# Skills 4 eosc

# D2.1 Catalogue of Open Science Career Profiles - Minimum Viable Skillsets

| Lead Partner: | Digital Curation Centre (UEDIN) |
|---|---|
| Version: | **1.2** |
| Status: | ==**Submitted draft not yet approved by the EC**== |
| Dissemination Level: | **PU: Public** |
| Document Link: | https://doi.org/10.5281/zenodo.8101903 |
| DOI: | 10.5281/zenodo.8101903 |

| Deliverable Abstract |
|---|
| This deliverable reports  initial steps towards a catalogue of Minimum Viable Skillset (MVS) Profiles. These describe key skills and competences for roles that enable researchers, professionals, and stakeholders to practice Open Science (OS) with the support of the European Open Science Cloud (EOSC). MVS Profiles draw on available skills resources, including competence frameworks, and are proposed as an aid to developing skills through curricula and course design. Each MVS Profile relates the essential skills  to the Open Science (OS) practices, activities, and outcomes that may typically be expected of the role concerned. |

**DELIVERY SLIP**

| Date | Name | Partner/Activity | Date |
|---|---|---|---|
| *From:* | Angus Whyte | UEDIN/ T2.1 | 08.05.2023 |
| *Moderated by:* | Dominique Green | UEDIN/ WP2 | 08.05.2023 |
| *Contributor:* | Karla Avanço | AMU/ T2.1 | 08.05.2023 |
| *Contributor:* | Sara Di Giorgio | GARR/ T2.1 | 08.05.2023 |
| *Contributor:* | Arnaud Gingold | OPERAS-AMU/ T2.1 | 08.05.2023 |
| *Contributor:* | Laurence Horton | UEDIN/ T2.1 | 08.05.2023 |
| *Contributor:* | Bojana Koteska | UKIM/ T2.1 | 08.05.2023 |
| *Contributor:* | Katerina Kyprianou | GRNET/ WP3 | 08.05.2023 |
| *Contributor:* | Ognjen Prnjat | GRNET/ WP3 | 08.05.2023 |
| *Contributor:* | Päivi Rauste | CSC/ T2.1 | 08.05.2023 |
| *Contributor:* | Luca Schirru | KU/ ELSI WP | 08.05.2023 |
| *Contributor:* | Claire Sowinski | INIST- CNRS/ T2.1 | 08.05.2023 |
| *Contributor:* | Gabriela Torres Ramos | INIST- CNRS/ T2.1 | 08.05.2023 |
| *Contributor:* | Nida van Leersum | TU-DELFT/ T2.1 | 08.05.2023 |
| *Reviewed by:* | Curtis Sharma | TU-DELFT | 22/05/2023 |
| *Reviewed by* | Eva Méndez | UC3M | 28/05/2023 |
| *Approved by:* | Emma Lazzeri | GARR | 30/06/2023 |

**DOCUMENT LOG**

| Issue | Date | Comment | Author |
|---|---|---|---|
| *v.0.1* | *8.5.2023* | *Initial draft based on Milestone 2.1 report, community feedback & internally reviewed MVS drafts* | *Angus Whyte [lead] and co-authors named above* |
| *v.1.0* | *15.5.2023* | *Draft updated for internal review* | *As above* |
| *V.1.1* | *24.5.2023* | *Revision to respond to review comments* | *As above* |
| *v.1.2* | **30.6.2023** | *Revision responding to review comments* | *As above* |

## LIST OF ACRONYMS AND ABBREBIATIONS
**[See also EOSC Glossary https://eosc-portal.eu/glossary** ]

| | |
|---|---|
| **CARE** | Collective Benefit, Authority to Control, Responsibility, and Ethics |
| **CSCCE** | Centre for Scientific Collaboration and Community Engagement |
| **DMP** | Data Management Plan |
| **ELSI** | Ethical, Legal and Social Issues |
| **EOSC** | European Open Science Cloud |
| **ETHRD IG** | Education and Training on Handling of Research Data Interest Group (RDA) |
| **ICT** | Information and Communication Technology |
| **IT** | Information Technology |
| **JRC** | Joint Research Centre |
| **FAIR** | Findable, Accessible, Interoperable, and Reusable |
| **MVS** | Minimum Viable Skillset |
| **ORCC** | Open Research Competencies Coalition |
| **OS** | Open Science |
| **R&I** | Research and Innovation |
| **RDA** | Research Data Alliance |
| **RDM** | Research Data Management |
| **RI** | Research Infrastructure |
| **RPO** | Research Performing Organisation |
| **RSE** | Research Software Engineer |
| **T4fs** | Terms for FAIR skills |
| **WG** | Working Group |

# Contents

# 1 Executive summary

This report introduces the concept of Minimum Viable Skillsets (MVS) in Open Science, providing a structure and process for creating them. It also provides a basis for further work to establish catalogue of MVS Profiles. The inital set describes 'essential skills and competences' for nine roles, three of which have variations for different organisational contexts, and one for different career stages.

Skills4EOSC aims to co-create further MVS Profiles that expand the roles covered, as well further career stages for those included here. This initial set of MVS Profiles is intended as a basis for more extensive catalogue, to FAIRify the MVS as learning resources to be accessed and reused in a 'training for trainers' context. Further MVS will co-created  with other groups interested in building capacity for Open Science, with Skills4EOSC leading on the underlying catalogue.

Section 2 offers an introduction that aims to answer basic questions about the purpose of MVS, the methodology to produce them, and the proposed Catalogue. It also positions MVS in the EOSC context, gives more detail about the Profile content and structure, lists the roles presently covered, and describes their relation to career paths.

Section 3 gives more detail on the roles currently included in the MVS catalogue, and describes the reference sources they are derived from. Section 4 describes the co-creation approach that has been taken for the initial set of MVS. This is also proposed for the co-creation of further MVS for additional roles as well as for variations of those already produced.  Finally, Section 5 outlines next steps.

