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**ITALIAN NATIONAL PLAN FOR
OPEN SCIENCE**

Courtesy translation: in case of discrepancy between the Italian language original text and the English language translation, the Italian version shall prevail.



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OPEN SCIENCE: WHY

Open science is an approach to the scientific research process based on collaboration, open and timely sharing of results, new ways of disseminating knowledge leveraging online digital technology, and transparent methods of validation and evaluation of research results.

Open science increases the effectiveness of collaborative work and ensures that research results can be reproduced. It increases collaboration possibilities, by ensuring the access to research data and their reuse for new analysis, also in interdisciplinary projects and for training purposes. At the same time, the open science improves the usability of scientific knowledge by making it more transparent, to the benefit of the whole society.

An open access to scientific information means the possibility of sourcing online scientific publications, data and all other results of scientific research and teaching, together with the metadata that make them usable, at no cost to the user and without legal or technical barriers.

The funding principles of open science are:

- knowledge as a common good;
- collaboration and solidarity among scientists, fairness and inclusion;
- transparency of the processes and acknowledgment of the contributions for the creation and validation of scientific results;
- free availability of research results and learning materials, with the rights to reuse them to the benefit of society, innovation and citizen science;
- scientific rigour, reproducibility of experimental results, critical assessment of data, information and knowledge made accessible online.

Open science produces a greater return on investment in public research and wider impact on society as a whole, through:

- faster knowledge and learning. The free and timely access to research results; the rights and the tools for reusing research and academic results (publications, data, software and licences) and the support to collaboration are all prerequisites for a faster progress;
- new facilities for interdisciplinary and multidisciplinary research as needed to address global challenges and the “missions” of the Horizon Europe (HEU)¹ framework programme;
- the timely verifiability by the scientific community of new shared results, and of their reproducibility, in an open and transparent way;
- the integrity and quality of scientific communication, as based on accessible results, fostering a more participatory society;
- the reuse of available publications, data, software and protocols;
- innovation based on all scientific discoveries, even the most recent ones;
- fair development of the potential of all researchers by creating equal opportunities for access to publications, data and other results, regardless of nationality or institutional affiliation;
- an enlarged access to educational and training resources.

¹ Horizon Europe https://ec.europa.eu/info/horizon-europe_en



THE CONTEXT

Openness as a scientific paradigm

The printing press was key in the establishment of modern science as it facilitated the communication of results among scientists. Over time, the choice to publish opened up to a growing and diverse audience people (scientists or ordinary citizens) and the dissemination of knowledge enabled reviews and critical scrutiny (peer review). In the same way, the world-wide web, which is so well-rooted in all cultural and economic activities, has the same potential to boost shared research processes among scientists, who can also collaborate from everywhere in the world. To date, however, economic, legal and cultural barriers are preventing the majority of researchers and citizens from accessing the methodology and results of research as well as online teaching resources. The open science approach can break down the barriers **existing barriers between scientists from developing and developed countries** or that divide scientists from citizens, or teachers from students, as well as the disciplinary silos. The evolution of high-data-flow observational and experimental methods poses important challenges to the openness, transparency and effectiveness of sharing them. It also introduces an unlimited number of possibilities for research and innovation. The online availability of texts and data generated by experiments, observations, surveys, numerical simulations and computational science according to the open science and open access to FAIR (Findable, Accessible, Interoperable and Reusable) data, will lead to the development of new analysis tools, both for final and partial results, thus opening up new horizons of knowledge, also enhancing multi- and interdisciplinarity.

Tools for the implementation of open science

Open science will stimulate the development and the consolidation of new methodologies thanks to the timely availability and reuse of research data, texts, protocols, practices, instrumentation and analytical software. As far as texts are concerned, open access should be reinforced with the proper legal rights for reuse, and promote new ways of publication such as, for example, platforms with open reviewing. As far as data are concerned, the FAIR criteria are the basis for the findability, accessibility and reuse of research results from different sources across thematic areas and methodologies, along with the appropriate rules and licences. FAIR data management should become a reference standard in the process of generating results in publicly funded research activities. Major changes are required in the complex dynamics that regulate the research sector. New technologies must be developed to facilitate the acquisition, automatized when possible, of FAIR datasets and their processing along with appropriate access and usage rules, in line with the ongoing developments of the European open science Cloud (EOSC)² initiative. Incentives and sustainability of a FAIR data policy must include new professional figures, capable of guaranteeing the quality of FAIR data processing, and related services. The creation of EOSC is based on the idea of federating the cutting-edge solutions in the open data management. This will be carried out in the framework of the EOSC Strategic Partnership of the HEU Framework Programme³. Italy has played a founding role in the EOSC initiative, which is one of the foundations for the development of open science and open access and to foster scientific collaboration at all levels.

