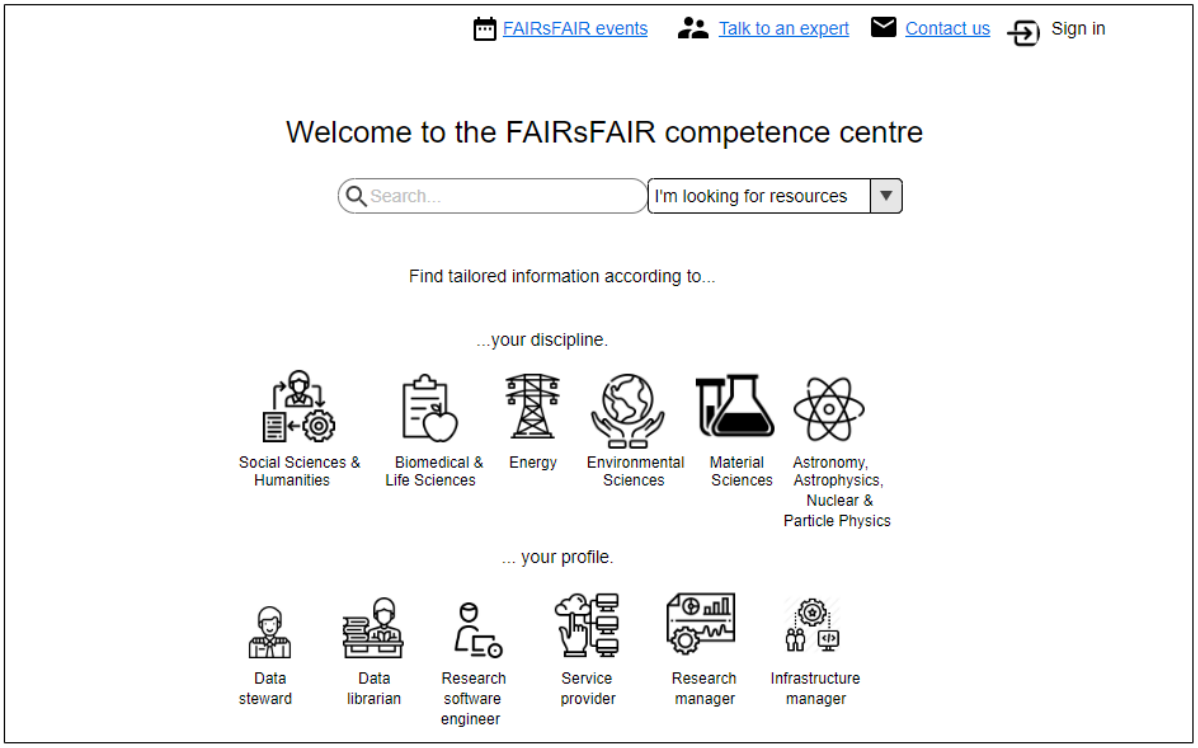

Figure 5: Mock-up of a start page for the FAIRsFAIR Competence Centre. Icons are provided by Freepik and eucalyp.

The core FAIRsFAIR Competence Centre would be based on a matrix content structure[45] allowing content to be explored by discipline or stakeholder it is tailored to from the start page. In addition, content will be tagged to align with the FAIR4S framework of FAIR data stewardship skills and be explorable by knowledge level of the end user.

9. Conclusions

Our landscape analysis showed that there are plenty of initiatives providing some aspects of a competence centre and some disciplines are served by initiatives that tick all boxes. However, through our desk research, open consultation, interviews and workshops we see that there are still areas where improvement is needed and work to be done to harmonise and link offers.

The recommendations for a core FAIRsFAIR Competence Centre are based on the findings of several information gathering approaches. Several requirements emerged issues across the various information gathering methods employed which supports our focus on a small number of key functionalities when developing the core Competence Centre. The project will continue to seek input from the community to define additional generic and discipline specific requirements as the project progresses.

45 https://www.usability.gov/how-to-and-tools/methods/organization-structures.html

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The next steps within the FAIRsFAIR project is to deliver on the recommendations for a competence centre as given in this document. This requires the development of a design for the centre, which includes:

- a definition of a web-based communications platform and its functionality, which can be efficiently managed as a delivery platform for material on FAIR data practise and a communication hub for user queries and user generated content.
- the definition and design of a knowledge base suitable for cataloguing and accessing information on FAIR data practices. This should allow the cross-referencing to information maintained in other external data sources.
- the design of policies and practises of the competence centre, including the mediation of user queries and criteria for developing additional material for harmonisation and training purposes.

