



*With this paper, EGI proposes the **Open Science Commons** as a new approach to digital research, tackling policy challenges and embracing open science as a new paradigm for knowledge creation and collaboration.*

EGI invites organisations from the research landscape to join it in this journey to develop these concepts, and through them to advance the implementation of the European Research Area.

European policy context

The European Research Area (ERA) was endorsed by the European Council in 2000 [1] as a way to build “a unified research area open to the world based on the Internal Market, in which researchers, scientific knowledge and technology circulate freely and through which the Union and its Member States strengthen their scientific and technological bases, their competitiveness and their capacity to collectively address grand challenges” [2].

Several actions for the ERA implementation have been undertaken by many actors with the aim of increasing the performance of European research through mobility and cross-border cooperation. Examples are the establishment of the European Strategy Forum on Research Infrastructures (ESFRI) and the e-infrastructure development for connectivity, high performance, grid and cloud computing and data. These initiatives sought to unite major user communities to ensure their expansion to Research Infrastructures.

The 2013 White Paper [3] released by the European e-Infrastructure Reflection Group (e-IRG)

stated that “...Europe needs a single ‘e-Infrastructure Commons’ for knowledge, innovation and science, as a living ecosystem, which is open and accessible and continuously adapts to the changing requirements of research”, to support the ERA and the emerging ESFRI communities.

Since then, the rapid growth of scientific data has highlighted the need for an *open* approach as a core aspect of the ERA. In its Horizon 2020 consultation report on Open Infrastructures for Open Science, the European Commission concluded that “open data e-Infrastructures increase scope, depth and economies of scale of the scientific enterprise. They are catalysts of new and unexpected solutions to emerge by global and multidisciplinary research. They bridge the gap between scientists and the citizen and are enablers of trust in the scientific process” [4].

This vision implies a European dimension beyond national and regional approaches, and an increase in capacities and capabilities.

The problem in 2014

While many European programmes target 2020 as the deadline for new frameworks and services, the European Council has repeatedly called for the ERA to be established by 2014. We must recognise that despite major efforts by a broad range of groups, obstacles remain in place and more must be done. Regarding the services that will support European science as well as the e-Infrastructures and Research Infrastructures that serve them, we see a number of areas requiring urgent attention.

Lack and/or incomplete roadmaps for research- and e-Infrastructures. The establishment of roadmaps for Research- and e-Infrastructure at a national and European level is progressing at different speeds. Policies of access to the European research system are not homogeneous, services are not always available to the long-tail of science, and knowledge transfer is not yet a strategic mission of many public research organisations. This represents a risk to the coherence of the European-scale initiatives. For example: with inconsistency in access policies, countries may find their national research communities excluded from crucial European-wide services. Shared understanding of the strategic objectives, the alignment of national strategies and to proceed faster in the development of the national policies are recognised by the European Council as necessary steps in [5]: *“the Member States should accelerate national reforms, where necessary, to boost the EU’s potential in research, development and innovation”*.

The lack of alignment in policies hinders the sustainability of e-Infrastructures of European dimension. A consensus solution would offer them the certainty of a long-term commitment to allow

for the construction of technical infrastructures and high-quality services.

Fragmented solutions and policies for access to data and knowledge. Access to research data and existing bodies of knowledge has moved towards openness, but has not yet achieved it. Efforts to support Open Access are hugely beneficial, but the scientific publishing sector is still adjusting to the evolution towards openness. The resulting inconsistency restricts exploitation of research results.

Insufficient cooperation between public and private sector. There is a general agreement amongst research communities and e-Infrastructure providers that working with the private sector is desirable. However, the mechanisms and models of engagement are not yet well understood, due to a range of technical and cultural factors. Steps such as SME instruments in Horizon 2020 have been broadly appreciated, but many challenges remain, due to different local strategies, restrictions in policies and insufficient European coordination of existing efforts.

Lack of national and European organization between all stakeholders. While the vision of the e-Infrastructure commons has been embraced by many groups, the sector remains fragmented and includes too many narrowly focussed services based on closed platforms that limit the portability of data, applications and knowledge. Also, we are still missing a common body of knowledge and a coordinated broad programme for knowledge transfer, including the private sector and the long-tail of science, providing a barrier to entry for the

emerging research infrastructures, skills and professions.