Appendix 1 provides a first version of the catalogue. Appendix 2 explains the design of the MVS with more detail of how its elements and their properties are defined. Appendix 3 describe an initial selection of OS skills terms, illustrating their application to the Data Steward MVS.

# 2   Introduction

## 2.1  Introducing Minimum Viable Skillsets

The notion of a 'minimum viable' product is well established in agile software development. It has recently been applied to the design of the European Open Science Cloud (or 'Commons') itself. The 'Minimum Viable EOSC' is a subset of EOSC resources 'necessary for forming the added-value and opportunities considered essential to be provided by the EOSC at a given moment in time'.  In a similar manner, the Minimum Viable Skillset (MVS) describes essential skills and concepts required to deliver Open Science outcomes for communities and organisations.  Each MVS is based on available resources that define skills required to practice Open Science (OS) e.g. competence frameworks and reports.

A main priority of Skills4EOSC is to define a catalogue of MVS for different EOSC actors, and Open Science practitioners including researchers, various professional roles that support them, policy makers and other stakeholders. The MVS is a key resource for the project's core objective of advancing their Open Science (OS) skills.

Each MVS identifies for a particular role the essential skills and competences in Open Science the role may need. A MVS is associated with a *profile* that gives additional context by describing the OS mission and outcomes typically expected from the role, the activities involved in contributing to those outcomes, and the proficiency level needed for each of the essential skills.  While each MVS is role-specific, the roles are described at a broad level with the aim of accommodating alternative titles, for example for 'data professional' roles sharing a similar mission for Open Science .

Skills4EOSC has so far identified 9 MVS skillsets, 4 of which have additional variations according to career stage or context, illustrating that the approach can be readily adapted to meet these needs.

**We strongly encourage co-creation of further MVS, e. g. based on further career stages and disciplinary variations in the skills and competences needed. We also invite co-creation of new MVS for roles not yet covered in this initial release.**

## 2.2  'Open Science' in the EOSC context

To provide a scope for the MVS, a definition of Open Science particularly relevant to projects funded through the EC is used. This definition is given in the *Programme Guide to Horizon Europe,* and summarised as follows: -

"Open science is a Research and Innovation (R&I) approach based on open cooperative work and systematic sharing of knowledge and tools as early and widely as possible in the process. It includes measures to ensure research outputs (such as publications, data, software, models, algorithms, and workflows) are reproducible and openly accessible according to domain standards. It includes participation in open peer-review; and measures to involve all relevant knowledge actors in co-creating R&I agendas and contents." [1]

Alternatively, the UNESCO Recommendation on Open Science frames the topic as follows.

"open science is defined as an inclusive construct that combines various movements and practices aiming to make multilingual scientific knowledge openly available, accessible and reusable for everyone, to increase scientific collaborations and sharing of information for the benefits of science and society, and to open the processes of scientific knowledge creation, evaluation and communication to societal actors beyond the traditional scientific community. It comprises all scientific disciplines and aspects of scholarly practices, including basic and applied sciences, natural and social sciences and the humanities, and it builds on the following key pillars: open scientific knowledge, open science infrastructures, science communication, open engagement of societal actors and open dialogue with other knowledge systems.' [2]

There are alternative definitions of Open Science. The League of European Research Universities (LERU, 2018) for example highlight that "Open Science opens up new ways in which research/education/innovation are undertaken, archived and curated, and disseminated across the globe. Open Science is not about dogma per se; it is about greater efficiency and productivity, more transparency and a better response to interdisciplinary research needs."[3]

While these and other definitions highlight slightly different aspects of Open Science that may influence decisions on the skills needed, the Horizon Europe

[1] European Commission (2023) Horizon Europe Programme Guide v3.0 April 2023 (pp.41-42) https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/programme-guide_horizon_en.pdf

[2] UNESCO Recommendation on Open Science (2021) Paris. UNESCO (p.7) https://unesdoc.unesco.org/ark:/48223/pf0000379949.locale=en

[3] LERU (2018) Ayris, Paul et al. 'Open Science and its role in universities: a roadmap for cultural change'. Advice Paper. https://www.leru.org/publications/open-science-and-its-role-in-universities-a-roadmap-for-cultural-change

definition above provides a necessary starting point to defining the essential skills for any role directly engaging with the European Open Science Cloud.

## 2.3 Use cases for Minimum Viable Skillsets

The MVS address gaps identified in the EOSC Strategic Research and Innovation Agenda, i.e., lack of Open Science and data expertise, and lack of a clear definition of data professional profiles and corresponding career paths. MVS can also help to address fragmentation in training resources, when used alongside the Skills4EOSC 'FAIR by Design' methodology for applying FAIR principles to these resources.[4]

The MVS meet use cases in skills development by summarising the 'essential skills' for Open Science for various intended users, who otherwise need to refer to the many relevant competence frameworks and reports describing gaps and needs across a variety of research and data-related professions. In doing so they will be useful signposting guidance for the following:

- **Trainers**: planning courses or developing curricula, by providing terms to use in searching for learning resource, and by identifying the scope of further learning resources that may need developed.
- **Team leaders** of researchers and data professionals, aiming to build capacity in Open Science, by offering a simple format for self-assessing and comparing competences across a variety of roles to find opportunities to fill them within the organisation.
- **Professional networks:** aiming to build the competences of any of the relevant professional roles, and **Competence Centres** aiming to develop their capabilities as centres of expertise in Open Science, by helping to identify any gaps that they may target in their activities.
- **Policymakers, civil servants, and knowledge brokers:** aiming to shape Open Science policy, or apply results of Open Science as evidence for policy-making, by indicating the additional skills they may need.
- **R&I Legal and ethics experts:** by identifying other roles their expertise may be targeted towards, and/or by identifying the scope of further learning resources that may require their input.

