



Montenegro
Ministry of Science

PROGRAMME OF IMPLEMENTATION OF OPEN SCIENCE PRINCIPLES IN MONTENEGRO WITH THE ACTION PLAN (2020-2022)



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LIST OF ABBREVIATIONS

ANR	French National Research Agency (<i>Agence nationale de la recherche</i>)
APC	Article Processing Charges
CEM	Chamber of Economy of Montenegro
CERN	European Organization for Nuclear Research
CRUK	Cancer Research UK
DMP	Data Management Plan
DOAB	Directory of Open Access Books
DOAJ	Directory of Open Access Journals
DORA	San Francisco Declaration on Research Assessment
EC	European Commission
EGI	European Grid Infrastructure
EMBL	European Molecular Biology Laboratory
EMBO	European Molecular Biology Organization
EOSC	European Open Science Cloud
ERA	European Research Area
ERAC	European Research Area and Innovation Committee
ERAC SWG OSI	ERAC Standing Working Group on Open Science and Innovation
ERA-PSF	European Research Area – Policy Support Facility
ERRIS	Engage in the Romanian Research Infrastructure System
ESA	European Space Agency
ESFRI	European Strategy Forum on Research Infrastructures
EU	European Union
EUA	European University Association
EUDAT	European Collaborative Data Infrastructure
FAIR	Findable, Accessible, Interoperable, Reusable
FWF	Austrian Science Fund (<i>Fonds zur Förderung der wissenschaftlichen Forschung</i>)
GÉANT	Gigabit European Academic Network
HPC	High Performance Computing
ICGEB	International Centre for Genetic Engineering and Biotechnology
MoE	Ministry of Economy
MoEdu	Ministry of Education
MoPA	Ministry of Public Administration
MoS	Ministry of Science
NHMRC	Australian National Health and Medical Research Council
SR	Scientific research
NI4OS-Europe	National Initiatives for Open Science in Europe
NWO	Dutch Research Council (<i>Nederlandse Organisatie voor Wetenschappelijk Onderzoek</i>)
OGP	Open Government Partnership
OpenAIRE	Open Access Infrastructure for Research in Europe
OS-CAM	Open Science Career Assessment Matrix
PRACE	Partnership for Advanced Computing in Europe
RCC	Regional Cooperation Council
SCHRM	Standing Working Group on Human Resources and Mobility of European Commission
SDG	Sustainable Development Goals
UCG	University of Montenegro

SUMMARY

The vision of Montenegro is that research activities should be based on Open Science principles, which implies that they should benefit society as a whole, and that public funding directed at research activities ought to be spent efficiently and transparently. This can be achieved through open access to publications, research data and research infrastructures.

The Programme of Implementation of Open Science Principles in Montenegro (2020-2022) envisages the following:

- Providing open access to peer reviewed scientific articles;
- Providing open access to national academic publishing;
- Enabling open access to research data in line with the principle “as open as possible, as closed as necessary”. Preparation and submission of a data management plan within the research process is encouraged;
- Providing for accessibility of research infrastructures (facilities, resources and digital infrastructures) where they have been acquired or established through public funding, as well as providing for interoperability of digital infrastructures with international digital research infrastructures;
- Awareness-raising, strengthening the skills and training in the field of Open Science for all Montenegrin science stakeholders;
- Acknowledging the practising of Open Science in research assessment.

The Programme applies to researchers, research performing organisations and research funding organisations.

The Programme is accompanied by an Action Plan that specifies activities with related indicators, responsible stakeholders, timeframes and the funding needed to provide the conditions for implementation of the Programme.

A two-level governance structure is planned for implementation of the Open Science principles in Montenegro, with a strategic working group, composed of representatives of all interested national Open Science stakeholders, and the operational working group of the Ministry of Science of the Government of Montenegro.

Montenegro strives to align its research system with the European Research Area (ERA), where Open Science is becoming the default mode of operation for researchers, research funders and other stakeholders. The provisions of the Programme of Implementation of Open Science Principles in Montenegro (2020-2022) are aligned with the requirements of open access to publications and research data in Horizon 2020 Framework Programme for Research and Innovation (2014-2020), while taking into account the development of Open Science that will be included in the Horizon Europe Framework Programme for Research and Innovation (2021-2027), i.e., the segment on research infrastructures, skills and training, as well as on research assessment.

The Programme is viewed as the first phase in aligning the Montenegrin research ecosystem with Open Science principles in the European Research Area.

1. INTRODUCTION

The openness movement implies a wide range of movements that are mutually connected and partially overlap in supporting the idea of a free and open society in the fields of art, education, administration, science and research, technology, health, copyright and other key areas.

It was the advent of the information revolution and digital economy that created a social and technological foundation which enables the realisation of the vision outlined by the “openness movement”. The best-known concepts of the movement are Open Source, Open Government, Open Data, along with Open Science and Open Education.

Globally, the Open Science practice is being increasingly adopted, which reflects the fact that the results of publicly funded research are a public good that can be fully exploited only if it is accessible to everyone without restrictions. In this regard, the next European Framework Programme for Research and Innovation – “Horizon Europe” (2021-2027) – will provide for mandatory application of Open Science principles.¹

The main objective of Open Science is to make every step of the scientific process visible and accessible and to make it available to both the scientific and the wider community. Therefore, given the fact that most governments support research programmes with public funding, and acknowledging that public funds invested in research and development lead to economic and social progress, Open Science can be viewed as part of a broader concept of Open Government. The Open Government paradigm is internationally recognised through the Open Government Partnership (OGP)², which encompasses seventy-eight countries, including Montenegro³, and aims to increase transparency and accountability of the public sector, as well as to promote the use of new technologies with a view to improving public administration.

Although it strives to follow European trends aimed at implementing the Open Science principles, Montenegro is still at the beginning of this path. Therefore, the Ministry of Science has drafted this Programme of Implementation of Open Science Principles in Montenegro with the accompanying Action Plan (2020-2022), in an effort to create a favourable environment and strengthen the scientific research ecosystem, all in accordance with the Work Programme of the Government of Montenegro for 2020. The Programme is rooted in several national policy documents, and the implementation of Open Science principles should contribute to greater use of scientific results obtained through scientific research, to the benefit of society as a whole, all through better visibility of scientific results, better integration of science and economy, i.e., science and society as a whole. As such, the Open Science concept also leads to the development of new research. Furthermore, with the implementation of this Programme, Montenegro will largely align the implementation of Open Science principles with the EU Action Plan for Open Science, given that it relies on the recommendations of the European Commission in this domain.

¹ [Open Science, Open Data, and Open Scholarship: European Policies to Make Science Fit for the Twenty-First Century](#)

² [Open Government Partnership](#)

³ [Proposal for a National Action Plan for implementation of Open Government Partnership initiative in Montenegro \(2018- 2020\)](#)

2. OPEN SCIENCE CONCEPT

Open Science has emerged as a movement striving to make the results of publicly funded scientific research, data and publications available to all interested segments of society completely free of charge.

Nowadays, the Open Science concept has been expanded beyond its original notion and has come to include the sharing of all available research resources with other researchers and the wider community in an effort to improve the transparency and validity of the scientific process. The fundamental Open Science principles must be implemented while intellectual property rights, copyright and ethical norms are observed.

Nevertheless, in practice, scientific knowledge production has proven to be much more closed, fragmented and isolated from social problems than the idealist conception of modern science expected it to be. This is a result of three phenomena:⁴

- Firstly, scientific practice has become locked in the pursuit of personal/individual success. Scientists compete to reach their priorities and much of their knowledge is not disseminated.
- Secondly, research assessment processes have been increasingly influenced by marketing strategies of academic publishers, which push for the use of quantitative indicators based on citations as proxy for research quality. Thus, researchers worldwide are motivated to guide their research to areas, topics and methods that would be widely cited worldwide, which does not necessarily coincide with societal needs.
- Finally, scientific policies oriented to the commercialisation of scientific knowledge have increasingly locked up scientific knowledge. Political pressures in the developed world have urged scientific production to demonstrate its social and economic utility. In addition, disproportionate intellectual property protection mechanisms often limited access to the scientific knowledge created through public funding. These practices accelerated the processes of science occlusion; knowledge became protected and could only be used with the owner's authorisation.

2.1 OPEN SCIENCE ASPECTS

Open Science based on the idea that scientific knowledge should be openly shared is closely linked to digital revolution and today's socio-technical innovation. By demanding maximum transparency and knowledge exchange, as well as the participation of all relevant stakeholders in the scientific process, the Open Science movement strives to increase:⁵

- reusability of results and innovation,
- reproducibility of results and accountability,
- collaboration and participation of society.

Open Science entails a fundamental paradigmatic change where scientific quality implies much more than the published scientific publications. The focus of Open Science now includes other science aspects as well, such as research data, research infrastructures, research methods, assessment of scientific results and the engagement of citizens in science.