The impact of open science

² The European open science Cloud (EOSC) is a virtual consolidated environment defined as a “web of data”, globally accessible, and regulated by precise conditions, in which researchers, innovators, private companies and citizens can publish, find and reuse each others’ data and tools for research, innovation and education purposes. Italy participates in the EOSC co-programmed Strategic Partnership of Horizon-Europe (HEU) and is a founding member of the EOSC Association AISBL. In addition, a Strategic Forum of Member Countries (EOSC Steering Board) will exercise a coherent guiding role in the framework of the European research area for the construction of the EOSC and for the convergence of related national policies.

³ <https://www.eosc.eu/partnership>



The expected impact from the adoption of the open science principles and the necessary implementation of the new methods and tools, will be pervasive in all aspects of the knowledge society and knowledge civilization. By making scientific research more efficient and collaborative, through the possibility of combining large amounts of data from different sources, it will become possible to carry out, in a transparent way, mission-oriented research as envisaged by HEU, to face the challenges of our planet and society. New transparent practices for the validation of research results as well as free and timely access to such resources with rights and tools for their reuse (publications, data, software, licences and educational material) will greatly facilitate the process of creating knowledge and enhance effective education. This will lead to progress in both science and education. Open science will create equal opportunities for all researchers, regardless of their nationality or institutional affiliation, and will promote the integrity of research and scientific communication. The potential impact of open science on innovation is also very high, both for the development of new products and services based on recent scientific discoveries and for the competitiveness of the national productive system.

The impact on society and on informed decision-making is even more significant. The difficult experience of managing the COVID-19 pandemic has dramatically highlighted how the limited access to publications, the lack of shared criteria for collecting useful data, and the ill-timed sharing of all epidemiological and clinical data prevents their integration with the laboratory results from the study of the virus and human genomes, and thus obstacles the development of robust hypotheses for the solution or mitigation of the phenomenon.

Open science and the EOSC foster the evolution of the European Research Area (ERA)⁴ and of the knowledge society, with the aim of maximising the use of the scientific knowledge generated with public resources by researchers of all disciplines, by economic and social operators, and by citizens.

The assessment of research will consequently have to identify new transparent criteria and methods, overcoming the current emphasis on the prestige of publishing companies and related bibliometrics, and enhancing the innovative practices of open science. Collaboration at the European level on aspects of research evaluation is being structured to develop a common reference basis within the framework of the new European Research Area (ERA).

STRUCTURE AND OBJECTIVES OF THE PLAN

The objective of this National Plan is to lay the foundations for the full implementation of open science in Italy, facilitating the transition toward an open, transparent, fair and inclusive research system, in which the scientific community regains control and ownership of the communication of research results, for the benefit of research itself and of society as a whole. The National Plan for open science is a key element of the National Research Program (PNR) and it is complementary to the National Research Infrastructure Plan (PNIR). The plan aims to create the conditions for Italy's full participation in European and international open science initiatives.

This is a programmatic document that:

- contributes to the implementation of open science as an overarching paradigm with specific strategies for the deeply interconnected aspects of research, aiming at creating an open ecosystem (publications, data, protocols and methods, software, analysis tools, infrastructures and education resources);
- ensures coordination and synergy among all the actors involved: Parliament and the Government, the national evaluation agency, the research infrastructures (IR), public research organisations and universities and the CUN, engaging all system on clear and measurable goals;
- defines the role that Italy must play at the European level on open science and in the framework of the EOSC initiative, highlighting national priorities and specificities;

⁴ https://ec.europa.eu/info/research-and-innovation/strategy/strategy-2020-2024/our-digital-future/era_en



- complies with the requirements of Commission Recommendation 790/2018 of the European Commission on access to scientific communication and its conservation in terms of coordination and strategy at national level on open science;
- emphasises the fundamental role of open research data in addressing the SARS-Cov-2 and COVID-19 pandemic as well as Italy's participation in the relevant European data-sharing platforms.

The National Open Science Plan is structured with five axes of action, centred on: open access to scientific publications; openness of research data in all fields of knowledge, online IT-service enabled collaboration; and on the engagement of researchers, public research institutions and infrastructures for the adoption of open science practices, validation and evaluation of research. All this in the fundamental conviction of the value of knowledge sharing at times of crisis, such as the current pandemic.

Each action is organised as:

- introduction of the specific goal;
- overview of the current situation;
- setting out the plan of actions to be developed within the framework of this plan, by 2027, and indicated the further long-term objectives, with recommendations for the actors involved;
- selection of a monitoring system.