## 2.4 Roles currently with Minimum Viable Skillsets

The MVS aim to meet training needs for a range of actors in Open Science, particularly those that EOSC aims to support. The initial set of MVS Profiles covers nine roles, four of which include variations in the essential skills, as follows: -

---

[4] Filiposka, Sonja, et al. (2023). Draft Methodology for FAIR-by-Design Learning Materials (1.2). Zenodo. https://doi.org/10.5281/zenodo.7875541

1. **Students**: at *undergraduate* stage, and on taught *masters* programmes.
2. **Researchers**: *early career* (R1-R2) and *senior* researchers (R3-R4).[5]
3. **Data Stewards**: including data professional roles (Data Manager, Data Curator, Data Librarian) with two variations according to whether the role is of a *coordinator* working across domains or *embedded* in a research team.
4. **Policymakers**: *research policymakers* steering OS as evidence production, and *evidence-informed* policymakers using OS outputs.
5. **Knowledge Broker**: providing an 'honest broker' role at the interface between research and policymaking.
6. **Civil Servant**: applying Open Science in policy implementation.
7. **Research Infrastructure Professional**: focusing on those with a managerial role.
8. **Legal Expert**: providing legal advice or information to stakeholders on the legal basis for Open Science or constraints on various actions it involves (e.g. IPR issues, data privacy, etc.).
9. **Ethics Advisor**: providing information on organisational processes to assure that ethical aspects of open research, particularly on the issues related to data production and use are properly addressed.

Section 3 describes the broader range of roles we are considering within the scope of this work, and the sources that were used to identify essential skills and competences.

## 2.5 Contents of the MVS Profile

A Skills4EOSC MVS Profile is a short document based on a landscape review of literature describing roles and skills needed for Open Science. The MVS Profiles focus mainly on researchers and data-related professional roles (mainly, but not exclusively, in Research Performing Organisations, RPOs).

The overall need for these skills and competences is framed by five dimensions of Open Science, based on the Horizon Europe guidance. These dimensions are visualised in the MVS as a wheel showing the extent to which a particular role deals with each dimension.[6]  The  MVS then provides a set of terms[7] describing

---

[5] European Commission DG Research & Innovation, (2011), Towards a European Framework for Research Careers
https://cdn5.euraxess.org/sites/default/files/policy_library/towards_a_european_framework_for_research_careers_final.pdf

[6] The extent to which the role deals with each dimension is derived from the list of essential skills and competences in the MVS, by counting terms whose definitions are relevant to the skills and competences described.

[7] The terms are work-in-progress drawn from terms4FAIRskills (https://www.ebi.ac.uk/ols4/ontologies/t4fs) and CSCE 'skills wheel terms' (https://www.cscce.org/resources/glossary/)

the 'Open Science Skills Scope' for the role. The terms are derived from published terminologies, and serve as keywords to summarise the essential skills and competences.

The MVS Profile takes a closer look at the role's overall mission for Open Science, describing the outcomes and activities typically expected of the role. The Profile begins by introducing the rationale for treating the role as an Open Science actor and ends with references to the reports and sources it is based on. The introduction suggests a range of organisational contexts for the role. From that starting point, the Profile summarises the following: -

- **Mission**: what this role does in relation to Open Science, both broadly defined and within the EOSC context.
- **Outcomes**: further statements describing results that should be achieved through practising OS.
- **Activities**: actions performed to accomplish the outcomes.
- **Essential skills and competences**: those required to perform the actions.

The Annex to this report details the content of each MVS Profile completed to date. As Figure 1 illustrates, the Profile is intended to flow from the general to the specific, homing in on essential details.



Figure 1. MVS Profile

At the core of the Profile is the Minimum Viable Skillset (MVS). This has two components, illustrated below in Figure 2:

1. Essential skills and competences: a short list of those highlighted in the literature sources, aligned to various dimensions of the Horizon Europe definition of Open Science.
2. The authors' selected keywords summarising these skills and competences, based on a controlled list of OS Skills Terms.

The essential skills and competences are visualised as the 'Open Science Skills Scope' for any particular role (e.g. Data Steward in Figure 2). The degree of shading in each dimension indicates the extent to which the role addresses each dimension. This is derived from the MVS Profile, by counting terms whose definitions are relevant to the essential skills and competences it describes.



## MVS Summary

| Dimensions | Data Steward Open Science Skills Terms |
|---|---|
| **Technology** | Data policy; Service level management; Data curation; Preservation; Open access publishing; Data access risk assessment and mitigation; Information security; Product management of technology platforms; Technical support; Data repository management; Data sharing and publication; Assessment on FAIR data criteria; Software preservation; Data curation, Metadata exposure; |
| **Domain** | Domain knowledge to contextualise data handling; Data management; Advocacy; Evaluation & assessment; Landscape analysis; Business modelling; Analysis; Project management; |
| **Interpersonal** | Mentoring on open and FAIR methods; Advocacy; Engagement; Cultural competence; Mentoring; Teaching and training; Moderation, mediation, and intervention; Creativity; Collaboration; |
| **Communication** | Consultation and listening; Knowledge brokering; Copywriting and editing; Knowledge brokering; Speaking and presenting; |
| **Leadership** | Data Governance; Community governance; Proposal development; Securing sustainable funding; Community governance; |

**Figure 2. Scope of OS skills and terms summarising MVS, e.g. for Data Stewards**

## 2.6 MVS Profiles as an aid to planning career paths

The MVS assume various stages an individual researcher or data professional will take through their career. These are represented as different types of MVS, matching the following stages:

1) **Student**: an undergraduate or graduate student undertaking a taught degree course at a recognised higher education institution.
2) **Research Actor**: performs research as a PhD student or post-doc, or supports the research process undertaken by others, e.g. by providing services, making policy for research, or making policies that are informed by research results.
3) **Senior Research Actor**: has responsibilities for supervising research or practitioners who support research, or for leading implementation of Open Science within and across organisations.