Table 1: Overview of Open Science aspects

Aspects	Description
Open Access to Scientific Publications	Open access to scientific publications refers to free online access to publications in scientific journals and peer-reviewed scientific monographs. In general, Open access to scientific publications enables faster and more extensive transfer of knowledge through digital means, and is therefore one of the foundations of Open Science.
Open Research Data⁶	Open research data are data in digital form, which are collected or created during scientific research activities and used as evidence in the research process, or are generally accepted in the research community as necessary for the validation of research findings and results.
Open Research Infrastructures	Open access to research infrastructures aims to promote and enable unhindered access to research infrastructures, in order to improve research, development and innovation, as well as to improve research methods and human resources skills through the promotion of national and international cooperation.
Open Methods	The objective of Open Methods is to make clear accounts of the methods and sources used in research freely available via the internet. Scientific blogging and commenting culture are core practices in this regard. Open annotation, open bibliographies, proper reference management and open source software are also an integral part of this concept.
Open Evaluation	Open Evaluation implies combining several different metrics to assess the quality of a scientific publication, researcher, and even reviewers themselves. There are several different ideas of what Open Evaluation should include, and it most often entails publicly available paper reviews, ranking of papers based on multiple metrics (statistics on access to work, citations, etc.), ranking of reviewers, etc. The difference in relation to previous evaluation criteria is that the criteria, methods and databases for assessment are transparent and open and freely accessible. The altmetrics movement is currently developing a range of novel indicators to complement traditional measures to assess research papers and researchers themselves.
Open Education	Open Education includes freely distributable textbooks and teaching materials, such as filmed lectures, readings, education sets, but also interactive user forums. New digital education platforms support cooperation with open libraries, archives and academic institutions. Massive open online courses are complementing traditional teaching as a new form of interactive distance mass education.
Citizen Science	Citizen Science – despite still being a developing field – is already an expanding concept. Supported by collaborative technologies, citizens can participate in the research design, data gathering, analytical process, as well as in dissemination and exploitation activities. Citizen science adds important dimensions to the democratisation of science and responsible research and innovation. Moreover, Citizen Science provides many opportunities for children and students to be involved in scientific activities.

⁴ [Systematizing Benefits of Open Science Practices](#)

⁵ [Mutual Learning Exercise, Open Science: Altmetrics and Rewards](#)

⁶ [Directive \(EU\) 2019/1024 of the European Parliament and of the Council of 20 June 2019 on open data and the re-use of public sector information](#)

2.2 OPEN SCIENCE BENEFITS

Benefits associated with Open Science can be divided into three groups:⁴

1. Improving scientific efficiency

One of the strong arguments for supporting Open Science practices is that they increase scientific efficiency. This is the result two mechanisms:

- a) Wider availability of knowledge resources that makes research cheaper and research success more likely; and
- b) More successful collaboration among heterogeneous knowledge stakeholders that amplifies collective intelligence and creativity.

2. Improving free access to scientific knowledge

There are three complementary mechanisms through which Open Science practices improve access to scientific knowledge:

- a) By improving access to scientific resources;
- b) By enabling the participation of a wider community in the research process; and
- c) By making science better understandable for a wider population.

3. Improving research capacity to attend societal needs:

- a) Open Science practices can help local problems to become visible;
- b) By promoting community stakeholders to participate in the scientific endeavour the research agenda could be better guided towards solving problems affecting that group;
- c) More successful cooperation between scientific research institutions and the economy.

2.3 OPEN ACCESS TO SCIENTIFIC PUBLICATIONS

Open Access to scientific publications is defined as unrestricted online (internet) access to scientific publications (scientific papers, monographs, books, etc.), which is free of charge for the end user and allows the reuse of scientific information (searching, reading, downloading, printing, distributing, indexing and/or use in any other lawful manner). In this context, “unrestricted” means without any restrictions and conditions imposed in terms of access and use. In order to provide for unrestricted access to information, it is necessary to guarantee anonymity of information users.

Open access to peer-reviewed publications is enabled by storing the publication in a digital repository available on the internet, and then allowing open access to the full text of the publication via the repository.

Digital repositories for scientific publications are data archives available via the internet. They can be institutional, thematic or centralised. The repository must enable free access, unrestricted distribution, interoperability and storage of data in digital form. Archived scientific publications in digital repositories should have accompanying Open Access licenses. Open Access licenses allow for various forms of reuse (in addition to reading, downloading and printing, also copying, use, distribution, transmission and public display, creation and distribution of works for any purpose implying responsible use are included).

The two main routes to exercise Open Access to scientific publications are:

“Green” open access (self-archiving): a published paper, or a final peer-reviewed manuscript, is archived by the authors in a repository available on the internet, respecting copyright, before, after or in parallel with its publication. Access to the paper is often postponed (“embargo period”) at the request of the publisher, in order to enable the subscribers of the journal to have an advantage. The repository software enables the author to postpone access to the full text of the relevant version of the paper and thereby observe the embargo period.

“Gold” open access (publishing with Open Access): allows the published paper to be open for access immediately after their publication in the journal. Copyright is managed through Open Access licenses (authors retain copyright over the material, and published paper can be archived in the repository). Payment of publication costs, i.e., the charges for publishing Open Access papers (Article Processing Charges - APC), is transferred from readers (via subscriptions) to authors. These costs are usually borne by the university or research institute where the researcher is engaged, or a funder that supports the research.

The researchers and their universities are normally the first stakeholders in signing and adhering to the principles defined in the well-known Open Access declarations, such as the ones from Budapest⁷, Berlin⁸, or Bethesda⁹. In general, Open Access initiatives and mandates operate under a bottom-up principle, and are initiated institutionally at the academic level, as institutions usually enjoy a significant degree of autonomy in developing their own academic policies. University managements and researchers usually work with librarians and information technology professionals to provide for preservation of scientific papers, electronic theses and dissertations, and grey literature, such as conference proceedings for which most of them have had repositories for long time, used to archive research results.

Some of the benefits of Open Access to scientific publications for researchers are shown in Figure 1.¹⁰

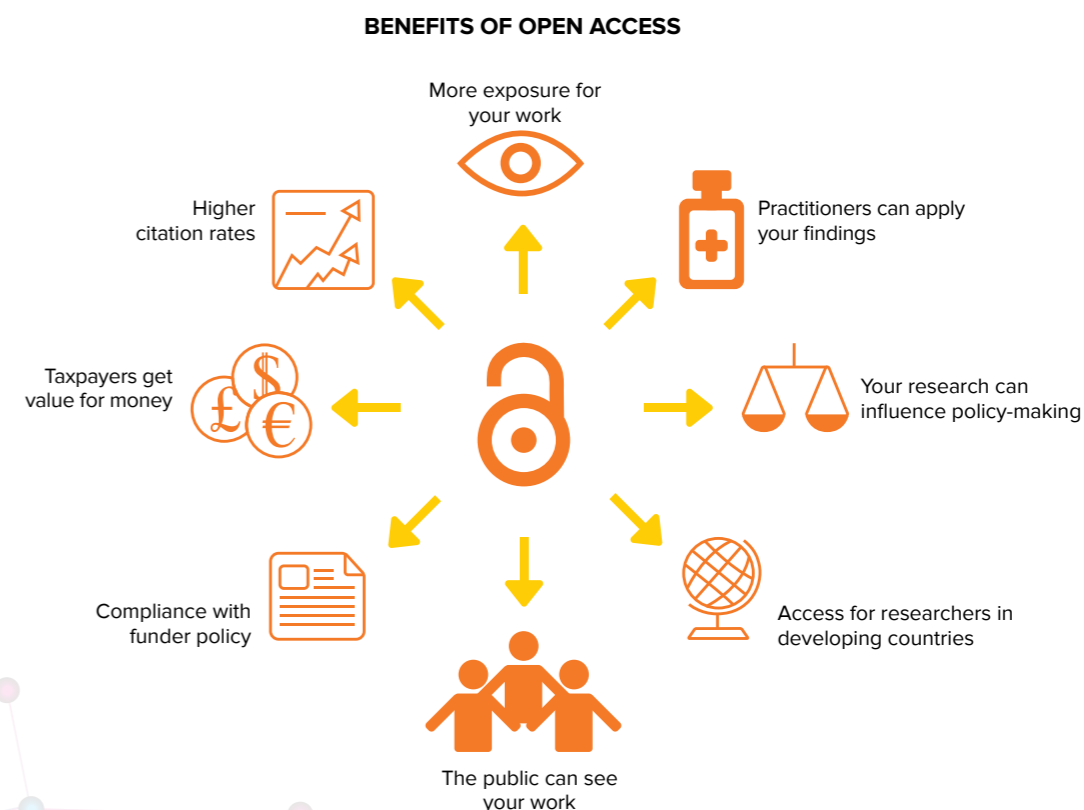


Figure 1: Benefits of Open Access for researchers

CC BY Danny Kingsley & Sarah Brown

Modern research builds on extensive scientific dialogue and progress made through the improvement of previous achievements. Fuller and wider access to scientific publications and data will therefore help to:¹¹

- Accelerate innovation (faster access to market, i.e., faster economic growth);
- Foster collaboration and avoid duplication of effort (greater efficiency);
- Build on previous research results (improved quality of results);
- Prevent unethical behaviour in research and science;
- Involve citizens and society (improved transparency of the scientific process).