The National open science Plan has a seven-year term. It will be periodically updated with the involvement of the research communities.

The Ministry of Universities and Research will supervise the implementation of the Plan with special measures to monitor the consistency of the initiatives proposed and provided by the scientific community with the objectives defined in the Plan.



AXES OF INTERVENTION

Italian National Plan for open science (2021 – 2027)	
Axes of intervention	Plan of intervention
1. Scientific Publications	<ul style="list-style-type: none"> ● Open access to publications ● Non-commercial forms of publications ● Regulatory framework on copyright ● Monitoring system ● Open Educational Resources
2. Research Data	<ul style="list-style-type: none"> ● FAIRification in the Italian research system ● Integration in EOSC ● Collaborative data production processes ● Training of technical staff
3. Research evaluation	<ul style="list-style-type: none"> ● Evaluation processes and criteria ● Collaboration among institutions and researchers ● To publish in open access ● Open peer review ● National infrastructure
4. Open science, the Scientific Community and European participation	<ul style="list-style-type: none"> ● Coherent process towards open science ● Coordination activities at European level
5. Opening of research data on Sars-Cov.2 and Covid-19	<ul style="list-style-type: none"> ● National portal for FAIR data and texts on Covid-19 ● Open data models on public health



1. SCIENTIFIC PUBLICATIONS

OBJECTIVES

- to provide immediate open access to publicly funded scientific publications [Rec. 790/2018 Art. 1]
- to encourage the use of non-commercial forms of open access publications [Rec. 790/2018 Art. 1]
- to provide Italy with an organic regulatory framework on copyright enabling open access to scientific publications [Rec. 790/2018 Art. 1]
- to establish an Italian monitoring system on the implementation of the open access principles to scientific publications [Rec. 790/2018 Art. 1]
- to rationalise, and give public evidence to subscriptions and contracts with scientific journals by public academies and research institutions [Rec. 790/2018 Art. 1]
- to promote and encourage the creation of Open Educational Resources

The Landscape

Open Access is “a fundamental element of Member States' policies that aims to ensure responsible research and innovation by making research results available to all, and encouraging the participation of society”, as recognised by Commission Recommendation 417 EU, of 17 July 2012 and as reaffirmed by the subsequent Recommendation 790 of the EU Commission of 25 April 2018 on access to and storage of scientific information.

The current scientific communication market harbours, in some important scientific areas, oligopolistic practices that undermine open science. Authors and reviewers are unpaid, and, with the free transfer of copyright, the editorial groups acquire total and lasting control of the publications. This oligopoly also determines an uncontrolled pricing policy for publications, which has reached unsustainable levels and makes the terms and clauses of subscriptions largely unapproachable by the public.

It is, therefore, necessary to introduce into fully transparent negotiations of subscriptions and contracts, a request for immediate open access to journals by publicly-funded academic and research institutions. Finally, it is necessary to support “open” non-commercial alternatives.

Currently, the two possibilities of publishing open access are submitting to open editorial offices (so-called Gold OA) and depositing the publications in open archives (so-called Green OA), which are nevertheless bound by copyright rules (embargo time).

Green deposit is free, while Gold journals can ask for Article Processing Charges (APCs). On the other hand, new forms of publication are emerging at the international level, which provides for an open review of the preprint accompanied by the data. The new Open Research Europe (ORE)⁵ platform will offer beneficiaries of H2020 projects and their collaborators a high-quality publishing option, with peer review service, at no cost. Such initiatives will make research results globally accessible to the scientific community, and to the society at large, in all areas of knowledge, without waste of results, and maximising the impact of public funding. Other publication means, such as monographs and volume contributions, that are typical of the humanities and social sciences, are evolving in a fragmented publishing landscape. Diverse quality levels and services are offered by both global oligopolists and small publishers. The obligation to publish and deposit, as established by the H2020 and HEU framework programmes, determines the need to adopt transformative contracts with

⁵ <https://open-research-europe.ec.europa.eu/>



commercial publishers⁶. Initiatives such as PlanS⁷ promote transparency on costs and prices and the preservation of rights by the author.

The open access ecosystem must focus on non-commercial publishing (e.g. journals managed by universities and research bodies or by national or European scientific associations; open access platforms; open access archives), also leveraging added value commercial services offered by small and medium-sized Italian and European publishing companies.

The principle of open access was born spontaneously within the scientific community, but today it is the subject of regulations and soft law at the international and national levels. The current regulatory framework, in particular copyright law, hinders the development of open access in scientific publications.