These are informed by the European Framework for Research Careers, which defines 4 career levels (R1-R4). The absence of similarly well-defined career paths for data professionals is one of the challenges Skills4EOSC aims to address, by enabling individuals to build careers with enough flexibility to work around current institutional limitations and also gain recognition.

Individuals need to be supported throughout their career to move between researcher and support professional roles. They may also move back and forth between different organisational contexts e.g. between Research Faculty, University Libraries, IT Services, Research Offices, Research Infrastructures, and industry. The 'competence wheel' representation of the MVS offers some, limited, support for individuals to self-assess and compare their own competences with other roles.

It is therefore important that the MVS offers substantial input to curricula that can be structured in a modular way, For example, a learner may be following a career path that overlaps between research and data professional roles. Individuals in the latter may be expected to actively contribute to a research teams outputs, and be rewarded accordingly, while others are deployed by a service provider (internal or external) in a role that is rewarded according to other indicators (e.g. service reliability, or user uptake of research infrastructure).

The extent to which MVS support career path planning will be further assessed later in Skills4EOSC as the project develops learning paths that learners may follow through the curricula based on these MVS.

# 3  Roles and Skills Sources

## 3.1  Landscape review

The Minimum Viable Skillsets are based on a landscape review conducted in the first six months of the project. The starting point for this review was the framework of ten roles identified by the 2021 report of the EOSC Working Group on Skills and Training.[8] This is illustrated in Figure 3, and covers four distinct areas of activity described as "ICT, library and information science, research and the general public".



**Figure 3 Roles, skills and interactions of actors in the EOSC ecosystem. (Source: EOSC WG Skills and Training [2])**

The WG report describes these roles, acknowledging that as broad categories they may be interpreted  with some flexibility.

---

8.  European Commission, Directorate-General for Research and Innovation (2021) Manola, N., Lazzeri, E., Barker, M.et al., *Digital skills for FAIR and Open Science – Report from the EOSC Executive Board Skills and Training Working Group*, Manola, N.(editor), Lazzeri, E.(editor), Barker, M.(editor), Kuchma, I.(editor), Gaillard, V.(editor), Stoy, L.(editor), Publications Office, https://data.europa.eu/doi/10.2777/59065

The Skills4EOSC task focuses on a subset of the EOSC Skills and Training WG roles for which the project is expected to deliver courses and curricula. These include:

– Data stewards, and 'data professionals' more broadly
– Researchers, including PhD students
– Policymakers and knowledge brokers acting as 'honest brokers' in the science-society interface
– Research Infrastructure professionals

The initial list of 'data professional' roles was expanded, informed by a survey and literature review conducted by the RDA Professionalising Data Stewardship Interest Group [9], and refined further through co-creation surveys carried out firstly among project partners, and then for public responses (see section 5 for further details of this). This resulted in a list of Open Science roles illustrated in Figure 4. This list frames the initial set of MVS, although it is not intended to be exhaustive or final. In addition to 'data professional' roles it includes others instrumental in shaping Open Science, including e. g. policymakers, civil servants, and knowledge brokers.

Taking the scope from this list of roles, the sources used in writing the MVS Profiles was compiled collaboratively by the Skills4EOSC T2.1 partners, working in sub-groups dedicated to specific roles. The sources are available in a Zotero group collection (Note that access requires a Zotero account). The sources collected include reports, peer-reviewed journal articles, deliverables from other EC-funded projects, and government policy documents. While the collected sources focused on the roles of interest, the geographic scope of the sources varied. Many resources came from The Netherlands, Denmark, France, and the United Kingdom.

---

[9] Wildgaard, L., & Rantasaari, J. (2022). RDA Professionalising Data Stewardship - Data Stewardship Landscape Report Resource Matrix [Data set]. Research Data Alliance. https://doi.org/10.15497/RDA00077

**Open Science and Scholarship**
- Data Scientist
- Data Analyst
- Early Career Researcher
- Citizen Scientist

**OS Coordination and Governance**
- Research Policymaker
- Senior Researcher
- Project manager/ Lab coordinator
- Research Infrastructure Professional

**OS Data Support**
- Data Steward
- Data Curator
- Data Librarian
- Data Manager
- RDM Coordinator

**OS Infrastructure**
- Data Archivist
- Research Software Engineer
- Data Engineer
- Service Manager
- User Support Professional

**OS Research Support**
- Research Manager
- Trainer/ Educator
- Legal Advisor
- Ethics Advisor
- Scholarly Communications Specialist

**Open Societal Engagement**
- Policymaker
- Knowledge Broker
- Citizen Scientist
- Civil Servant
- Undergraduate & Masters Student

**Figure 4. Selected Open Science actors, highlighting those currently with MVS**

## 3.2 Terminology sources for Open Science Skills Terms

The MVS Profiles offer descriptive sentences in bullet-point lists. Skills4EOSC also aims to provide an Open Science Taxonomy serving three main purposes:

- Provide a harmonised view of the scope of learning resources to be produced in Skills4EOSC.
- Expand the terms4FAIRskills ontology (t4fs) to include machine-readable terms describing Open Science activities and skills.
- Help to make the Minimum Viable Skillsets available as FAIR learning resources  e.g. by providing metadata terms to be applied according to the FAIR by Design methodology).[10]
- Provide content for visual summaries of the MVS.

As a first step, a set of 129 keywords were compiled from two sources, covering related aspects of Open Science: FAIR data stewardship (t4fs ontology), and scientific community management (CSCCE Glossary). Both were originally developed to describe courses or learning materials.

1) The t4fs ontology[11] provides terms oriented to technology, domain and project management aspects of FAIR data stewardship, from which 84 terms were selected.
2)  The 45 terms from the CSCCE glossary [12] are included mainly to cover interpersonal and communication aspects of Open Science. The terms selected are from the CSCCE 'skills wheel' for science community managers.