The benefits of this approach can be found in the speed of scientific progress and the return on R&D investment, and in particular publicly-funded investment which has enormous potential for boosting productivity, competitiveness and growth. Wide, affordable and easy access to scientific information is particularly important for innovative enterprises.

⁷ [Budapest Open Access Initiative](#)

⁸ [Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities](#)

⁹ [Bethesda Statement on Open Access Publishing](#)

¹⁰ [Australasian Open Access Strategy Group \(AOASG\), Benefits of Open Access](#)

¹¹ [Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Towards better access to scientific information: Boosting the benefits of public investments in research, COM\(2012\) 401](#)

2.4 OPEN ACCESS TO RESEARCH DATA

Open Access to research data refers to the right to online access and free use of digital research data (experimental results, observations, computer-generated information, etc.) which form the basis for the analyses included in scientific publications.

Research data generated through public funding must be open and accessible, with as few restrictions as possible. Exceptions to the default full open access must be precisely defined and justified, e.g., for reasons of national security, protection of personal data and intellectual property rights. Technological, legal and ethical aspects of Open Access to research data must be verified.

The aim of depositing research data in digital repositories is to ensure their permanent storage, the possibility of their reuse for scientific or other purposes, as well as verification of research results validity.

One of the great challenges of data-intensive science is to facilitate knowledge discovery by assisting humans and machines in their discovery of, access to, integration and analysis of task-appropriate scientific data and their associated algorithms and workflows. In this regard, FAIR¹² represents a set of guiding principles to make data Findable, Accessible, Interoperable, and Reusable.

The FAIR principles are:

- **F. For data to be findable:**
 - F1. (Meta)data are assigned a globally unique and eternally persistent identifier;
 - F2. Data are described with rich metadata;
 - F3. (Meta)data are registered or indexed in a searchable resource;
 - F4. Metadata specify the data identifier.
- **A. For data to be accessible:**
 - A1. (Meta)data are retrievable by their identifier using a standardised communications protocol.
 - A1.1 The protocol is open, free, and universally implementable;
 - A1.2 The protocol allows for an authentication and authorization procedure, where necessary.
 - A2. Metadata are accessible, even when the data are no longer available.
- **I. For data to be interoperable:**
 - I1. (Meta)data use a formal, accessible, shared, and broadly applicable language for knowledge representation;
 - I2. (Meta)data use vocabularies that follow FAIR principles;
 - I3. (Meta)data include qualified references to other (meta)data.
- **R. For data to be re-usable:**
 - R1. Meta(data) have a plurality of accurate and relevant attributes.
 - R1.1 (Meta)data are released with a clear and accessible data usage license;
 - R1.2 (Meta)data are associated with their provenance;
 - R1.3 (Meta)data meet domain-relevant community standards.

It should be noted that FAIR Data and Open Data are different concepts, although similar and somewhat overlapping. Open Data is available for everyone to reuse but may not have all characteristics of FAIR data: e.g., no consistent way of accessing it, may lack in machine readability and may be harder to be interpreted (no semantics). On the other hand, FAIR Data presents a well curated digital manifestation of the data, persistent and consistent in the way it is accessed, but may be (partially) closed, or may be free for particular types of use/reuse only (under the principle of “as open as possible, as closed as necessary”).¹³

¹² [FORCE 11: The FAIR Data Principles](#)

¹³ [“Open Access: an opportunity for Malta”, Recommendations for the Development of a National Policy for Open Access to publications, research data and related issues](#)

Making research data available can benefit researchers and the institutions in which those researchers are engaged, research funders, as well as society as a whole. Thus, for example, researchers can prosper from greater visibility and trust in their research work, opportunities to reproduce their research, greater citation and influence, increased opportunities to create new research partnerships and projects, possible new engagements, preservation of their research data over a long period of time, new ways of acquiring scientific reputation, etc. Similarly, research institutions gain greater reputation and influence in the scientific and wider community, as well as greater visibility, trust of funders, opportunities to create new partnerships and to work on new projects, greater attractiveness in hiring renowned researchers or research groups, etc. Research funders can also get various benefits if the data obtained during the research are organised appropriately and made available according to the Open Science principles. Funders get more value for money invested, funding of duplicate research is avoided, the innovation process is accelerated, the quality of research is improved, policy makers are informed, etc.

Finally, sharing research data can also contribute to the progress of society as a whole, and the following benefits can be identified: improving interaction (dialogue) between science and society, removing social and national barriers, opening opportunities for everyone to participate in research, increasing people’s trust in science, improving public health and environmental protection, greater societal support to research funding, etc.

2.5 OPEN ACCESS TO RESEARCH INFRASTRUCTURES

Open access to research infrastructures is a key element in advancing the development of research and innovation, as well as in networking with potential users from the academic, business, public and civil sectors.

Open access to research infrastructures will improve the dissemination of scientific knowledge, enhance competitiveness, bridge the gap between research and industry, and provide training and research capacity building.

Research infrastructures, including e-infrastructure, are at the core of the knowledge triangle of research, education and innovation and therefore play a vital role in the advancement of knowledge and technology and their exploitation. Because of their ability to assemble a critical mass of researchers in a given science area, they play an important role in linking all the segments of society, as well as in stimulating international cooperation in science.¹⁴

In this document, the term “research infrastructures” refers to the facilities, resources and services utilised by research communities to conduct research and encourage innovation in their fields. They include research laboratories, scientific equipment (or sets of instruments), knowledge-based resources, such as collections, archives and scientific data, e-infrastructure, such as data and computer systems and communication networks, and any other tools necessary to achieve excellence in research and innovation. They can be “single-sited”, “mobile”, “virtual” and “distributed”.¹⁵

In the European Charter for Access to Research Infrastructures, access is defined as legitimate and authorised physical, remote and virtual admission to, interactions with and use of research infrastructures and to services offered by research infrastructures to users. Access includes education and training, expert support, analytical services, performing experiments, sample preparation, machine usage time, use of archives and data, etc.

Access to research infrastructures can be provided in accordance to four different access modes, i.e., “research-driven”, “education-driven”, “market-driven” and “wide”. Depending on their function, contractual and legal obligations, the research infrastructures may regulate their Open Access policy according to one or a combination of any of the available access modes.

The modes of access to research infrastructures are:¹⁶

- Research-driven access depends exclusively on the level of research value, originality, quality and technical and ethical feasibility of an application evaluated through peer review conducted by internal or external experts. It enables users to get access to the best facilities, resources and services wherever they are located. This access mode enables collaborative research and technological development efforts across geographical and disciplinary boundaries.

¹⁴ [European Charter for Access to Research Infrastructures, Principles and Guidelines for Access and Related Services](#)

¹⁵ [Evaluating and Monitoring Socio-Economic Impact of Investment in Research Infrastructures](#)

¹⁶ Protocol on Open Access to Research Infrastructure in the Western Balkans (draft), RCC, 2020

- Education-driven access is aimed at enabling users to access to research infrastructures with a view to gaining skills to effectively use the facilities, resources and services wherever they are located. This access mode enables enhancing research skills and methodologies, collaborative research and technological development efforts across geographical and disciplinary boundaries. Research infrastructures are encouraged to provide education and training in the areas of their activities and to collaborate with other institutions and organisations that benefit from using the research infrastructures for education and training purposes.
- Market-driven access mode applies when access is defined through an agreement between the user and the research infrastructure that will lead to a fee for the access and that may remain confidential.
- Wide access mode guarantees the broadest possible access to scientific data and digital services provided by the research infrastructure to users wherever they are based. Research infrastructures adopting this mode maximise availability and visibility of the data and services provided.

In the White Paper of European Strategy Forum on Research Infrastructures (ESFRI) “Making Science Happen”, physical, remote and virtual access are also defined.¹⁷

2.6 EDUCATION AND PROMOTION OF OPEN SCIENCE

When all researchers are aware of Open Science principles, and when they are trained, supported and guided at all career stages to practice Open Science, the potential is there to fundamentally change the way research is performed and disseminated, fostering a scientific ecosystem in which research gains increased visibility, is shared more efficiently, and is performed with maximum research integrity. The actual situation in practice is significantly different. In 2017, the Working Group on Education and Skills, which is part of the European Commission’s Steering Group on Human Resources and Mobility (SGHRM), reported that three out of four researchers had not yet participated in any Open Access or Open Data training, but would be happy to do so. What is best known to the research community is the publication of papers in accordance with the Open Access, and there is a great interest in the practice of managing research data.

The Report of the Working Group on Education and Skills¹⁸ focuses not only on First Stage Researchers (R1 – up to the point of PhD) and Recognised Researchers (R2 – PhD holders or equivalent who are not yet fully independent), but also Established Researchers (R3 – researchers who have developed a level of independence) and Leading Researchers (R4 – researchers leading their research area or field), in identifying the following needs:

- Researchers R1/R2 – there is a need for these skills as part of their learning process as well as the need for recognition/rewards and reputation and impact building, as a result of using Open Science skills.
- Researchers R3/R4 – there is a need to take leadership and ensure that their mentees acquire the skills as well as the need to demonstrate to them the positive effects of sharing research data and information.

The report also stresses the importance of cooperation with the funding agencies and employers of researchers. Furthermore, the monitoring of Open Science practices is proposed.