There are two priorities:

- a) To promote the inalienable and non-negotiable right of immediate republication (without embargo limits) for scientific publications partially or totally financed with public funds.
- b) To extend the scope of exceptions and limitations to copyright in the science domain. In particular, one needs to implement the EU Directive 2019/790 of the European Parliament and of the Council of Europe of 17 April 2019 on copyright and related rights in the digital single market. One must obtain an exception to allow reserved access to relevant publications for the purpose of carrying out evaluations of research as required by the Government.

Obligations to publish, as implied in research funding measures, must be supported by appropriate incentives to the beneficiary institution that bears the responsibility of implementing open access, as well as monitoring and sanctioning measures in the event of non-compliance with such obligation. A system for monitoring the degree of implementation of open access is needed and must be modelled according to the Digital Administration Code.

Open access is valuable not only for scientific research, but also for teaching. In Italy, the development of Open Educational Resources is still embryonic. Incentives must be introduced in the system to encourage universities to publish educational resources in open access (from traditional manuals, to hypertexts, to multimedia material used for teaching and learning), as well as to create a national infrastructure for remote learning. As a matter of fact, currently almost all Italian universities rely on platforms owned by large oligopolistic companies which in fact entails multiple risks (e.g. in terms of personal data protection, intellectual property protection, etc.).

The action plan

In order to obtain open access to scientific publications, the following recommendations are formulated:

- A. to include in all publicly funded research calls the obligation of open access (deposit or publication) for the produced articles and monographs and to implement adequate control mechanisms;
- B. to promote the interconnection of existing open archives and their interoperability at national and European level, e.g. with what has been developed by OpenAIRE⁸, and linking publications, projects and expertise;
- C. to foster the development of a national research data infrastructure implementing the open science Guidelines, suitable for all disciplines, and a public portal that will collect and make searchable and accessible the scientific production deposited in archives, while respecting copyright law. This will foster new sustainable textual research practices and will provide a transparent reference for evaluation

⁶ Transformative contracts stipulate that the amount paid to publishers must cover the costs of publication without taxing the reader, making scientific literature open.

⁷ PlanS is the initiative of a growing number of research funding bodies in Europe which provides, in addition to immediate open access starting from January 2020, collateral actions such as putting a cap on APCs, the use of free licenses and the maintenance of rights by the authors.

⁸ <https://www.openaire.eu/>



- exercises. Set up and maintain an open access institutional repository, or, alternatively, indicate a certified European repository consistent with purpose, that would guarantee the validation of the entered data, as well as the conservation and the interoperability with a national infrastructure, according to the MUR Guidelines (see point b.);
- D. to adopt open access policies that promote Green deposits and warrant reuse rights as well as free access;
 - E. to actively pursue the goals of open access publishing, favouring the Green deposit method;
 - F. to encourage researchers to the full use of ORCID-ID, and its functionalities for enabling and connecting services, linking also to citations;
 - G. to monitor the costs of open access publications, in particular the Article Processing Charges (APCs) and transfer these data to the Open APC⁹ project in order to sustain the entire open science communication system;
 - H. to support open citation initiatives such as I4OC¹⁰, in collaboration with Italian publishers.

2. SCIENTIFIC RESEARCH DATA

OBJECTIVES

- To contribute to the fulfilment of the FAIR data paradigm in the Italian research system, inherent to its integration in EOSC [Rec. 790/2018 Art. 6]
- To invest in the creation of new FAIR-by-design data tools with the automatic generation, where possible, of the metadata and of the appropriate contextual information that enables its search and reuse [Rec. 790/2018 Art. 3 and 4]
- To encourage collaborative production processes of data and other research results by offering open environments and services for their production, management, and use [Rec. 790/2018 Art. 5]
- To start the training of technical staff to support the management of research data [Rec. 790/2018 Art. 8]

The landscape

The standard condition for public research in Europe to receive funding is openness to the results achieved, in terms of open access publications, data, according to approved management plans (DMP-Data Management Plan) approved. The European Research Council provides a guide 'Open Research Data and Data Management Plans'¹¹ with specific guidelines for the implementation of specific thematic areas. HEU requires the DMP of

⁹ <https://openapc.net/>

¹⁰ The Initiative for Open Citations is a collaboration between scientific publishers, researchers and other stakeholders to promote the public availability of citational data from the scientific literature.

¹¹ https://erc.europa.eu/sites/default/files/document/file/ERC_info_document-Open_Research_Data_and_Data_Management_Plans.pdf



projects and provides a reference scheme¹². Science-Europe published a 'Practical Guide to the International Alignment of Research Data Management'¹³.