The FOSTER Open Science taxonomy [13] was also considered as a potential terminological source given the obvious relevance of its scope. Its terms were considered to relate more to OS outcomes than activities, and therefore less applicable at this initial stage.

The terms are applied to the narrative bullet-point descriptions of essential skills and competences in the MVS, also using the Open Science activities these relate to (e.g. To resolve any ambiguity about applicability of terms).  Based on the number of terms applied, an assessment is made on the overall relevance of each dimension to the role. This is then visualised in the 'OS Skills Scope' format shown in Figure 2 . Appendix C in the Annex to this report gives further detail of how the terms were applied to this example.

---

[10] Filiposka, Sonja, et al. (2023). Draft Methodology for FAIR-by-Design Learning Materials (1.2). Zenodo. https://doi.org/10.5281/zenodo.7875541

[11] terms4FAIRskills (tf4s) https://www.ebi.ac.uk/ols4/ontologies/t4fs

[12] CSCCE Glossary of Skills Wheel terms: https://www.cscce.org/resources/glossary/

[13] FOSTER Open Science Taxonomy: https://www.fosteropenscience.eu/taxonomy/term/141

## 3.3 Catalogue metadata and platform sources

Minimum Viable Skillsets are learning resources in their own right, as they aim to help all those involved in designing courses or curricula for OS roles to identify the scope of he learning objectives of these.  As such, the MVS need to be catalogued with appropriate metadata to make them FAIR.

Key sources of metadata to make learning resources FAIR are reviewed in the Skills4EOSC FAIR by Design Methodology,[7] and for this purpose the minimal metadata for learning resources identified by the RDA Interest Group on Education and Training in Handling Research Data (ETHRD-IG) was selected.[14] The RDA ETHRD-IG metadata comprises the set of recommended elements in Table 2, which defines how they are applied to the MVS.

| Element Name | RDA ETHRD-IG Definition | Application to MVS |
|---|---|---|
| Title | The human readable name of the resource. | MVS title e.g. 'Minimum Viable Skillset for Data Stewards' |
| Abstract / Description | A brief synopsis about or description of the learning resource. | Abstract of the MVS |
| Author(s) | Name of entity(ies) authoring the resource. | Authors contributing to the MVS |
| Primary Language | Language in which the resource was originally published or made available. | Language the MVS is published in. |
| Keyword(s) | Keywords or tags used to describe the resource. | Open Science Skills Terms |
| License | A license document that applies to this content, typically indicated by URL | CC-BY-4.0 |
| Version Date | Version date for the most recently published or broadcast resource. | Version date of the MVS |
| URL to Resource | URL that resolves to the learning resource or to a "landing page" for the resource that contains important contextual information including the direct resolvable link to the resource, if applicable. | DOI link in MVS Catalogue (Zenodo collection) |
| Resource URL Type | Designation of the identifier scheme  used for the resource URL, e.g., DOI, ARK, Handle. | DOI |
| Target Group (Audience) | Principal users(s) for which the resource was designed. | Trainers and educators |
| Learning Resource Type | The predominant type or kind that characterizes the learning resource. | Curricular resource |

| | | |
|---|---|---|
| Learning Outcome | Descriptions of what knowledge, skills or abilities a learner should acquire on completion of the resource. | Knowledge of key topics to cover in developing the competences of a role involved in performing or supporting Open Science |
| Access Cost | Access cost: Choice stating whether or not there is a fee for use of the resource (CV = Y/N/Maybe | N |
| Expertise (Skill) Level | Target skill level in the topic being taught; example values include: beginner, intermediate, advanced. | Beginner |

**Table 2 Catalogue metadata for MVS**

The first iteration of the MVS catalogue is quite basic: a Zenodo collection consisting of each MVS created in months 4 to 9 of the Skills4EOSC project. Section 5 of this report includes plans to assess alternative platforms.

# 4. MVS Co-creation Approach

## 4.1 Methodology to co-create a MVS Profile

The process followed by Skills4EOSC is a straightforward collaborative authoring and publication process,  outlined below as a guide for others interested in applying the approach.
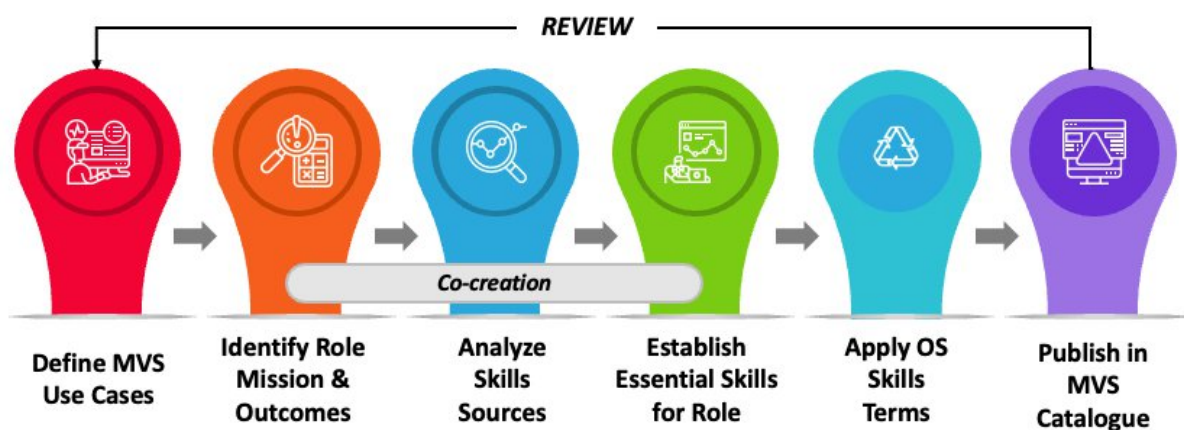


**Figure 5. MVS publication steps**

A. **Define MVS use cases**

The use cases may vary according to the role(s) the MVS are to be developed for, and the intended users of the MVS (e.g., trainers or managers of the roles).