In the scope of Open Data, it is necessary to conduct education to develop a set of skills that should enable the effective implementation of the collection, labelling and management of research data. Within the skills and abilities of FAIR4S, developed as part of the EOSC pilot project, the following necessary skills for research data management have been defined:

- Creating a plan for managing and sharing FAIR results;
- Reuse of data from existing sources;
- Using or developing open research tools/services;
- Preparation and documentation for FAIR results;
- Publishing FAIR results in recommended repositories;
- Identifying, quoting and acknowledging the contributions of other researchers;
- Developing an open research strategy and vision;
- Implementing policies in accordance with legal requirements, ethical and FAIR principles;
- Providing funding / support for Open Science;
- Following examples of good practice.

¹⁷ [Making Science Happen, A new ambition for Research Infrastructures in the European Research Area, ESFRI White Paper 2020](#)

¹⁸ [Providing researchers with the skills and competencies they need to practise Open Science](#)

2.7 RESEARCH ASSESSMENT CRITERIA

The number of publications still remains the most widespread criterion for assessing researchers, and is followed by attracting external research funding, participating in projects, and collaborating with the academic community. Open Science and Open Access activities are rarely part of institutional reward systems. Even if this is the case, they are usually not given much importance. This was also shown by a survey conducted in 2019 by the European University Association (EUA)¹⁹, in which 260 valid answers were collected from universities from 32 European countries. However, in order for Open Science to come to life in practice, it is necessary to introduce incentives and rewards for researchers and institutions that apply the Open Science principles. There are several different initiatives and recommendations to this end.

In 2017, the European Commission’s Working Group on Rewards under Open Science published a report²⁰ proposing the so-called Open Science Career Assessment Matrix (OS-CAM) and describing it as a “possible, practical move towards a more comprehensive approach to evaluating researchers through the lens of Open Science”. In addition to publications, OS-CAM considers a wide range of researchers’ activities, their leadership skills, contribution to the teaching process, impact in the research area, overall research results and activities related to the research process. The focus is placed on Open Science aspects within these activities and research results are measured against FAIR principles related to data, quality standards in Open Data management and open datasets, as well as whether researchers have used Open Data from other researchers.

According to the European Commissions Working Group on Rewards, the Open Science practices should be encouraged and incentivised through the assessment of research at two levels, i.e.:

- Research performing organisations should be encouraged to include Open Science practices in the evaluation of performance and of career development.
- Research funding organisations, at regional, national, EU and international level (including management bodies funding research under their programmes), should be strongly encouraged to include Open Science practices in the evaluation criteria for funding proposals and as part of the assessment of the researcher.

The San Francisco Declaration on Research Assessment (DORA)²¹ identifies the need to improve the assessment of scientific research results and makes a number of recommendations aimed at eliminating the assessment of researchers based exclusively on the rank of the journal itself. The recommendations are intended for institutions that fund scientific work, as well as for academic institutions, journals and the researchers themselves. The declaration was adopted in 2012, during the Annual Meeting of the American Society for Cell Biology in San Francisco. The following recommendations of the declaration are particularly important:

- There is need to eliminate the use of journal-based metrics, such as Journal Impact Factors, in assessing an individual scientist’s contributions, or in hiring, promotion, or funding decisions.
- It is necessary to explicitly list the criteria used in evaluating the scientific productivity of grant applicants and clearly highlight, especially for early-stage investigators, that the scientific content of a paper is much more important than publication metrics or the identity of the journal in which it was published.
- For the purposes of research assessment, the value and impact of all research outputs (including datasets and software) should be considered in addition to research publications, and a broad range of impact measures including qualitative indicators of research impact, such as influence on policy and practice.
- It is necessary to be explicit about the criteria used to reach hiring, tenure, and promotion decisions, clearly highlighting, especially for early-stage investigators, that the scientific content of a paper is much more important than publication metrics or the identity of the journal in which it was published.

With a view to supporting researchers, a team composed of five experts, led by Diana Hicks, a professor of political science at Georgia Institute of Technology and Paul Wouters, director of the Centre for Science and Technology Studies at Leiden University, presented the Leiden Manifesto for research metrics²², proposing a set of ten principles to be used as quantitative metrics in research assessment.

¹⁹ [Research Assessment in the Transition to Open Science, 2019 EUA Open Science and Access Survey Results](#)

²⁰ [Evaluation of Research Careers fully acknowledging Open Science Practices, Rewards, incentives and/or recognition for researchers practicing Open Science](#)

²¹ [San Francisco Declaration on Research Assessment](#)

²² [Leiden Manifesto for Research Metrics](#)

It should be noted that the European Commission has also published a call for proposals, under its Horizon 2020 programme, for support to research and innovation dimension of European universities, stating, in the document dated 26 March 2020, which serves as a guide for this call for proposals²³, the following:

- “Open Science incentives and rewards: develop academic career systems that support and reward researchers who participate in engaging with society and in a culture of sharing the results of their research, in particular by ensuring early sharing and open access to their publications and other research outputs; set up strategies and institutional policies and mechanisms that enable, incentivize, measure and reward Open Science practices; enrich research and career evaluation systems through the introduction of additional indicators and metrics that can inform assessment on openness, including but not only on the broader social impact of research and at the individual level of a researcher (‘new generation metrics’); exchange best practice and mutual learning within the alliance.”

Documents recommending the use of multiple indicators for the assessment of researchers, such as the European Commission’s Next-Generation Metrics report, DORA and the Leiden Manifesto, have had a significant impact, with some institutions integrating them in their hiring, career promotion and other rewarding procedures. As examples of good practice, the following institutions can be listed: Ghent University, University of Bristol, Delft University of Technology, French National Research Agency (ANR), Austrian Science Fund (FWF), European Molecular Biology Organisation (EMBO), Cancer Research UK (CRUK), Dutch Research Council (NWO), Australian National Health and Medical Research Council (NHMRC), U.S. National Science Foundation, etc.²⁴

23 [H2020 Programme, Guidance document Support for the Research and Innovation Dimension of European Universities, Version 1.0, 26 March 2020](#)

24 [“Open Access: an opportunity for Malta”, Recommendations for the Development of a National Policy for Open Access to publications, research data and related issues](#)

2.8 KEY OPEN SCIENCE STAKEHOLDERS

Open Science policies, strategies and initiatives involve various stakeholders, including government sectors, research funding organisations (e.g., national agencies, research councils), research organisations, national academies of science and science societies, libraries, as well as researchers themselves, publishers and other stakeholders.²⁵

Researchers are becoming more open in terms of the way in which they conduct their research. The effort to demonstrate the impact of research has led researchers to connect more closely with research users. Significant growth has been achieved in the engagement of the society in the formulation of research questions, in the composition of assessment committees for research or in the committees of stakeholders that manage the research process.

However, in this regard, researchers must be fully aware of the need to maintain quality, considering the commercial interests, privacy, security and integrity of the research. All this requires training, which should begin during doctoral studies at the latest. This requires institutions to provide training for the necessary skills. Improved infrastructure is needed to store large amounts of research data, along with new technical skills of staff and data management.

Funders represent a set of key stakeholders in designing Open Science policies and mandates. They also play a key role in implementing and monitoring preservation and dissemination policies, strategies and mandates. They are the ones who decide on the distribution of public funds, donations and loans to research programmes and research institutions, and thus establish the conditions and rules to do so through a top-down approach. Their role is also crucial in influencing the practices of Open Science policies and their enhancement, all in line with specific national needs.

Research councils and academies of science also perform important tasks related to research results, dissemination, and Open Science topics.

Universities and their libraries are among the most active stakeholders in Open Science. University libraries are becoming digital, almost without exception, and are key players in preserving scientific results, both in that they often manage institutional repositories of scientific results, and in awareness-raising activities, training and support for dissemination and publication of scientific results.

Publishers are usually mentioned when licensing negotiations are conducted at the national level with consortia of research organisations and/or libraries, which should also include open publishing of the corresponding authors (the so-called transformative agreements).²⁶

25 [Access to and preservation of scientific information in Europe, Report on the implementation of Commission Recommendation C\(2012\) 4890](#)

26 [ESAC Transformative Agreements](#)

3. STRATEGIC FRAMEWORK OF THE PROGRAMME OF IMPLEMENTATION OF OPEN SCIENCE PRINCIPLES IN MONTENEGRO (2020-2022)

3.1 EUROPEAN UNION DOCUMENTS

The vision of the European Union on access to and preservation of scientific information in the form of publications and research data is presented in several documents.

As a single research area open to the world and based on the EU internal market, the European Research Area (ERA)²⁷ allows for the free circulation of researchers, scientific knowledge and technology. In 2015, the European Council reaffirmed its commitment to a fully operational European Research Area and endorsed the **ERA Roadmap 2015-2020**. This is a living document that provides guidance to the EU countries in structuring the implementation of the ERA priorities at national level.