To foster the practices of open science, in the framework of the Strategic Partnership 2021-2027, the EOSC will create a virtual environment, which can be defined as a global “web of data”, with precise rules of participation and conditions, to provide services for European users in the fields of science and innovation. Academic institutions, organisations and European RIs (ESFRI, ERIC and national infrastructures with international users) will be asked to contribute to this “web of data” by making their data and services available. In this context, the Italian Computing and Data Infrastructure, (ICDI)¹⁴ was established to bring together the RIs operating in Italy, the EPRs, universities, and other institutional members, with the aim of coordinating the Italian contribution to the EOSC, also as mandatory organisation¹⁵ of the Government in the EOSC Association AISBL. The ICDI Competence-Centre together with the service www.Open-Science.it (ISTI-CNR, OpenAIRE) offer information and reference tools on Open Science addressed to the scientific community¹⁶.

The new data services will be shaped on interoperability and free access models (advanced software, Cloud distributed computing resources, High Power Computing and communication networks) also exploiting appropriate artificial intelligence solutions that will make data analysis and reuse possible. The initial stage will be the federation of services already offered by RIs and scientific data infrastructures operating in Europe. The goal is to realise a robust and sustainable system, impacting on all sectors of research and innovation.

Within a few years, today's volume of available FAIR data will be marginal compared to the volume of new generated data. It is necessary to develop a strategy for sourcing data that are FAIR from the acquisition stage (FAIR-by-design) in order for the open data space to grow at the pace of research, in a sustainable manner. FAIR-by-design involves the automation of the sourcing of metadata with new technologies, in all areas of research where this is possible, instrumental and infrastructural investments and the training of specific skills.

In this context, the objectives of the National open science Plan involve the entire research network, the RIs, the public research institutions (EPRs) and the universities:

- to adopt the necessary advanced management plan for research data and services to enable extracting knowledge from data and to support computing and network needs;
- to train and hire qualified human resources for the roles of Data Scientist, for the development of architectures and services, and of Data Steward, for the curation, description, identification and archiving of datasets;
- to adopt support measures for drafting Data Management Plans and for their effective implementation, including managing the legal aspects, and contributing to the EOSC implementation. The Data Management Plans (DMPs) adopted in Italy shall be aligned with the European and international ones as regards access and reuse, e.g. by implementing the EU Directive 2019/1024 of 20 June 2019 on the openness of data and the reuse of public sector information and, in particular art. 10, specifically on research data;
- to implement methods and protocols for verifying the quality of data, archives and services, and for the regulation of ethical and legal aspects;

¹² <https://www.google.com/search?client=firefox-b-d&q=data+management+plan+horizon+europe>

¹³ <https://www.scienceeurope.org/our-resources/practical-guide-to-the-international-alignment-of-research-data-management/>

¹⁴ <https://www.icdi.it/en/>

¹⁵ The mandated organisations, one per EU Member or Associate country, represent the contributions of the national scientific community in the EOSC Association AISBL.

¹⁶ <https://open-science.it/>



- to consider the creation of a national infrastructure for research data and archives, optimising existing resources and opening up new services to all organisations and disciplines also to enhance collaboration and interdisciplinarity.

The action plan

In order to enhance data assets and data services, and the Italian contribution to the construction of the EOSC, the following recommendations are formulated:

Responsibility of MUR (and of the other Ministries with research activities):

- a. to consolidate the survey, first launched by the EOSC (Landscape), on the state of the art of RIs, EPRs and universities with regard to FAIR data management practices and alignment with European and international DMPs;
- b. to strengthen ICDI in its role as mandated organisation within the EOSC Association;
- c. to insert the obligation to generate FAIR datasets to be stored in certified open archives, in all publicly funded research calls;
- d. to create university training courses for “data scientists” and “data stewards”, with European accreditation also by exploiting the skills of the RIs and EPRs;
- e. to capitalize on synergies between National and European RIs and existing services, and implement an investment plan in synergy with the EOSC architecture, to be also financially accountable as a national contribution to the Strategic Partnership;
- f. to implement art. 10 of EU Directive 2019/1024 of 20 June 2019 on the openness of data and the reuse of public sector information;
- g. to support the certification processes for FAIR data at a national level;
- h. to support investments for FAIR-by-design;
- i. to insert FAIR data production clauses in all calls for research projects;
- j. to provide the resources to cover related costs and include them within the eligible costs.
- k. to adopt an archive of reference data and data management policies, or check the alignment of existing ones with FAIR criteria, also in the perspective of certification;
- l. to publish yearly data and statistics about the status of implementation of FAIR principles and on the openness of data;
- m. to initiate basic training for all researchers and technologists on FAIR data management;
- n. to expand literacy in the use of research data to all training curricula;
- o. to invest in support services for the legal aspects of data management;
- p. to invest in data protection techniques applicable to long-term storage;
- q. to identify the NPR (National Points of Reference on Scientific Information).



