

# A View on the Implementation of the European Open Science Cloud

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**Abstract.** This paper outlines the discussion and presents the main outcomes of two workshops held in Padova and Venice in August–September 2017 on Open Science and the European Open Science Cloud (EOSC) initiative. The paper describes the three layers on which EOSC is grounded: governance, service and data layer, and discusses the new emerging roles for researchers and research support services. Suggestions about the EOSC implementation at local level are given.

**Keywords.** European Open Science Cloud, Data Management Plan, FAIR Principles, Research Data Management, Research Policies

## Introduction

The European Commission is promoting the European Open Science Cloud (EOSC), a supporting environment for Open Science whose ultimate goal is the building of a federated, globally accessible environment where researchers, innovators, companies and citizens can publish, find and re-use each other's data and tools for research, innovation and educational purposes under well-defined and trusted conditions<sup>1</sup>.

According to the resolutions adopted so far, the EOSC is not an actual cloud service, but is based on the reengineering of existing e-infrastructures based on scientific data. As such, it is a bottom-up process based on existing and emerging elements in the Member States, with lightweight international guidance and governance and a large degree of freedom regarding practical implementation<sup>2</sup>. As research is not an individual task, but the result of a joint effort between research and research support, the EOSC implementation impacts the whole organization of any research institutions; in particular it requires a shift from vertical to horizontal thinking by integrating several skills and knowledge into a coordinate set of services.

The goal of this paper is to outline the discussion and to present the main outcomes of the workshop “*The European Open Science Cloud (EOSC) versus the single Research Institution. Drawing the scenario at local level*” held in Padova and the “*Workshop on Open Science*” held in Venice (August–September 2017) organized by the University of Padova, the Ca' Foscari University of Venice and the University of Vienna<sup>3</sup>.

The results of the workshops are discussed here together with the final recommendations about the implementation of an EOSC strategy at local level.

## 1. The European Open Science Cloud - Three Layers

The implementation foresees the development of three layers: a governance layer, a service layer and a data layer. The governance layer addresses the issues of policies, good governance, trust, legacy and sustainability; as noted above, it suggests a bottom-up strategy based on federation of existing infrastructures. The service layer supports the governance strategy in several directions: (1) research

<sup>1</sup> [http://ec.europa.eu/research/openscience/pdf/realising\\_the\\_european\\_open\\_science\\_cloud\\_2016.pdf](http://ec.europa.eu/research/openscience/pdf/realising_the_european_open_science_cloud_2016.pdf)

<sup>2</sup> <http://ec.europa.eu/research/openscience/index.cfm?pg=open-science-cloud>

<sup>3</sup> All documents are freely available at <https://hdl.handle.net/11168/11.334202>

support, legal and ethical issues, exploitation rights, statistics and analytics; (2) IPR protection, privacy and personal data protection; (3) big data processing and high-performance computing; (4) data storage, access and re-use; (5) data management plans; (6) terminology; (7) data exchange, integration and fusion across different disciplines. The data layer provides technical support in terms of data storage, manipulation, conversion, export and re-use, discovery strategies and cataloguing functions.

Different research areas have different demands about the amount of data; physics, life sciences and Earth sciences are the leading users with the most data intensive environments, while humanities and citizen science, at the other side of the range, are less demanding; such distribution justifies a high degree of flexibility in the organization of the research support systems, coherent with the approach suggested by the European Commission.

## 2. New Roles for Researchers and Research Support

To pave the way to the realization of EOSC at local level the Research Institution must provide a digital workflow to manage the research process and assure the convergence of knowledge into shared transversal services to support research. This organization is motivated by the idea that excellent research is possible only if accompanied by optimal research support.

A goal of this process is the offering of advice and the concrete monitoring on cost generation and development along the entire chain concerning data production, storage and reuse, e-infrastructures, human resources development, funding, services, timing. The key elements are:

- The digital workflow of research processes, to assure the compliance with the FAIR principles<sup>4</sup> required by the EOSC.
- Research data (RDM) management policies, regarding roles and responsibilities of researchers, research support entities and the institution, as well as good governance models<sup>5</sup>.
- Data management plans (DMP) defining data and all processes concerning their production, use and final reuse<sup>6</sup>. DMPs are structured guidelines (documents or online tools) that depict the entire lifeline of data. DMPs must assure that research data are traceable, available, authentic, citable, properly stored, and that they adhere to clearly defined legal parameters and appropriate safety measures governing subsequent use.
- A single reference point gathering transversal knowledge for research support involving a set of competences and skills (internal or/and outsourced). The reference point is intended to be a service (internal or external). In any case the reference point will be able to solve questions referring to shared services, central services and cross-disciplines services.