Horizon 2020 Framework Programme for Research and Innovation requires open access to peer-reviewed scientific papers resulting from co-financed projects, while open access to other types of publications is recommended. Beneficiaries are required to prepare a data management plan and ensure the openness of research data under the principle of “as open as possible, as closed as necessary”.²⁸

European Commission Recommendation (EU) 2018/790 of 25 April 2018 on access to and preservation of scientific information²⁹, which is a renewed document, originally adopted in 2012³⁰, more precisely defines the action plans and target metrics of Open Science, through the following obligations:

- Open access to scientific publications;
- Management of research data, including open access;
- Preservation and re-use of scientific information;
- Creating infrastructures for open science;

and furthermore:

- Defines the necessary skills and competences;
- Recommends incentives and rewards for practicing Open Science;
- Recommends a multi-stakeholder dialogue on open science at national, European and international level.

In September 2018, “cOAlition S” announced **Plan S**³¹, which requires full and immediate Open Access to peer-reviewed publications that result from research funded by public grants, with copyright to be retained by the authors or their institutions and managed via Creative Commons licenses. The European Commission and the European Research Council support Plan S and will implement its provisions under Horizon Europe Framework Programme for Research and Innovation.

The growing importance of the principles and policies of Open Science is also emphasized in the context of the **Digital Single Market Strategy**³², according to which the optimal sharing and transfer of scientific knowledge contributes to increasing innovation, jobs and growth in the European Union.

Article 10 of **Directive (EU) 2019/1024 of the European Parliament and of the Council of 20 June 2019 on open data and the re-use of public sector information**³³ requires that Member States support the availability of research data by adopting national policies and relevant actions aiming at making publicly funded research data openly available (‘open access policies’), following the principle of ‘open by default’ and compatible with the FAIR principles. In that context, concerns relating to intellectual property rights, personal data protection and confidentiality, security and legitimate commercial interests, shall be taken into account in accordance with the principle of “as open as possible, as closed as necessary”.

27 [European Research Area \(ERA\)](#)

28 [Horizon 2020 Online Manual, Open access & Data management](#)

29 [Commission Recommendation \(EU\) 2018/790 of 25 April 2018 on access to and preservation of scientific information](#)

30 [Commission Recommendation of 17 July 2012 on access to and preservation of scientific information \(2012/417/EU\)](#)

31 [About Plan S](#)

32 [Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, A Digital Single Market Strategy for Europe, COM/2015/0192 final](#)

33 [Directive \(EU\) 2019/1024 of the European Parliament and of the Council of 20 June 2019 on open data and the re-use of public sector information](#)

Those open access policies shall be addressed to research performing organisations and research funding organisations. Article 17 prescribes that Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive by 17 July 2021.

Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation)³⁴ provides for free flow of personal data in accordance with the rules on personal data protection, including the ethical principles to be observed.

In the **ERAC (European Research Area and Innovation Committee) Opinion on the future of the European Research Area** dated 23 January 2020, Open Science and Open Innovation are recommended as default comprehensive principles for a new standard within the European Research Area³⁵.

Recommendations of the ERAC Standing Working Group on Open Science and Innovation (SWG OSI) on Open Science and Open Innovation, dated 1 April 2020 (1203/20)³⁶, were created on the basis of Council conclusions on the transition towards an Open Science system, adopted on 27 May 2016 (9526/16)³⁷.

The European Strategy Forum on Research Infrastructures (ESFRI) published a strategic document – White Paper titled **Making Science Happen** to achieve the vision of creating an integrated system of research infrastructures that will be able to fully respond to new challenges and contribute to achieving the goals of the renewed European Research Area (ERA).³⁸

The key recommendations of the European Union, contained in the aforementioned documents for improving the skills of Open Science in the research community, are the following:

- Consider “the application of FAIR principles and openness” to all research results. This first and basic recommendation should contribute to increasing the quality of research, increasing the impact of high-quality research and increasing innovation for all researchers, enterprises, citizens and society in general, taking advantage of rapid access to research.
- Promote and protect Open Science in the European legal framework on copyright. This recommendation proposes balancing the copyright legal framework across Europe to adjust to Open Science and the benefits it brings.
- Develop and advocate an understanding of innovation between EU Member States, based on Open Science. This recommendation suggests addressing the balance between openness and retention of some rights and emphasizes mutual benefits.
- Develop end-user skills for better acquisition of knowledge arising from research. This recommendation aims to enable the re-use of research results by end-users who may be distanced from research practices.
- Encourage the involvement of citizens in science. This recommendation aims to deepen the consultation and engagement of citizens in science.
- Adapt assessment, reward and evaluation systems. This recommendation emphasizes the need for stronger incentives that enable high standards in collaboration and quality, by promoting and rewarding the use of research results.
- Encourage Open Reviews as a default legal approach to scientific validation. This recommendation seeks to improve the quality of the review and increase recognition and reward for reviewing research work.
- Require that the infrastructures, processes and workflows on which the European research system relies adopt and practice open standards. This recommendation proposes that critical services and infrastructures, on which the European Research Area rests, remain under the control of the academic community, by being accessible through open and interoperable technologies.
- Provide for full transparency for the terms and conditions of the subscription agreements and Open Access agreements. This recommendation emphasizes the need to organise and acquire control over the costs of publishing and reading of the scientific content.

34 [Regulation \(EU\) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC \(General Data Protection Regulation\)](#)

35 [ERAC opinion on the future of the ERA](#)

36 [ERAC SWG OSI opinion on future Open Science and Open Innovation priorities in the European Research Area](#)

37 [Council Conclusions on the transition towards an Open Science system adopted on 27 May 2016 \(9526/16\)](#)

38 [Making Science Happen, A new ambition for Research Infrastructures in the European Research Area, ESFRI White Paper 2020](#)

3.2 EUROPEAN OPEN SCIENCE CLOUD

The development of a large number of narrowly specialised scientific disciplines has inevitably led to a huge production of scientific results. Consequently, it is not possible to follow all relevant publications and results that appear around the world, even in a single scientific discipline. Therefore, different search tools are utilised to extract only the narrowest possible range of research results and publications.

Despite a large production of publications as a result of research, most of the research data underpinning scientific publications are never published. Of the research data made available to the wider scientific community, a significant portion does not have adequate associated metadata, which would allow it to be easily findable and used in further research.

Over the course of last two decades, the European Commission has made large investments through its Infrastructure Programme. Research infrastructures manage transnational and global access to large research infrastructures and are key stakeholders in terms of creating and preserving research data, as they establish practices and standards related to data storage, preservation and reuse for research communities. E-infrastructures provide services at different levels of data structures: network connectivity and reliable identification (GÉANT), aggregation of open and linked research results (OpenAIRE), pooling of computer resources (EGI), shared storage-related data services (EUDAT), sharing access to high performance computing resources (PRACE). In addition, they play an important role in setting up the standards and mechanisms for complete national infrastructure and data-related services.

Having in mind the above and considering that a large number of European researchers encounter the problem of research data fragmentation and non-uniform access to quality data sets for different research areas, in 2016, the European Commission launched an initiative to create a cloud platform for Open Science, entitled EOSC³⁹ (European Open Science Cloud). EOSC is recognised as an important component of Europe's Digital Single Market, which should give Europe a global advantage in terms of scientific information infrastructure. The goal of EOSC is to provide 1.7 million European researchers and 70 million science and technology professionals with a virtual environment offering free access to scientific data storage, management, analysis and reuse services, in all science disciplines. EOSC is an umbrella initiative for the implementation of key Open Science programme policies.

EOSC was soon established as a clear priority of the European Research and Innovation Area, which was confirmed by a Resolution⁴⁰ adopted by the European Parliament in January 2017. During 2016 and 2017, extensive consultations were held with scientific and institutional stakeholders, who also strongly supported this initiative. As a result, following the first EOSC Summit, held in June 2017, the EOSC Declaration was adopted⁴¹, in October 2017, with the support of more than 70 institutions. The European Commission presented a summary of the results of these consultations in March 2018, in the form of an Implementation Roadmap for the European Open Science Cloud⁴².