Today, services are provided by a broad range of sector-based, national and pan-European providers, which grew in different ways. They have worked hard on interaction and interoperability in recent years but this does not provide the optimal return on investment for national and European funds used to support services.

As digital science services such as e-Infrastructures move toward sustainable operating models, the need for coordination and coherence is rapidly increasing.

Many providers without a single market. Despite some efforts we lack a single portfolio of services

to provide a ‘backbone’ of European ICT capabilities. The existing offering is fragmented, with different policies of access and different channels for engagement with the user community. The lack of an established national Research- and e-Infrastructure component in some countries even prevents the access to the existing services. Such European-scale coherency must be achieved to make the ERA a reality, and progress towards it must be rapidly increased. Insufficient competition in national research systems, barriers to pan-European cooperation and restricted circulation of and uneven access to scientific knowledge are also recognized as issues by the ERA implementation assessment [6].

The Open Science Commons

EGI proposes a new vision to address policy and organisational aspects, the sustainability and the access policies of all components of the ERA.

Open Science Commons Vision

Researchers from all disciplines have easy, integrated and open access to the advanced digital services, scientific instruments, data, knowledge and expertise they need to collaborate to achieve excellence in science, research and innovation.

This paper suggests the Open Science Commons as an overarching policy designed to overcome the barriers preventing the implementation of the ERA. The Open Science Commons seeks to encompass all the elements required for a functioning ERA: **research data**, **scientific instrumentation** (such as the Large Hadron Collider or Square Kilometre Array), **ICT services** (connectivity, computing, platforms and research-specific services such as portals), and **knowledge**. The Open Science Commons evolves from two pre-existing and broadly accepted ideas:

Open Science (also referred as Science 2.0 [7]) for the opening of knowledge creation and dissemination to a multitude of stakeholders, including society in general. Open Science supports multiple perspectives, from infrastructure-orientated views seeking to increase efficiency through better tools and services, to public-orientated views trying to ensure citizens have access to scientific knowledge [8].

A **Commons** to reinforce the need of sharing within a community in a way that allows non-discriminatory access, while ensuring adequate

controls to avoid congestion or depletion when the capacity is limited [9]. The Commons concept is embedded in Open Science, which stresses cooperation to reduce barriers to collaboration, knowledge transfer and sharing of results. In the last decade, this has been driven by the digitalisation of the research process and by the globalisation of the scientific communities. Infrastructures often generate spill overs that result in large social gains and it is recognised that applying commons management principles maximise such benefits.

We argue that using Open Science as a guideline and applying the Commons as a management principle, will bring numerous benefits for the research community, and society at large.

The Open Science Commons relies on **four pillars**, representing a wide range of groups, providers and community types:

Data. The data that is the subject matter for research. It should be dealt with according to the principles of open access and open science, while maintaining trust and privacy for researchers.

e-Infrastructures. The technology and technical services supporting researchers, building towards integrated services and interoperable infrastructures across Europe and the world.

Scientific instruments. The equipment and collaborations which generate scientific data, from small-scale lab machines to global collaborations around massive facilities.

Knowledge. The human networks, understanding and material capturing skills and experience required to carry out open science using the three other pillars.

In the following table, we present the principles of a commons and how they apply in the area of Open Science.

Principle of Commons	What it means to the Open Science Commons
Shared resources	Research data, scientific instruments, digital services (including those for data-intensive science), software, written knowledge (e.g., scientific publications, educational and training resources), expertise from people.
Access rights Collective rights, access with no central authority	Access modes are well defined and non-discriminatory for all members of the ERA (e.g. [10] for research infrastructure).
Policies Community-based rules and procedures in place with built-in incentives for responsible use, right of access to all according to established community policies	Harmonised access policies, based on one market, clear points of access and support, integrated body of policies for access and use.