B. **Identify the role's expected mission and outcomes**

For Skills4EOSC, the mission and outcomes relate to Open Science and are expressed in very generic terms. They may also be specified at a more granular level to fit national, regional, sectoral, domain or other organisational requirements.

C. **Analyse skills sources to identify role activities and competences**

The MVS design provides a model defining elements and properties (Appendix A in the Annex to the report). These elements provide a minimal classification scheme for analysis literature sources. The Skills4EOSC bibliography 15 is available for reuse and includes competence frameworks, reports on skill requirements and related literature. For other roles, it may also be helpful to

---

[15] Skills4EOSC Zotero Group for Skills landscape sources:
https://www.zotero.org/groups/4892313/task_2.1_landscaping_and_mapping_skills_to_professional_profiles?token=500yajsc5n4wjejpu2dtzkc49raojm9swzlls8ws

collect and review job descriptions, e. g. if there is insufficient recent literature available to describe skills requirements for the role in question.

### D. Establish 'essential skills' needed to deliver intended outcomes

Skills4EOSC established an editorial group to draft each MVS, where possible including at least one author who expects to use the MVS in their practice as a trainer or curriculum developer.  Successive drafts were reviewed and critiqued, with each iteration broadening the range of actors whose comments were sought. The first target group were intended users of the MVS, in each case a different group of course and curriculum developers within Skills4EOSC Work Packages. The next targets were selected 'critical friends' among stakeholders we anticipated would be interested in contributing. Several MVS were also shared publicly, as described below in the next section.

### E. Summarise the MVS using Open Science Skills Terms

Adding classification terms from an Open Science Skills taxonomy, plus standard metadata terms applicable to learning resources, will contribute to the MVS becoming a FAIR resource, i. e. Findable and Reusable by its intended audience.

At time of writing the Skills4EOSC Open Science Skills Taxonomy has had limited development. As mentioned previously, it currently comprises selected terms from the t4fs (terms for FAIR skills) ontology, and from a glossary for Science Community managers. and as a first step is applied to the Summary MVS for Data Stewards.

Applying the taxonomy terms is a straightforward process involving the following steps:
1. Identify which bullet-point statements the terms are to be applied to. This should be the 'essential skills and competences' in the MVS. Optionally the 'activities' these relate to can be included, e.g. If they may clarify which terms apply.
2. For each statement, select up to 5 terms from the list and copy them to columns in a table, each column representing one of 5 dimensions of OS Skills (technology, domain, interpersonal, communication, leadership). The relevant terms will probably be spread across more than one of the dimensions.
3. Count the number of terms that have been applied in each column (dimension), and based on their relative frequency classify the skillset's overall relevance to each dimension as 'high', 'medium' or 'low'.
4. Produce a visualisation of the OS skills scope, showing the relevance to each dimension.

5. Compile a table listing the terms selected for each dimension, copy these terms to the MVS Profile, and include links to the definitions given in the terminology sources (t4FS, or CSCCE Glossary).
6. Review the selected terms against the MVS Profile 'essential skills and competences' statements to consider rewording them, e.g. if selected terms are only implicit and can be made explicit.

F. **Publish in MVS catalogue**

The MVS Catalogue is currently a document collection in the Zenodo repository, maintained by the Skills4EOSC project. We encourage interested groups to submit MVS for additional roles (or variations of those already published). Skills4EOSC will add to the collection following a lightweight editorial check that the text fulfils the following criteria.

- Content accurately reflects one or more dimensions of the OS definition applied by the EC to its Horizon Europe programme
- Written using clear language,
- Coherently structured content for all elements of the MVS,
- Sufficient context for the reader to identify the type of organisation or research community the MVS is applicable to,
- Contains a reference list of relevant sources used,
- Has been been reviewed by a user group e.g. trainers or curriculum developers, and considered suitable for the intended use case(s).

## 4.2 Co-creation process so far

Skills4EOSC actively engaged in extensive outreach activities to gather input from the wider community of interest in EOSC skills development. This involved consultation with other work packages in the project, plus external groups. By adopting a well-defined co-creation procedure, Skills4EOSC ensured the production of project outcomes that were informed by diverse perspectives.

The consultation process began at the consortium level, where feedback was collected from tasks and work packages. Once this feedback was incorporated, a public version of the output was shared with relevant key stakeholders. To kickstart the process, internal meetings were held with various work packages, particularly WP3, focused on "OS training for evidence-based policy and public administration." These meetings aimed to define and discuss the Minimum Viable Skillset (MVS) for Policymakers and share the MVS approach. Additionally, continuous consultation with the ELSI WP ensured the inclusion of ELSI skills for each profile, leading to the creation of separate profiles for legal experts and data ethicists/ethics advisors.

Having consolidated a first draft of the Open Science Career Profiles and MVS, which was released and published on Zenodo[16] at the end of February, Skills4EOSC launched a community review[17], to reach a project milestone. The paper provided a definition and template for the MVS, along with an initial example for policymakers. Feedback on the MVS approach, examples, and priorities for further profiles was collected through a questionnaire on EU Survey[18]. Stakeholders responded to the questionnaire by March 31, 2023.

To ensure a comprehensive consultation, Skills4EOSC reached out to various organisations and channels, including EOSC Forum, the EOSC Task Forces[19] 'Upskilling Countries to engage in EOSC', 'Data Stewardship Curricula and Career Paths' and 'The Research careers, recognition and credit'. Also consulted were the Community of Practice for Training Coordinators (CoP)[20], RDA ETHRD IG focus group[21], JRC community of trainers[22], ORCC, and FAIR-IMPACT coordinator. These engagements aimed to gather valuable insights and perspectives from a well-informed experts.