The implementation of the EOSC at a local level will improve the visibility and the attraction of the Research Institution, contributing to improve also its ranking. Research support entities will be called to play a major and strategic role in this process. The improved quality of training will attract further resources and more qualified personnel and students.

## 3. Conception and adoption of RDM Policies

RDM policies are key issues for the implementation of the EOSC Governance Layer. In this context we refer to the outputs and findings of the project LEARN and the results of the Italian working group *GDL-Dati della ricerca*<sup>5</sup>.

Policies concern: jurisdiction, intellectual property rights (IPR), handling of research data, responsibilities, rights, duties (e.g., “Researchers are responsible for...”, “the Research institution is responsible for...”), validity.

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<sup>4</sup> Findable, Accessible, Interoperable, Reusable/Reproducible <https://www.dtls.nl/fair-data/go-fair/>

<sup>5</sup> H2020 Project LEARN [www.learn-rdm.eu](http://www.learn-rdm.eu) and the results of the working group GDL-Dati della ricerca (Policies sulla gestione dei dati della ricerca [http://wikimedia.sp.unipi.it/index.php/OA\\_Italia/Risorse\\_sugli\\_open\\_research\\_data](http://wikimedia.sp.unipi.it/index.php/OA_Italia/Risorse_sugli_open_research_data))

<sup>6</sup> See: Model Policy for Research Data Management (RDM) at Research Institutions/Institutes, <http://learn-rdm.eu/wp-content/uploads/RDMToolkit.pdf>

Data management plans are the key elements of policies. They refer to description and management of information, the content acquired and generated by the projects and the context in which they are used. DMPs must be generated at the start of the project and may evolve into versions during the project development. They must address the following issues: making data findable, making data accessible, making data interoperable, increase data re-use, allocation of resources and data security.

The FAIR principles are the guiding elements in the conception of the DMPs<sup>7</sup>. Particular attention should be paid to the following issues: the management of resources (especially time), reproducibility and reusability of the produced data, the assignment of proper licenses, security (infrastructure and processes), compliance of legal and ethical issues.

At present, there are several models of DMPs available<sup>8</sup>, offered by the issuing institutions according to the domain research processes of the related disciplines. Therefore, the research workflow may have different expressions, e.g., depending on data formats, size, objectives, etc.<sup>9</sup>

#### **4. A set of recommendations for successful implementation of EOSC at the local level**

A bottom-up process grows and extends according to the dynamics of the organization's components, which are most often different in size, data usage, temporal scale, requirements and practices. Partial failures (or, worse, a complete failure) cannot be avoided, in principle, if the dynamics are left free to evolve independently. Hence, the importance of the governance layer is evident, and the Policies and DMPs are instruments effective only if properly driven by a common superior view, leading to an integration of bottom-up and top-down approaches<sup>10</sup>.

Precise recommendations, even if plausible in principle, should be considered more than practical guidelines, and a control must be exercised over them to ensure the successful implementation of a common EOSC strategy. From the workshops in Padova and Venice the following issues were emerging as primaries:

1. Enhance the shift of mentality from vertical based thinking to horizontal based thinking; create and offer new horizontal cross-disciplines services; make convergence of knowledge possible and gather efforts into Reference Points for research support.
2. Start policy development and alignment at all levels, and introduce especially RDM policies. As a further step generate and adopt Data Management Plans, supporting data stewardship<sup>11</sup>.
3. Acknowledge the increasing relevance of the roles of research support units versus the researcher community.
4. Get involved into the bottom-up processes of EOSC and participate to the networks and initiatives concerning the EOSC. Activate all stakeholders in your Research Institution for the realization of the EOSC.

#### **5. Conclusion**

The realization of the European Open Science Cloud will generate changes. The implementation of the EOSC at a local level will improve the visibility and the attraction of the Research Institution, contributing to improve also its ranking. Research Support entities will be called to play a major and strategic role in this process. It will be not easy but the sooner a Research Institution starts to adapt its organization, the sooner it will achieve the goal: EOSC is planned to be a tangible reality in 2018.

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<sup>7</sup> See also GO-FAIR <https://www.dtls.nl/fair-data/go-fair/>

<sup>8</sup> See DCC-DMP online, the template of the EC, national versions of DMP online, locally tailored versions, etc.

<sup>9</sup> Future developments foresee the creation of machine actionable plans, process management plans and data stewardship plans.

<sup>10</sup> See LIBER Statement on a European Open Science Cloud <http://libereurope.eu/wp-content/uploads/2015/11/Open-Cloud-Principles.pdf>

<sup>11</sup> See: Realising the European Open Science Cloud, [https://ec.europa.eu/research/openscience/pdf/realising\\_the\\_european\\_open\\_science\\_cloud\\_2016.pdf](https://ec.europa.eu/research/openscience/pdf/realising_the_european_open_science_cloud_2016.pdf)