<p>Management Community management of communal services and resources</p>	<p>Formally managed services using transparent methods to maintain service access and quality. Management spans organisations to support collaboratively-provided services and is intended to support provision of long-term, high-quality services.</p>
<p>Governance The community of individuals building the commons can intervene in the governing of their interaction processes and of their shared resources.</p>	<p>Governance model with multiple stakeholders, including research communities as producers of knowledge and data, scientific infrastructures, resource providers, national and European infrastructures, and providers or the platforms that enable national and Europe-wide sharing (e.g. open source software repositories, training marketplace, service marketplace, identity providers).</p>
<p>Stewardship Long-term, persistent care for a given resource for the benefit of oneself and others (including the resource itself) and collective trusteeship. Caring for the commons means more than just regulating. Caretakers are needed, that is, a system nurturing societal cooperation, sharing of goods and thoughtfulness of generations to come. It entails establishing norms that reduce free riding and hold communities together (community building).</p>	<p>Long-term support of funding agencies to allow for infrastructures to take a long-term view and build for a common European future. A framework of policies and support allows for the growth and development of e-Infrastructure capacity and capabilities. Active maintenance of open science resources, such as technical development, certification of data repositories, and maintenance of training and education programmes. Active effort to increase the amount and quality of knowledge held by the community on required topics such as data preservation, curation and sharing. Regional and national scientific instrumentations are accessible to all, for creation of knowledge, reuse of research outputs and new ways to create scientific data.</p>

Benefits of the Open Science Commons

Managing shared resources as a Commons maximises benefits for society. In the area of digital infrastructure, this has already demonstrated great benefits (the Internet itself is an example). Applying this principle to the Open Science process is expected to improve the stewardship from the funding agencies in

collaboration with the stakeholders through mechanisms such as public consultations, to increase the perception of shared ownership of the infrastructures. It will also create clear and non-discriminatory access rules together with the sense of shared ownership stimulates a higher level of participation, cooperation and social reciprocity.

Recommendations

In order to move towards an Open Science Commons for the ERA, EGI has identified the following initial recommendations that apply to the digital part of the research process:

1. Holistic approach to knowledge, data, scientific instruments and e-Infrastructures implementation to ensure national and European cohesiveness, better community building, integrated service offerings to create a coherent European research

system built of national components. This requires the harmonisation of the research and e-Infrastructure components at national and European levels, including policies for access and use.

Benefits: the entire research system is accessible without discrimination.

2. Coordination of the research and e-Infrastructure efforts and developments both at national and European levels to reduce the risk of duplications or diverging components. This should lead to the identification and reinforcement of a set of backbone capabilities.

Benefits: efficient spending, streamlined set of backbone capabilities on which domain-specific research infrastructures can build upon.

3. Development of a common approach to the sustainability of Research Infrastructures and e-Infrastructures of European relevance that are financially supported by the relevant national and European funding agencies to develop the needed capacity to serve the ERA

Benefits: persistent services to the ERA, coordinated procurement and provisioning, available capacity to serve the demand.

4. Opening and integration of SMEs and industry in the research and innovation value chain through a European coordination to harmonise the scattered initiatives undertaken at national level. This needs a revision of the barriers in policies for service and knowledge exchange between the private and public sector.

Benefits: increased competitiveness of the EU economy, growth of jobs, more resources for research.

5. Expand in scope and integrate the network of Centres of Excellence for wider access to knowledge and expertise to train, educate and consult researchers in specific problems cutting across e-Infrastructures and research infrastructures.

Benefits: accelerated skills and capability development.

Participate in shaping the future of the Open Science Commons

This document is the first public version of the motivations, vision and actions for an Open Science Commons for the ERA. EGI invites all interested stakeholders to participate in the discussion and co-create the future of the scientific process in the digital age together. The interest of EGI is to build a community that supports a shared Open Science Commons vision, and actively contributes to its implementation.

We welcome you to engage in the discussion by providing your expression of interest and feedback to: policy@egi.eu

The feedback received will be used to jointly advance the current vision. A workshop with all interested players will be organised in Spring 2015 to define an implementation roadmap and concrete actions.

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Colophon

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Authors:

Sergio Andreozzi, Owen Appleton, Sara Coelho, Tiziana Ferrari, Sy Holsinger, Yannick Legré.

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