The consultation process resulted in 11 responses, which played a significant role in determining the prioritisation of MVS profiles. The feedback received from the intended users and stakeholders was carefully considered, leading to the establishment of the following MVS priorities:

- Very high priority: Data Steward/Curator, Researcher, RI Manager
- High priority: Policymaker (Open Science and Research-informed), Principal Investigator (Senior Researcher), Lab Coordinator, Data Manager, RDM Coordinator, Scholarly Communications Professional, Research Software Engineer, Data Scientist, Data Analyst, Data Engineer, User Support Professional, Research Manager
- Moderate priority: Knowledge Broker, Civil Servant

One respondent commented that the MVS Profiles were too long. The MVS Summary format, with 'OS Skills Scope' illustration and table of keywords, is partly a response to that. As such, this report is the first opportunity to share this format. The example for Data Stewards demonstrates than an MVS can convey essential details in a single page format for ease of presentation.

---

[16] https://zenodo.org/record/7686263#.ZGZE73ZByUk

[17] See the section in the project's web site: https://www.skills4eosc.eu/participate/materials-for-community-review

[18] https://ec.europa.eu/eusurvey/runner/b5b03d28-733c-b791-5852-2435c0f02623

[19] https://eosc.eu/eosc-task-forces

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

[21] https://www.rd-alliance.org/group/education-and-training-handling-research-data-ig/post/rda-ethrd-ig-focus-group-training

[22] https://knowledge4policy.ec.europa.eu/home_en

# 5. Next Steps

## 5.1 Further develop the OS Skills Terms and MVS Summaries

Initial steps towards building on the terms4FAIRskills ontology have been taken, by selecting terms currently within that ontology, supplemented by the CCSE Glossary. The  been applied to the Data Stewards MVS, as a first step towards an OS Skills Taxonomy for roles and skillsets within the project scope.  The results suggest that some aspects of the Data Stewards skillset are under-represented, including terms within the following broad headings:-

- Data policy development
- Research software engineering
- Critical and analytical thinking

To address these and other potential gaps, a more comprehensive OS Skills Taxonomy needs to draw on other sources that define terminology for Open Science (e.g. FOSTER). Skills4EOSC aims to advance this OS Taxonomy through steps to:-

- Further evaluate the relevance of terms applied to the Data Steward MVS, and the reliability of their application across individual indexers.
- Apply the MVS Summary format (OS skills scope and key topics) to the remaining MVS Profiles in the current Catalogue, with further internal review and external feedback.
- Engage with ongoing initiatives in this area e.g., terms4FAIRskills, CODATA, and Software Sustainability Institute, to Integrate the current terms with further FAIR semantic resources.

## 5.2 Recommend MVS proficiency levels

The MVS design in Appendix 2 includes recommended proficiency levels (basic, intermediate, or advanced). The intention is to identify these for each of the essential skills and competences stated in each MVS. The next iteration of the current MVS will include these recommended levels, based on further dialogue between Work Package 2, as 'provider' of the profiles, and the 'consumer' work packages that are using the MVS to define courses and curricula.

## 5.3 Produce MVS variations

The current MVS listed in Table 3 include several with variations for different career stage or role. The MVS documents are provided in the Annex to this report, and will be accessible from the Zenodo collection 'Open Science Minimum Viable Skillsets'.  Metadata for each MVS is available in the corresponding Zenodo record.

| MVS Title (Role) |
| --- |
| Undergraduate student |
| Masters student |
| Early Career Researcher |
| Senior Researcher |
| Data Stewards - Coordinator, Embedded |
| Policymakers - Research policy, Evidence-based policymaker |
| Knowledge Broker |
| Civil Servant |
| Research Infrastructure Professional |
| Legal Expert |
| Ethics Advisor |

**Table 3. Current MVS catalogue entries, with variations**

The current MVS Profiles will also be expanded to include further senior-level roles (e. g. Senior Data Steward). Further work is also proposed on variations for several domains involved in Skills4EOSC (e. g. Humanities, Physics), and a further cross-domain role (Scholarly Communications Specialist).

## 5.4 Co-creation call

Based on this initial set of entries in the MVS Catalogue, Skills4EOSC plans to issue a non-funded call for organisations and initiatives to describe MVS for further roles, or to define new variations of those included in the initial catalogue. Skills4EOSC will proactively seek collaboration on the following roles that are not included in the current set, and which our consultation survey identified as high priorities:

- Data Analyst
- Digital Preservation Specialist
- Data Engineer
- Research Manager
- Research Software Engineer (RSE), and Senior RSE
- Scholarly Communications Professional

Skills4EOSC will explore further possibilities to work with organisations and initiatives in years 2 and 3 of the project, on both of the following,

- Adopting MVS from the current set as a basis for job profiles and case studies of individuals working in roles covered by the current set.
- Adapting the current MVS to organisations' more specific needs e. g., to plan and monitor skills development.

The MVS catalogue will be further developed incrementally and an update of this report provided in February 2025, Month 30 of the Skills4EOSC project.