This design will then be realised in an active competence centre environment.

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11. Supplementary data

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12. Annex I - Survey questions and high-level results

The full survey questionnaire and answers are available on Zenodo. (Davidson and Whyte 2019)

Survey questions of relevance to the analysis in this deliverable are copied below:

Competence centres

In this section, we'd like to know how FAIR training and guidance resources could best be organised to help communities put the principles into practice.

If researchers you work with require help to make their data FAIR, which are the top 3 most likely online sources they would use to find this support?

between 1 and 3 choices

☐	Institutional services
☐	Research infrastructure
☐	Project-based training and guidance resources
☐	Funding body guidance
☐	Publisher or journal site
☐	Peers
☐	Search engine (e.g. Google)
☐	Other

If you selected 'other' above, please describe where you would expect researchers to look for support.

Where should training and guidance resources be **most effectively** located to get noticed and used, in your view? (please choose up to 3 options)

between 1 and 3 choices

☐	Institutional level e.g. through RDM services
☐	National level (e.g. through national service providers)
☐	Discipline level (e.g. through Research Infrastructures)
☐	Cross-domain level (e.g. through horizontal European Open Science Cloud (EOSC) services, EOSC cluster projects)
☐	Thematically (e.g. through stakeholders addressing specific challenges)
☐	Other

If you selected 'other', please specify.

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How can training and guidance materials and event information be pooled **most effectively** across the European Open Science Cloud (EOSC) in your view (please choose up to 3 options)?

between 1 and 3 choices

☐	Manually selecting and curating training and guidance resources
☐	Aggregating trainings automatically from selected providers
☐	Aggregating training portals
☐	Identifying people able to respond to discipline-specific questions from researchers about making data FAIR
☐	Other

If you selected 'other', please specify.

Which of the following functions should the EOSC prioritise in your view, to help communities put the FAIR principles into practice?

	High priority	**Medium priority**	**Low priority**	**Don't know**
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.	○	○	○	○
Collate information on skills gaps and community requirements for training and guidance	○	○	○	○
Guidance on finding repositories certified as	○	○	○	○

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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	○	○	○	○
Other	○	○	○	○

If you selected 'other', please specify.

About you

In this section, we'd like you to answer a few questions about your role and organisation. Please note that only statistics from this section will be shared, not individual responses.

Which of the following types of organisation best describes your employer?

- ☐ Research Infrastructure
- ☐ University
- ☐ Research Performing Organisation
- ☐ Government/local government
- ☐ Private company
- ☐ Medical School/ Teaching Hospital
- ☐ Other

If you selected 'other', please specify.

What is the approximate number of researchers (full time equivalent), including doctoral candidates, working in your organisation?

- ☐ None
- ☐ < 100
- ☐ 100-500
- ☐ 500-1000
- ☐ > 1 000
- ☐ Don't know

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In which country are you based?

☐	Austria
☐	Belgium
☐	Bulgaria
☐	Croatia
☐	Cyprus
☐	Czechia
☐	Denmark
☐	Estonia
☐	Finland
☐	France
☐	Germany
☐	Greece
☐	Hungary
☐	Ireland
☐	Italy
☐	Latvia
☐	Lithuania
☐	Luxembourg
☐	Malta
☐	Netherlands
☐	Other country or countries
☐	Other European country
☐	Poland
☐	Portugal
☐	Romania
☐	Slovakia
☐	Slovenia
☐	Spain
☐	Sweden
☐	United Kingdom

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Which of the following describes your role? Please select all that apply.

☐	Researcher
☐	Policy maker or senior manager
☐	Research support or liaison
☐	User support/outreach provider
☐	Data steward or research data librarian
☐	Repository or scientific database provider
☐	Other

If you selected 'other', please specify.

Does your organisation currently provide in-house support to researchers for putting FAIR into practice?

☐	Yes
☐	No
☐	Don’t know

High level results on survey respondents

Breakdown by organisation type

Responses were provided by representatives of a wide range of organisations as can be seen in Figure 6. The majority of responses were received from staff working in Universities (44%) followed responses from Research Infrastructure staff (30%), Research Performing Organisations (10%) and ‘other’ (9%). Those selecting ‘other’ included financing organisation, think tank; University Medical Center; Funding bodies, e-infrastructures, Institute of Technology; Cross-disciplinary trustworthy digital repository; cluster of research infrastructures; not-for-profit organisation.