3. RESEARCH EVALUATION

OBJECTIVES

- to make the evaluation processes and the data they are based on, more transparent
- to make the evaluation criteria more reliable and robust
- by including all the validated research results [Rec. 790/2018 art.9]
- by reducing the influence of bibliometric indicators referring to the publishing companies
- to implement evaluation criteria that encourage collaboration among institutions and among researchers [Rec. 790/2018 art.9]
- to publish in open access those research results that are subject to evaluation activity (e.g. VQR) [Rec. 790/2018 art.5]
- to apply forms of open peer review to all national assessment activities (e.g. VQR)
- to develop systems that guarantee the public availability of citation data from scientific literature
- to provide Italy with a national distributed infrastructure, building on the interconnection of existing open archives, to provide the basis of the Research Registry (ANPREPS) [Rec. 790/2018 art. 5 and 9]

The landscape

Research evaluation is necessary to steer investment of resources in a well-rooted manner, to assess the return on investment, and to make responsible use of public funds.

Open access to research results can be a contribution to strengthen the entire evaluation process, making it more transparent. Open science creates the conditions for a shared modification of the evaluation system¹⁷, expanding the concept of impact even beyond the academic perimeter.

At the European level (ERC, a number of major universities), there has been a move away from editorial impact indices in the evaluation of research projects and academic careers.

Within the framework of the renewed ERA, Member States and the European Commission are collaborating to define a new common basis for research evaluation.

The implementation of a national infrastructure for open science, starting with the interconnection of existing open archives, should make it possible to link publications, projects and expertise.

The action plan

The following recommendations are made as regards the research evaluation:

- a. to modify the rules of submission of the research products for national evaluation processes by requiring the deposit in an open access archive of all publications to be evaluated;
- b. to enlarge the evaluation criteria by reducing the weight of bibliometric indicators (Impact Factor, H-index) and by appropriately evaluating contributions to open science and Third Mission activities, in accordance with the evolution of these criteria in ERA;

¹⁷ Only some of the documents that agree on these issues are cited; the bibliographic references can be found in the Documents section: *San Francisco Declaration on Research Assessment (DORA)*; *Leiden manifesto for research metrics*; *Amsterdam Call for Action on open science*; *Future of scholarly publishing and scholarly communication*; *EUA Reflections on University Research Assessment: key concepts, issues and actors*; *Evaluation of research careers fully acknowledging open science practices*; *Next-generation metrics: Responsible metrics and evaluation for open science*.



- c. to develop, with the involvement of scientific communities, new criteria for assessing the impact of scientific results;
- d. to establish a national Research Registry;
- e. to adhere to the principles of the DORA Declaration, by aligning evaluation methods;
- f. to adapt the research evaluation criteria by inserting the production and protection of FAIR data and their services among the products to be evaluated;
- g. to acknowledge and reward open science good practices as evaluation criteria of Third Mission activities, also at the level of research or academic institutions.

4. OPEN SCIENCE, THE SCIENTIFIC COMMUNITY AND EUROPEAN PARTICIPATION

OBJECTIVES

- to promote open science activities [Rec. 790/2018 art. 1, 2 and 8]
- to coordinate and create synergies among the actors involved in defining a coherent process towards open science [Rec. 790/2018 Art. 10]
- to monitor at a national level the increase in open science activities [Rec. 790/2018 art. 1 and 3]
- to encourage and strengthen the Italian participation in the EOSC and the development of national initiatives converging to the EOSC [Rec. 790/2018 art. 6]
- to participate in coordination activities at European level [Rec. 790/2018 Art. 10 and 11]

The landscape

The EOSC will be a key reference and implementation tool for open science. Many Italian RIs, Electronic or Data Infrastructures, EPRs and Universities do participate in H2020 projects for the development of the EOSC and have joined, individually and/or in the frame of ICDI, the EOSC Association AISBL which will contribute to the construction of the EOSC as a member of the 2021-2027 Strategic Partnership.

The national coordination between the actors involved in the generation of FAIR scientific data, its protection and archiving, the use and reuse of data, training in open science and specialised professions for data, research evaluation agencies and academia, is of fundamental importance for optimising the process towards open science, to enhance Italy's contribution to the construction of the EOSC and to enhance the value of Italian research data. Support for the EOSC, the RIs and the entire national research system, must extend to the initiatives developed by informal coordination networks involving all research stakeholders.

It is also important to encourage coordination and discussion at a national level between the concerned players (RIs, EPRs, universities, AISA, IOSSG, APRE, CRUI and ANVUR) and, at European level, with the EOSC related initiatives.