# Appendix I. MVS Design

The MVS are structured around four core elements or concepts that have been the subject of recent work to build skills for FAIR and Open Science, in the EOSC context and internationally. These are shown in Figure 1 and described further in Table 1.
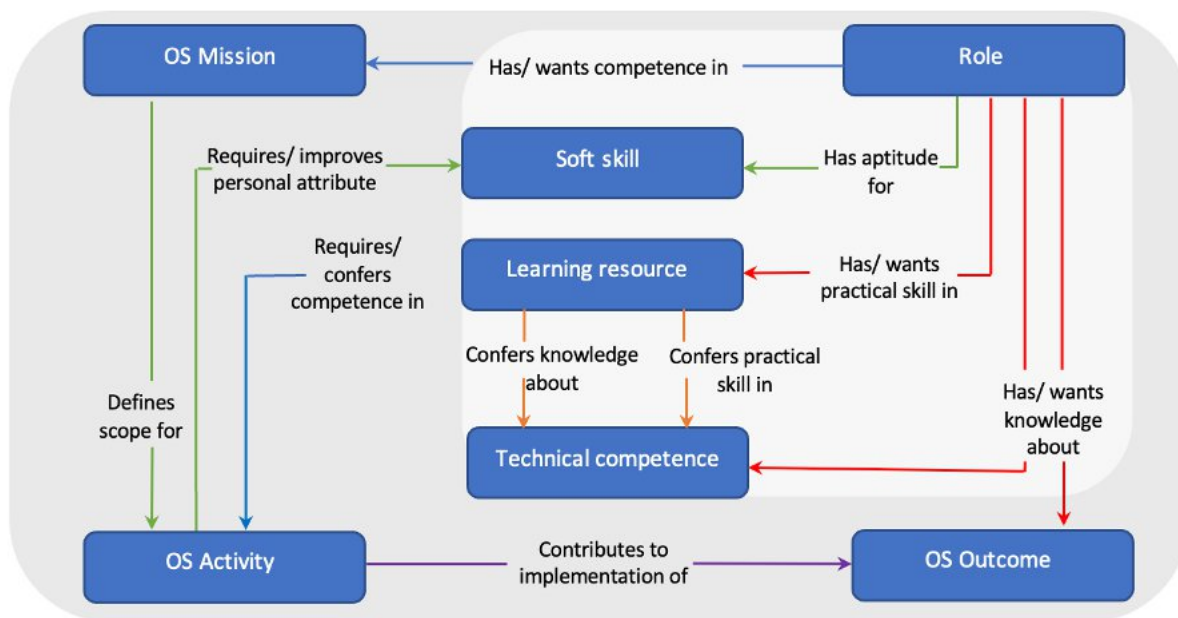


Figure A1. Elements and Properties of a Minimum Viable Skillset

| Definition | Min-Max (guideline) | Word length |
|---|---|---|
| Role: label summarising a mission that contributes to Open Science activities or outcomes, plus bullet-points listing kinds of organisation expected to fulfil these. | 1 * per MVS | 1-5 |
| Mission: description of a role's scope or responsibility for performing activities leading to an OS Outcome, on behalf of a competence centre, organisation, or community. | 1 per MVS | 10-50 |
| OS Activity: set of actions involved in performing essential skills and competences | 3-9 per MVS | 10-20 |
| Essential skill or competence: statement describing either: Soft skill: personal attribute or aptitude required for the interpersonal, communication, or leadership dimensions of an activity, and which are improved with practice in the activity. Technical competence: knowledge or skill required for the technology or domain-related dimensions of an activity, | 3-9 per MVS | 5-20 |

| | | |
|---|---|---|
| including its legal, ethical and social aspects. | | |
| Learning resource: OS Skills term from published terminology, expressing the subject topic(s) of an essential skill or competence statement, at a level of granularity appropriate for a learning resource. | 1-5 per skill statement | 2-3 |
| OS Outcome: Open Science capability, output or objective that a role may contribute to the implementation of by carrying out OS activities. | 1-6 per MVS | 5-20 |

Table A1. Dictionary of MVS Elements

# Typologies: competences and career stages

## OS Competence dimensions

| | |
|---|---|
| Technology | Developing and implementing processes to support systematic sharing of knowledge and tools, including measures to ensure open access to all digital research outputs. |
| Domain | Planning and implementing processes based on domain standards to ensure that research practices meet legal and ethical obligations, and that research outputs are reproducible. |
| Interpersonal | Developing open cooperative working relationships to involve all relevant knowledge actors in the co- creation of R&I agendas and contents |
| Communication | Planning, creating, editing, and delivering information relating to Open Science practices or policies to all relevant knowledge actors |
| Leadership | Development, advocacy, and evaluation of open science practices in collaborative R&I projects, programmes, or services. |

Table A2.   Dimensions of Open Science Competences

## Proficiency levels
- Basic: awareness of the knowledge required to perform a skill
- Intermediate: ability to perform a skill confidently and routinely with little or no supervision.
- Advanced: ability to to supervise others in performing a skill, and to adapt the skill to meet complex and specialist needs.

## Career stages
1. Student: an undergraduate or graduate student undertaking a taught degree course at a recognised higher education institution.
2. Research Actor: performs research as a PhD student or post-doc, or supports the research process undertaken by others, e.g. by providing services, making policy for research, or making policies that are informed by research results.

3. Senior Research Actor: has responsibilities for supervising research or practitioners who support research, or for leading implementation of Open Science within and across organisations.

   Levels 2 and 3 are intended to be consistent with the R1-R2 and R3-R4 stages (respectively) of the European Framework for Research Careers. 23

## Notes

- Learning resource definition is from the Learning Resource Metadata Initiative (LRMI) https://www.dublincore.org/specifications/lrmi/lrmi_terms/2020-11-12/#LearningResource
- Relevant learning resources may be tagged/identified with the relevant MVS but they do not need to be listed in the MVS itself.
- The model in Figure A1 is based on terms4FAIRskills.  The main differences are as follows:
  - Mission is added, to be explicit about the scope of a role's function in relation to Open Science
  - Technical 'competence' is used instead of 'concept'
  - 'Open Science Outcome' instead of 'Data stewardship guideline'
  - Activities contribute to implementation of Outcomes
  - Learning 'resource' is used instead of 'medium'. This conceptually links the MVS to metadata standards for learning resources. The MVS identifies keywords terms for topics to enable the MVS to be used to find resources with matching terms in catalogues or registries that use the metadata standards (e. g. in EOSC portal).

---

23 European Commission DG Research & Innovation, (2011), Towards a European Framework for Research Careers
https://cdn5.euraxess.org/sites/default/files/policy_library/towards_a_european_framework_for_research_careers_final.pdf