The EOSC Implementation Roadmap describes six lines of action, presented in Figure 2.⁴³

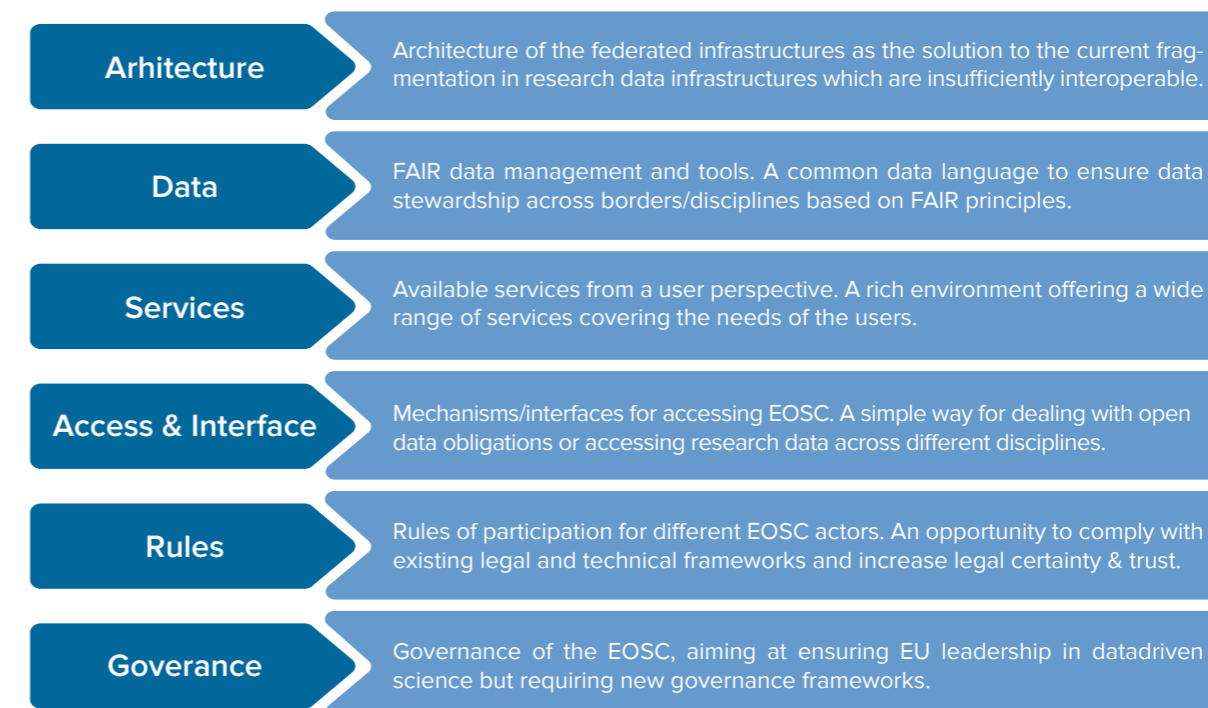


Figure 2: EOSC Implementation Roadmap lines of action

The EOSC Portal⁴⁴ was officially launched on 23 November 2018, during the Austrian Presidency of the Council of the European Union. At the very beginning, 46 e-service providers from 32 countries enabled the launch of 57 e-services⁴⁵ on the EOSC portal. However, the EOSC⁴⁶ Strategic Implementation Plan for 2019-2020, adopted in June 2019, provides that by the end of 2020 a sustainable EOSC should be available, with official Statutes, including the rules of participation, governance structure, FAIR data and interoperable services.

Furthermore, in January 2018, the Commission rendered a decision on creating a EuroHPC Joint Undertaking⁴⁷, which will provide High Performance Computing infrastructure (HPC) to support EOSC data processing.

As for the period of 2019-2020, EOSC management is organised through three bodies: EOSC Governance Board, EOSC Executive Board and Stakeholders Forum⁴⁸. One of the first decisions of the EOSC Governance Board was to define six priorities, in order to enable the stakeholders to direct their efforts at common objectives. The following priorities have been defined:⁴⁹

- Landscape: Mapping of the existing research infrastructures which are candidates to be part of the EOSC federation;
- FAIR: Implementing the FAIR data principles by defining the corresponding requirements for the development of EOSC services, in order to foster cross-disciplinary interoperability;
- Architecture: Defining the technical framework required to enable and sustain an evolving EOSC federation of systems;
- Rules of participation: Designing the Rules of Participation that shall define the rights, obligations governing EOSC transactions between EOSC users, providers and operators;
- Skills and training: Providing a framework for a sustainable training infrastructure to support EOSC in all its phases and ensure its uptake;

39 [Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, European Cloud Initiative - Building a competitive data and knowledge economy in Europe](#)

40 [European Parliament resolution of 16 February 2017 on the European Cloud Initiative \(2016/2145\(INI\)\)](#)

41 [EOSC declaration, 26/10/2017](#)

42 [Commission Staff Working Document, Implementation Roadmap for the European Open Science Cloud](#)

43 [EOSC Strategic Implementation Roadmap, 2018-2020, May 2018, European Commission, DG Research and Innovation, RTD.A2. Open Data Policy and Science Cloud](#)

44 [European Open Science Cloud \(EOSC\)](#)

45 [EOSC Marketplace](#)

46 [European Open Science Cloud \(EOSC\) Strategic Implementation Plan](#)

47 [European Commission Press corner, "Commission proposes to invest EUR 1 billion in world-class European supercomputers"](#)

48 [Commission Decision of 27.8.2018 Setting up the Expert Group - Executive Board of the European Open Science Cloud \('EOSC'\) and laying down rules for its financing](#)

49 [EOSC Working Groups](#)

- Sustainability: Providing a set of recommendations concerning the implementation of an operational, scalable and sustainable EOSC federation after 2020.

Since the launch of the INFRAEOSC H2020 Call, a number of Horizon 2020 projects that realize the defined six goals of the EOSC Governance Board have been implemented, which is how EOSC is coming into practice.

3.3 NATIONAL FRAMEWORK DOCUMENTS

The introduction of the Open Science principles in Montenegro rests on several national policy documents, and further application of these principles will certainly be included in future strategic planning as well, given the importance of this issue and the process of alignment with European policies in the field of science and research.

The Strategy of Scientific Research Activity (2017-2021)⁵⁰ envisages the promotion of Open Access policy, as a significant aspect of Open Science, in several directions, including specifically those whose implementation is thoroughly elaborated through this Programme, i.e.:

- **Availability of scientific research literature** at the national level to the entire scientific research community, which would reduce the cost of subscriptions paid for international publications needed on the one hand, and increase the pool of users on the other hand, with development of incentives to intensify and strengthen the quality of domestic publishing in the field of science;
- **Availability of data from publicly funded research**, following the practice of the Horizon 2020 programme, and alignment of the actions of all institutions with the trend of Open Access and preservation of scientific information in the form of publications and data in accordance with the EU practice;
- **Availability of scientific research infrastructure** – both through intensification of cooperation on projects implemented under international programmes, and by connecting stakeholders who possess scientific research equipment at the national level, and connecting researchers and teams with the equipment of entities to which they do not belong institutionally.

The document titled Montenegro Development Directions 2018-2021 defines the development directions and policy fields, including smart growth. This programme contributes to the goals set by the smart growth pillar, in the field of science and higher education.

Furthermore, this Programme will partly contribute to responding to the obligation arising from the Mid-Term Work Programme of the Government⁵¹ (Goal 16, Obligation 16.2), defined in the previous period and referring to the affirmation of scientist profession.

The Open Science concept fully supports the strategic goal of “Improving the excellence and relevance of scientific research activities” defined by the Smart Specialisation Strategy of Montenegro (2019-2024)⁵². Namely, in order to provide support and build a more efficient research ecosystem, the Smart Specialisation Strategy of Montenegro especially focuses on opening access to infrastructures owned by public institutions and, in this regard, on improving domestic scientific research infrastructures. The reason for this is that research infrastructures greatly contribute to gathering a critical mass of researchers in any given science field, attracting excellent researchers from the international scientific research community, as well as members of the business and civil sector, along with new knowledge and investment, which is why it has a very important role in connecting all segments of society and stimulating international scientific cooperation.

The Economic Reform Programme 2020-2022⁵³, in terms of structural reforms, contains the segment of Research, Development and Innovation (RDI) and digital economy (5.3.4), defining three reform measures that envisage the promotion of legislative framework for innovations and innovation support system, as well as strengthening human resources. The operational goals in the Open Science Programme and accompanying activities are relating to the legislative framework and strengthening human resources.

⁵⁰ [Strategy of Scientific Research Activity \(2017-2021\)](#)

⁵¹ [Mid-Term Work Programme of the Government 2018-2020](#)

⁵² [Smart Specialisation Strategy of Montenegro \(2019-2024\)](#)

⁵³ [Economic Reform Programme 2020-2022](#)

The National Sustainable Development Strategy by 2030⁵⁴ defines the key outcomes aspired to be achieved until 2030, whose achievement would be supported by the introduction and development of the Open Science concept. Specifically, these are the measures that relate to increase in the research funding, increase in the number of scientists, participation in international cooperation programmes, improvement in position of Montenegrin universities in international rankings, in connection with Sustainable Development Goals⁵⁵ (SDG):

- **Improve education and science component in higher education** (measure 1.3.3) linked to SDG 4 (4.3, 4.4, 4.c), SDG 8 (8.3);
- **Encourage research and development in the field of resource efficiency and development of human resources** (measure 4.2.3), linked to SDG 2 (2.a), SDG 8 (8.3), SDG 12 (12.1, 12.a, 12.c), SDG 17 (17.3, 17.6, 17.16, 17.17).

⁵⁴ [National Sustainable Development Strategy by 2030](#)

⁵⁵ [Sustainable Development Goals](#)

4. OPEN SCIENCE IN MONTENEGRO IN EARLY 2020

4.1 OPEN ACCESS TO SCIENTIFIC PUBLICATIONS

No scientific research institution in Montenegro has adopted policies or recommendations related to implementation of the principle of Open Access to scientific publications, nor has this been required by research funders so far, which means that the implementation of these principles is up to individual researchers. The first steps in supporting publishing in accordance with the Open Access principles have been taken by the Ministry of Science, and the University of Montenegro is also working to raise awareness of the importance of this approach in scientific research activities.