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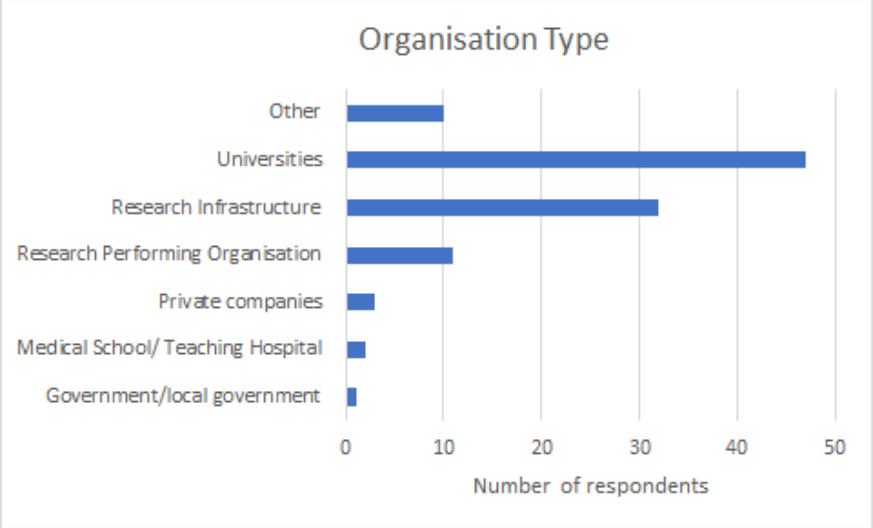

Figure 6: Breakdown of respondents by organisation type, FAIRsFAIR open consultation on Policy and Practice

Breakdown by country

We received a good number of responses to the open consultation from across Europe as shown in Figure 7. The majority of responses were received from respondents based in the UK (19%), followed by the Netherlands (13%), Germany (12%), Finland and France (9% each), Ireland, Italy, Spain and Sweden (5% each). The majority of responses came from countries that currently demonstrate a relatively high engagement with Open Science and the FAIR principles.

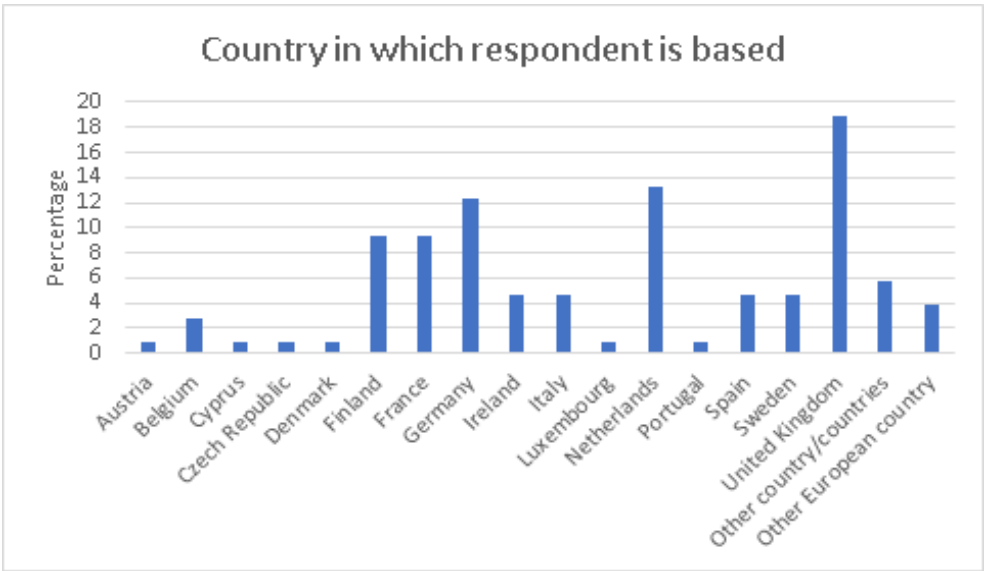

Figure 7: Breakdown of respondents by country in which they are based, FAIRsFAIR open consultation on Policy and Practice

Provision of in-house support for FAIR

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In light of the need for access to guidance and support across the research ecosystem, the open consultation asked respondents to indicate whether their host organisation currently provides in-house support to researchers for putting FAIR into practice. Of the 106 respondents who provided an answer to this question, about two thirds do offer in-house support services as can be seen in Figure 8. As noted above, the majority of responses came from countries with a high level of commitment to Open Science and the FAIR principles. While the responses are too low to provide concrete evidence, the findings suggest that in-house support is most frequently provided by respondents based in Belgium (100%), Finland (90%), United Kingdom (85%), the Netherlands (71%) and Germany (69%).