Open science activities can be disseminated thanks to the involvement of the research communities who, progressively, align their work method to the new paradigm.

The universities might prepare an internal Roadmap, e.g. inspired by the model proposed by the League of European Research Universities (LERU)¹⁸.

Training plays a crucial role in open science and is a prerequisite for the full involvement of the national scientific community. New skills are needed to support the necessary developments for realising open science: from intellectual property to relevant regulations on ethical aspects and personal data protection (GDPR), technologies for the automatic generation of FAIR data, good data management practices, the transparency of the research process and its integrity and the reproducibility of results. A literacy process in the use of research

¹⁸ <https://www.leru.org/>



data must involve the entire training chain, from the first grades of school and university to permanent training and professional retraining initiatives.

The action plan

To ensure the involvement of communities and foster effective participation at European and international level, the following recommendations are proposed:

- a. to support the development of a national open science Monitor to aggregate data from individual institutions and track progress in the various sectors of open science;
- b. to perform communication activities on open science topics, initiatives and new standards being defined at European level (EOSC, ERA);
- c. to promote the alignment of open science rules and services adopting international and EOSC standards;
- d. to appoint the National Coordinator for open science as required by Recommendation 790/2018;
- e. to monitor and valorise Italian research in-kind contributions for EOSC development;
- f. to contribute to the training of young people on the logic and methods of open science and on the tools to use and practise it;
- g. to support initiatives for data literacy and open science in general for all the concerned actors.

5. OPENING OF RESEARCH DATA ON SARS-COV-2 AND COVID-19

OBJECTIVES

- to create a national portal for FAIR data and texts on COVID19, interoperable with European initiatives
- to explore innovative open data models on public health, to enhance research and provide a transparent and accessible basis of reference

The landscape

The onset of the COVID-19 pandemic impacting on health and economy of all populations and regions of the world, has provided full dramatic evidence on how the timely sharing of scientific knowledge and data on social and economic phenomena is essential to face such emergency, to understand its future implications and to develop models and technical solutions. A pandemic is an extreme example of a complex problem that requires access to widely different data, ranging from “omics” sequences and analyses, to bioinformatic tools, to clinical and epidemiological data, to sociological, economic and environmental data.

The restrictions on the mobility of researchers (a founding principle of the European Research Area) and the recourse to distance learning at all levels and grades of the educational system, has opened a flaw in the structure of research and training. The lack of adequate open science technology and culture is proving to be a bottleneck of our civilization when struggling to tackle problems of high complexity and to answer to anti-scientific reactions.

EOSC, in spring 2020, called for the creation of the European COVID-19 platform which makes “omics” data on the virus and its mutations and on the human genome easily accessible, bringing together the resources of the most advanced scientific communities in terms of data sharing and methods of analysis and calculation.

Other data are necessary for analysing the pandemic, e.g. data on the resistance to aggression by SARS-CoV-2 of different human phenotypes and clinical data, but these have not been made available at all, or non-reliably, due to a lack of advanced and shared standards, lack of sharing practices, and many barriers only marginally attributable to ethical and legal barriers.



In Italy, the availability of resources of the RIs of diverse thematic areas to support research on specific aspects of COVID-19 was quickly identified and made public, through ICDI and the ESFRI national delegation. An initiative was launched for the convergence towards the creation of an open catalogue of clinical data as well as of all publications on the subject.

The action plan

To ensure the involvement of the scientific and clinical communities and to integrate data on SARS-CoV-2 and COVID-19 with European open platforms, the following recommendations are made:

- a. to create a national COVID-19 data platform based on the model of, and interconnected with, the European one;
- b. to solicit the correct application of the regulations on the protection of personal data, for example the GDPR, so that it does not prevent the dissemination of anonymised data of relevance for the analysis of the pandemic and its social and economic implications;
- c. to test an open data model on public health on COVID-19, to be extended to other aspects to enhance research and establish a transparent and accessible reference database;
- d. to introduce training on the structuring of FAIR data also in civil service contexts.

GLOSSARY

AISA— Associazione Italiana per la Promozione della Scienza Aperta (Italian Association for the Promotion of open science)

ANPREPS— Anagrafe nominativa dei professori ordinari e associati e dei ricercatori (Registry of names of full and associate Professors and researchers)

ANVUR— Agenzia nazionale di valutazione del sistema universitario e della ricerca (National agency for the evaluation of the university and research system)

APC—Article Processing Charges

Payment of the costs of publishing an article to make it immediately accessible to everyone. APCs can be requested by a dedicated open access publisher, and in this case, they are the only source of coverage of publication costs; or by commercial publishers offering an open choice on journals for which subscriptions have already been paid (hybrid journals) resulting in so-called double dipping (double payment).