As one of the first practical measures regarding Open Access, implemented since 2018, the Ministry of Science has allocated certain funds to co-finance the publication of papers by Montenegrin researchers in Open Access journals, covering article processing charges for researchers whose research was accepted for publishing in scientific journals categorised as Q1-Q3 in given fields. In 2020, the amount allocated for this purpose was EUR 30,000. In the period from 2018 to 2020, 42 publications were co-financed on this basis.

Under its Call for Applications for Financing Scientific Research Activities, the Ministry of Science also supports the publication of scientific journals with Open Access, provided that the journal is indexed in the Directory of Open Access Journals – DOAJ. In 2020, the amount allocated for this purpose was EUR 30,000. As regards the publication of Open Access journals in Montenegro, there are currently nine such journals from Montenegro in the Directory of Open Access Journals.

Of the scientific research institutions in Montenegro, until early 2020, only the University of Montenegro has signed the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities.⁵⁶ The act of signing took place on 22 October 2018. The University of Montenegro has also created a digital archive of the University, which includes an open electronic database of doctoral dissertations defended at the University of Montenegro.

Agreements between Montenegro and major international publishers have not been signed; therefore, no negotiations are planned with international publishers regarding transformative agreements for open publishing and reading of journals.

4.2 OPEN RESEARCH DATA

In Montenegro, there is no adopted policy of research funders or research institutions, which would require the systematic management of research data collected during the research in accordance with the FAIR and openness principles. Furthermore, no dedicated infrastructure, i.e., digital archive for storing research data, has been established so far. Various research projects funded by the Ministry of Science have collected research data that could be useful for other research and innovation projects, and/or could be used in the development of commercial products, but as there is no obligation to retain this data, upon project completion the research data are available only to individuals, if they still have research interests in the subject area, or the data is deleted. Examples of research data could include the data obtained by monitoring the marine environment, monitoring air and soil parameters on agricultural holdings, monitoring domestic and invasive mosquito species, recording atmospheric discharges by a measuring station on Lovćen mountain, etc.

4.3 OPEN RESEARCH INFRASTRUCTURES

One of the first steps taken by the Ministry of Science in this regard was to list publicly funded research infrastructures in Montenegro with a view to providing a detailed overview of it, as well as defining priorities and sources of funding in this area, recognising potential for regional and large European research infrastructures as well as identifying priority activities for the coming period.

Namely, in 2015, the Council for Scientific Research Activity adopted the National Roadmap for Research Infrastructure 2015-2020. Four years later, the document was revised due to significant changes that occurred in the meantime as a result of the introduction of various research and innovation funding instruments, which led to positive developments in the field of research infrastructures.⁵⁷ In addition to providing an extremely useful overview of available infrastructures and

⁵⁶ [Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities](#)

⁵⁷ [Revised Roadmap for Research Infrastructure in Montenegro \(2019-2020\)](#)

identification of key issues such as fragmentation, duplication, poor transparency, and even inadequate use of research infrastructures, the document specifically analyses the topic of Open Access to research infrastructures and the willingness of institutions to share equipment, as well as the interest of the public to use it.

It is encouraging that all institutions with significant research infrastructures expressed a positive attitude towards Open Access, as well as that there was a high degree of readiness of institutions to share equipment and offer education, training, as well as various types of measurements and testing. On the other hand, the public did not express much interest in accessing national research infrastructures, which is mainly due to the lack of transparency of available national research infrastructures, poor visibility of services offered by certain national infrastructures, as well as insufficient orientation of the business sector towards science-based development.

The involvement of Montenegro in various European and international organisations also provides Montenegrin researchers with numerous opportunities in terms of access to scientific research infrastructures, including: European Molecular Biology Organization (EMBO) / European Molecular Biology Laboratory (EMBL), International Centre for Genetic Engineering and Biotechnology (ICGEB), European Organization for Nuclear Research (CERN), European Space Agency (ESA), Laboratories of the European Commission's Joint Research Centre, etc.

At the regional level, an initiative of the Regional Cooperation Council aimed at drafting a Protocol on Open Access to Research Infrastructure in the Western Balkans was launched with a view to strengthening cooperation between researchers through promotion and facilitation of unobstructed access to research infrastructures in the region, as well as to improving the skills of researchers and optimising existing infrastructures in these countries. The document is fully aligned with the European Charter for Access to Research Infrastructures, which defines the principles and guidelines for defining policies for accessing research infrastructures and accompanying services.

4.4 EDUCATION AND PROMOTION OF OPEN SCIENCE

A significant number of researchers from Montenegro are not sufficiently familiar with the Open Science concept and principles, and the same applies to the majority of other main stakeholders in the Open Science domain. This is why a more intensive promotion of Open Science and education of all interested stakeholders is particularly important. So far, activities in this area have been undertaken by the Ministry of Science and the University of Montenegro.

The Ministry of Science has taken the first steps in promoting Open Science by supporting the publication of papers and scientific journals in accordance with the concept of Open Science. Namely, the Ministry co-finances the costs of publication of papers in Open Access journals that are indexed in the Web of Science database and classified as Q1-Q3 in their field, and supports the publication of Open Access scientific journals that are included in the DOAJ registry.

As noted above, the University of Montenegro (UCG) signed the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities in 2018. The University of Montenegro, i.e., the Faculty of Electrical Engineering in Podgorica as its representative, participates in the implementation of a Horizon 2020 project titled "National Initiatives for Open Science in Europe" (NI4OS-Europe), which started in September 2019. The project involves 22 partners from 15 countries and will last for three years. The main goal of the project is to become one of the main contributors to the EOSC portfolio, as well as to contribute to the EOSC governance structure and enable the implementation of the Open Science principles in the countries participating in the project.

Under the NI4OS-Europe project, national teams mapped possible Open Science stakeholders in each of the countries participating in the project. Two promotional events, two trainings at the national level and one training at the regional level, as well as other forms of capacity building support in the implementation of various Open Science aspects are planned in the countries participating in the project. In Montenegro, the first national NI4OS-Europe promotional event was held on 18 February 2020, as part of the international conference Information Technology – IT 2020, which took place in Žabljak on 18-21 February 2020. At this promotional event, which was attended by 34 participants, in addition to the activities and goals of the NI4OS-Europe project, the Open Science concept and EOSC were also presented.

In the process of drafting this Programme of Implementation of Open Science Principles in Montenegro (2020-2022), a meeting was held with the interested research institutions from Montenegro and contact persons were appointed by those institutions for future steps in the promotion of Open Science.

4.5 RESEARCH ASSESSMENT CRITERIA

In Montenegro, for the time being, there are no established criteria at the national or institutional level, under which researchers would have their practising of the Open Science principles assessed, i.e., under which they would be rewarded. Researchers who have started publishing their papers in accordance with the Open Access principle, or possibly organising the collected research data and making them openly accessible, do so by participating in international projects where this is one of the contractual obligations (e.g., projects from the H2020 Framework Programme), or because they recognised the benefits that Open Access can bring to them as individuals, in terms of better visibility of their research and results, as well as for opening opportunities for cooperation with international partners.

In the coming period, it will be necessary to establish criteria at the level of research institutions and at the level of research funders, who will acknowledge and reward research work conducted in accordance with the Open Science principles.

4.6 SWOT ANALYSIS

STRENGTHS

- Support to Open Science principles at the regional and state level;
- Activities on application of the Open Science principles have commenced;
- Presence of internationally well integrated excellence research teams/researchers;
- Developed scientific research system.

WEAKNESSES

- Absence of the national Open Science infrastructures;
- Inadequacy of legislative regulations and policies for support to Open Science principles;
- Insufficient application of the Open Science principles;
- Absence of education and insufficient promotion of Open Science principles.

OPPORTUNITIES

- Possibility of better utilisation of leading international funds for research and innovation resting on the Open Science principles;
- Possibility of better utilisation of Open Access to large international research infrastructures (JRC, CERN, etc.);
- Possibility of accessing open digital platforms for Open Science;
- Possibility of planning a “large-scale research infrastructure for sustainable technologies” in South-East Europe – SEEIIST, with a view to its more efficient use;
- Greater possibility for establishing public-private partnerships.

THREATS

- Publishers of scientific publications attempting to slow down the stronger establishment of Open Science principles;
- Change in the European strategic framework for application of Open Science principles;
- Outflow of highly-qualified research and innovation human resources.

5. VISION OF THE PROGRAMME OF IMPLEMENTATION OF OPEN SCIENCE PRINCIPLES IN MONTENEGRO (2020-2022)

The vision of Montenegro is that research activity is based on Open Science principles, which implies that it must be at the service of society as a whole and that public funds aimed at funding research activity need to be spent in an efficient and transparent manner. This can be achieved through open access to publications, research data and research infrastructures.

The results of the scientific research obtained through public funding are a public good and constitute national scientific heritage.

The provisions of the Programme of Implementation of Open Science Principles in Montenegro (2020–2022) constitute the best practices we aspire to and they have been taken over from the relevant documents of the EU countries, with adaptation to our local specific conditions:

- Employees in publicly funded higher education institutions and institutes and users of public funds, research grants are obliged to provide open access to publications and research data;
- Openness of research data must follow the principle: “as open as possible, as closed as necessary”;
- Research infrastructures procured or created as a result of publicly funded research must be available to all researchers in line with the Open Access principles;
- Education on the implementation of the Open Science principles and their promotion should be performed for all stakeholders;
- Institutional assessment of research should encourage Open Science;
- Montenegrin research infrastructures and repositories are part of the international Open Science infrastructures.