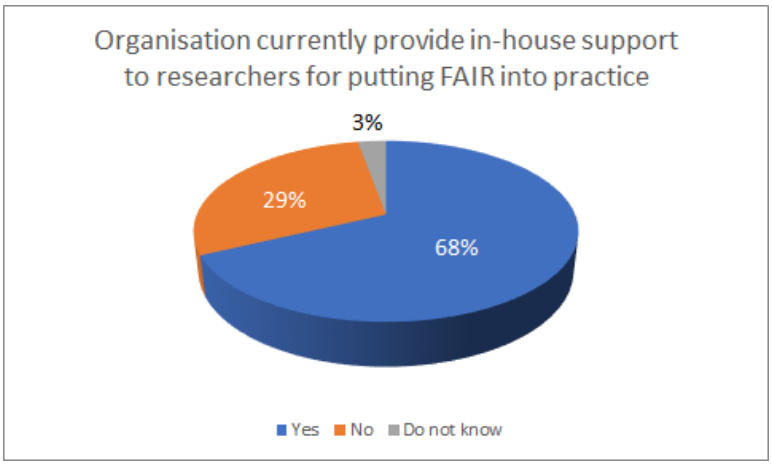

Figure 8: Organisations currently providing in-house support, FAIRsFAIR open consultation on Policy and Practice

More than three quarters of respondents working in Universities provide in-house support (77%), followed by 66% of Research Infrastructures, and 64% of Research Performing Organisations. While the vast majority of HEIs responding to the open consultation do provide in-house support, these findings should be viewed in light of the findings of the 2017-2018 EUA Open Access survey which revealed that only 13% of European HEIs had developed institutional guidelines for open access to research data[46].

Roles of respondents

The open consultation included a question asking about the respondent's role(s) within their organisation. Respondents could select as many of the options as they felt were relevant. Just over half of those responding (51%) classified their role using just of the options provided as is presented in Figure 9. Of these, the majority of respondents classify their role as Research Support or Liaison (14%), followed by Policymaker or Senior Manager (11%), and by Data Stewards or Research Data Librarian (9%). Almost half of respondents (49%) indicated that they held more than one role within their organisation. In many cases, respondents had between three and five roles within their organisation. The long tail of hybrid and potentially niche roles may reflect disparity among organisational structures and specific institutional needs. While the sample rate is too small to provide any concrete evidence, the long tail of

46 https://eua.eu/resources/publications/826:2017-2018-eua-open-access-survey-results.html

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respondents carrying out a number of different roles implies that there is a lack commonly agreed career profiles for many of those working in the broad field of data stewardship.

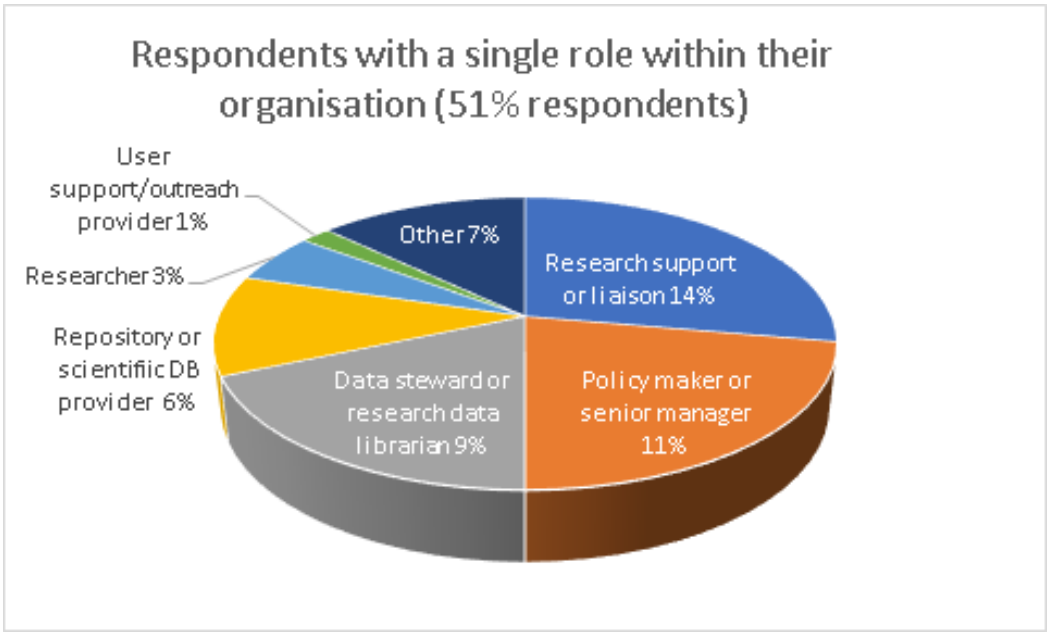

Figure 9: Breakdown of respondents by role, FAIRsFAIR open consultation on Policy and Practice