APRE—Agenzia per la promozione della ricerca europea (Agency for the Promotion of European Research)

CUN—Consiglio universitario nazionale (National University Council)

CRUI—Conferenza dei rettori delle università italiane (Conference of Italian University Rectors)

DOAJ—Directory of Open Access Journals

Registry of over 15,000 open access journals that meet minimum editorial quality criteria.

DORA—San Francisco Declaration on Research Assessment (2012)

Document on the need for a research evaluation method that would concentrate on effective contents avoiding to consider the prestige of the publishing company



DMP—Data Management Plan

Structured document linked to a set of data, providing information on formats, methods, volume, licenses, and all the documentation necessary for the correct management and reuse of data

EOSC—European Open Science Cloud

Federated environment, globally accessible, regulated by precise conditions, in which researchers, innovators, private companies and citizens can publish, find and reuse each other's data and tools for research, innovation and training purposes

ERIC—European Research Infrastructure Consortium

Legal status that facilitates the creation and operation of research infrastructures of European interest

ESFRI—European Strategy Forum on Research Infrastructures

Forum delle infrastrutture europee di ricerca, per favorire un approccio coerente e strategico sulle politiche e le iniziative per le infrastrutture di ricerca europee.

EPR— Public Research Institutes overseen by MIUR

FAIR—Findable, Accessible, Interoperable, Reusable

the FAIR principles are 14 technical specifications for making data Findable, Accessible, Interoperable and Reusable

GDPR—General Data Protection Regulation

The General Data Protection Regulation, Regulation (EU) No. 2016/679, is a European Union regulation on the processing of personal data and privacy which aims to strengthen the protection of the personal data of citizens of the European Union (EU) and EU residents, both inside and outside the borders of the EU, restoring control of their personal data to citizens, simplifying the regulatory environment concerning international affairs and unifying and homogenising privacy legislation within the EU.

HPC—High performance computing

ICDI—Italian Computing and Data Infrastructure

Work group created by representatives of some of the main Italian Research Infrastructures and Digital Infrastructures with the aim of promoting synergies at national level in order to optimise Italian participation in European programmes for scientific data and computing.

I4OC—Initiative for Open Citations

Collaboration between scientific publishers, researchers and other stakeholders to promote public availability of citation data from scientific literature.

IOSSG—Italian Open Science Support Group

Volunteer working group providing support tools for data management and open science

IR—Research Infrastructures

Open access research infrastructures, based solely on the merit of the proposed use. National, pan-European (ESFRI) and international (EIROForum) infrastructures.

IRIS

Modular system for the integrated management of research provided by CINECA and adopted in the vast majority of Italian universities; includes an IR (Institutional Repository) module which is both a Catalogue of research products and an Institutional archive with open access



LERU— League of European Research Universities, a consortium which includes some of the most prestigious and renowned European research universities.

Founded in 2002, as a collaboration between 12 of the most important European research universities. It included among its members 8 new universities in 2006 and 2 new universities in 2010. The Università di Milano is a member.

OpenAPC—Open Article Processing Charges

International project that tracks the expenses for Article Processing Charges and makes the data available to all.

OSPP—Open Science Policy Platform

Advisory body of the Directorate General for Research and Innovation of the European Commission whose purpose is to gather good practices, provide guidance documents and produce Guidelines for the implementation of open science.

PlanS

Initiative of a growing number of research funding bodies associated with CoalitionS aimed at ensuring the complete transformation of the scientific publications market towards open access by 2020, later postponed to January 2021. It is based on the conclusions of the Council on Competitiveness of 26 May 2016, (9357/16), which require that all European research be published in open access by January 2020.

PNR—Programma nazionale per la ricerca (National Research Plan)



DEFINITIONS

Citizen science

Scientific activity conducted by the general public in collaboration with scientists or under the direction of professional scientists and scientific institutions

Transformative contracts

Contracts in which it is envisaged that the amount paid to publishers goes to cover publication costs instead of reading costs, making all scientific literature immediately open.

Research data / Scientific research data

information, in any format, used according to a protocol defined as part of a specific research activity conducted by the Author and necessary to validate the results of the research itself. By way of example, the following is to be considered research data: results (positive and negative) of all the experiments relevant to the research, facts, observations, experiences, published and unpublished sources, bibliographic references, software and code, texts, interviews, products of the present or past, collected or created in digital/paper format. The research data can be expressed in numerical, descriptive, audio and video format. They can be raw or elaborated data.

Scientific publications

All the results of research projects for dissemination purposes (journal articles, monographs, chapters, conference proceedings, ...).

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