'Other' roles

Data manager; Digital Humanities Officer, Project Manager, Librarian and Repository Manager (Publications repository), Special Advisor and Project Manager, All-purpose librarian, Publisher, Public Affairs Officer, IT Staff, Academic journals publisher in addition to repository provider, Data analyst for policy support, scientific Project Manager (mix of logistics and scientific work), IT expert, Data Steward on departmental level in the research domain of a University Medical Center, Public IT Infrastructure Designer and Developer.

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13. Annex II - Characterisation of competence centres

The following existing competence centres were characterised as part of the landscaping overview:

- FAIRsharing.org: https://fairsharing.org/
- Australian Research Data Commons (ARDC): https://ardc.edu.au/resources/working-with-data/fair-data/
- GO FAIR: https://www.go-fair.org/
- Enabling FAIR Data: http://www.copdess.org/enabling-fair-data-project/
- FAIRDOM: https://fair-dom.org/
- DARIAH: https://www.dariah.eu/
- CESSDA: https://www.cessda.eu/
- ELIXIR: https://tess.elixir-europe.org/
- DMT Clearing House: http://dmtclearinghouse.esipfed.org/
- Data Curation Network: https://datacurationnetwork.org/
- UK Data Service: https://ukdataservice.ac.uk/
- EGI-Engage Competence Centres: https://wiki.egi.eu/wiki/EGI-Engage:Competence_centres
- FAIRplus: https://fairplus-project.eu/
- PARTHENOS: https://training.parthenos-project.eu/
- OpenAIRE and NOADs: https://www.openaire.eu/
- Digital Curation Centre: http://www.dcc.ac.uk/
- DANS: https://dans.knaw.nl/en
- LIBER: https://libereurope.eu/
- RDNL: https://researchdata.nl/en/
- eInfraCentral Platform: https://www.einfracentral.eu/home
- EOSC Hub: https://eosc-hub.eu/about-us
- EOSCpilot policy toolkit: https://docs.google.com/spreadsheets/d/1gqhL3NqdQ2FD47N2e26ifviovK30ZROW5TG_SgtW9Eo/edit#gid=2075068763
- GOBLET: https://www.mygoblet.org/
- PRACE: http://www.training.prace-ri.eu/
- EISCAT_3D Agile Data: https://www.eosc-hub.eu/research-communities/eiscat3d-agile-data
- ELIXIR Competence Centre: https://www.eosc-hub.eu/research-communities/elixir
- EPOS-ORFEUS Competence Centre: https://www.eosc-hub.eu/research-communities/epos-orfeus-competence-center
- ICOS Competence Centre: https://www.eosc-hub.eu/research-communities/icos
- Radio Astronomy Competence Centre: https://www.eosc-hub.eu/research-communities/radio-astronomy-competence-center
- Marine Research: https://www.eosc-hub.eu/research-communities/marine-research-competence-centre
- Fusion Research: https://www.eosc-hub.eu/research-communities/fusion-research

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- Disaster Mitigation+ Competence Centre: https://www.eosc-hub.eu/research-communities/disaster-mitigation-competence-centre-plus-dmcc
- Springer Nature: https://researchdata.springernature.com
- JISC RDM Toolkit: https://rdmtoolkit.jisc.ac.uk/
- forschungsdaten.info: https://www.forschungsdaten.info/
- GO FAIR - FAIR Data Resources: https://www.zotero.org/groups/2345721/fair_data_resources?
- Norway - TSD & Nettskjema: https://www.uio.no/english/services/it/research/sensitive-data/use-tsd/

The characterisation carried out used broad concepts and categories for stakeholders and services to identify major characteristics and gaps.

Types, partners, subject, target users, services, and resources have been characterised using controlled vocabulary; strength and gaps are free text fields where notes could be provided if aspects stood out for certain initiatives.

A snapshot of the characterisation spreadsheet as used for the analysis presented in this deliverable is available on Zenodo. (Herterich et al. 2019)

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