The Programme of Implementation of Open Science Principles in Montenegro (2020-2022) represents the first phase in the longer process of aligning the Montenegrin research system with the European Research Area.

6. PROVISIONS OF THE PROGRAMME OF IMPLEMENTATION OF OPEN SCIENCE PRINCIPLES IN MONTENEGRO (2020-2022)

The Programme of Implementation of Open Science Principles in Montenegro (2020-2022) is focused on three main Open Science aspects: Open Access to Scientific Publications, including scientific journals and monographs published in Montenegro, Open Research Data and Open Research Infrastructures. These aspects have been identified in the Strategy of Scientific Research Activity (2017-2021) as primary components that need to be further developed in the Montenegrin scientific research environment.

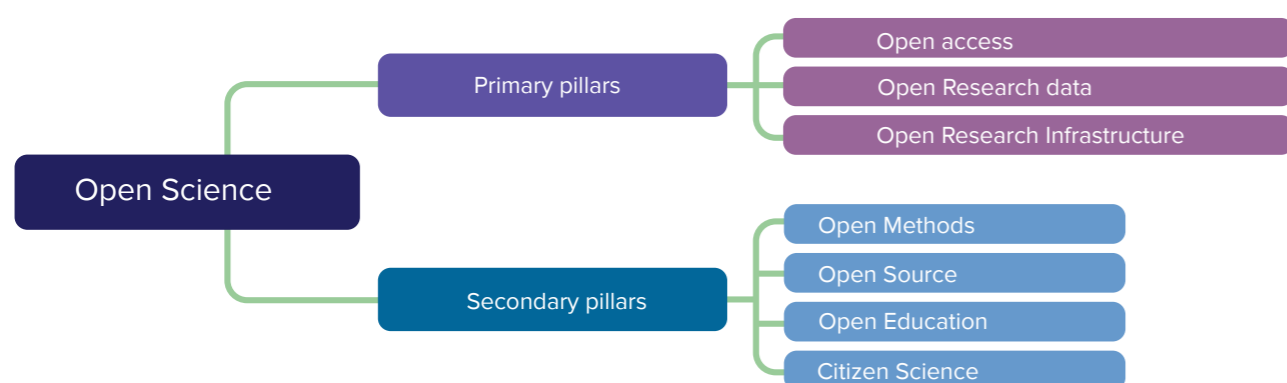


Figure 3: Open Science aspects in Montenegro

Open Science aspects are divided into primary and secondary, where primary aspects are identified as the main pillars of Open Science concept due to their practical application and presence in the academic sector. The primary aspects are: Open Access to Scientific Publications, Open Research Data and Open Research Infrastructures, while the secondary Open Science aspects are: Open Methods, Open Evaluation, Open Education and Citizen Science (Figure 3). A detailed description of each of these aspects is presented in Table 1.

Given that one of the problematic issues in Montenegro is the lack of cooperation between academic institutions and the economy, it is expected that the dissemination of research results in the manner envisaged by the Open Science policy will contribute to motivating the national economy to invest in research projects, as well as to a higher degree of cooperation and joint work with Montenegrin scientists.

Researchers and/or research organisations coming from the academic, business, public or non-governmental sector should decide how to use the results of their publicly funded research (Figure 4). If they opt for commercialisation (patenting or other forms of intellectual property protection), then the research results will not be published before protection. Thus, it is only after the researcher and/or research organisation decides to disseminate the research results that Open Access to publications and data can be implemented.

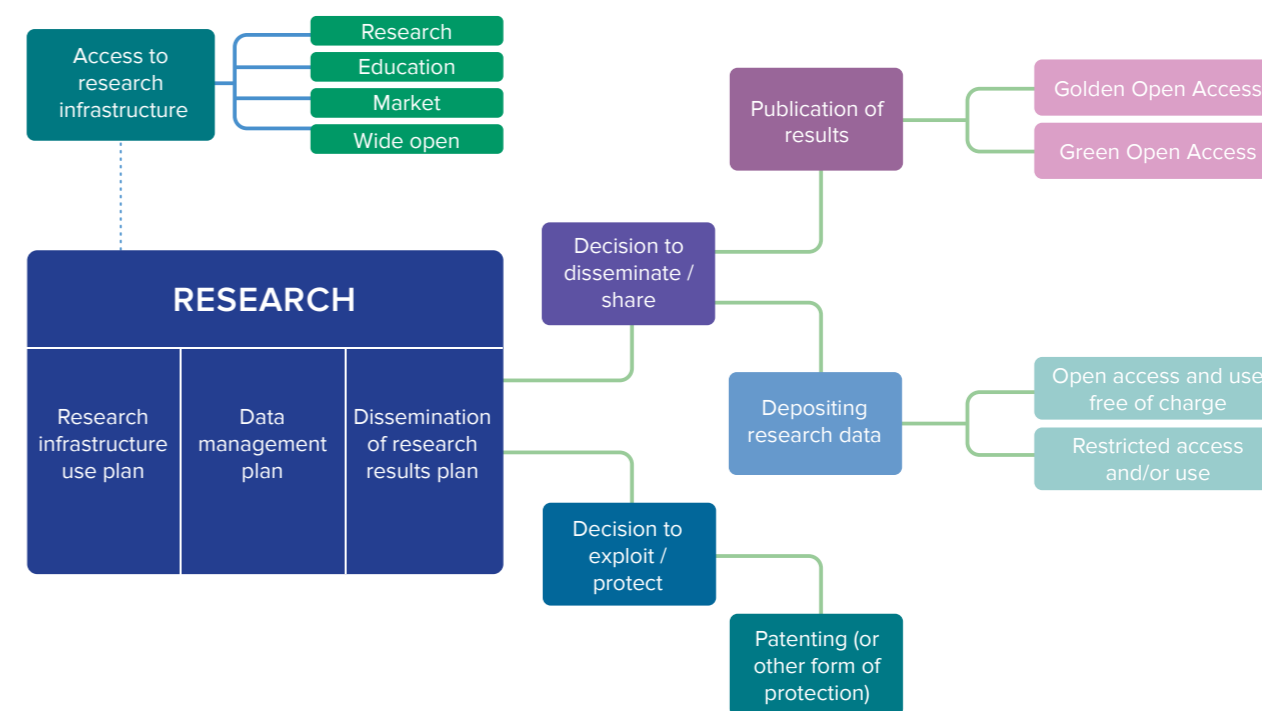


Figure 4: Research process and the process of dissemination of research results⁵⁸

In order to change research culture in terms of introducing the obligation to practice the Open Science principles and to achieve greater efficiency in this effort, it is necessary to apply a phased approach. This implies the gradual creation and establishment of the necessary framework (including technical, organisational, regulatory and other aspects) and the inevitable raising of awareness of researchers and other stakeholders on the importance of Open Science.

Montenegro will follow the impact of application of Open Science principles on the Global Innovation Index,⁵⁹ in the part related to Human capital and research (Section 2), as well as in relation to Global Competitiveness Index,⁶⁰ in the part related to Innovation capacity (Section 12) in the Research and Development sub-section.

6.1 OPEN ACCESS TO SCIENTIFIC PUBLICATIONS

In the first phase of establishing this aspect of Open Science, the focus will be placed on building an infrastructure for storing scientific publications, i.e., creating a national repository as a single point of access to overall national research results, along with appropriate rules for its use that will apply to all stakeholders taking part in the research process.

In the meantime, in order to immediately start strengthening the Open Science culture in terms of this aspect, it is recommended that until the national repository is built, all publications resulting from publicly funded research be stored in well-known international repositories,⁶¹ in accordance with the principles of Green Open Access. Through Green Open Access, i.e., through self-archiving, researchers can, without any additional costs, practice Open Access in relation to peer-reviewed publications; however, they should not choose repositories that require rights over the deposited publications and restrict access in any way. If, on the other hand, they opt for the Gold Open Access, the fees for processing the peer-reviewed paper when published in an Open Access scientific journal will represent eligible costs during the research project.

⁵⁸ Adapted from the [Guidelines on Open Access to Scientific Publications and Research Data in Horizon 2020](#).

⁵⁹ This index illustrates multidimensional innovation aspects, providing a detailed database at the global level and encompassing 90.8% of the world population and 96.3% of the world's GDP.

⁶⁰ This index provides a detailed map of factors resulting in greater productivity, growth and human development at the global scale, including 141 economies and 99% of the world's GDP.

⁶¹ [Open Access Infrastructure for Research in Europe \(OpenAIRE\)](#) provides support to select a repository. The information on Open Access repositories is also available in the [Directory of Open Access Repositories \(OpenDOAR\)](#) and in the [Registry of Open Access Repositories \(ROAR\)](#).

Once the infrastructure is established, the practice of Green Open Access will become mandatory, i.e., machine-readable electronic versions⁶² (published or accepted for publication⁶³) of all publications resulting from (partially or fully) publicly funded research will have to be deposited in a national repository and be made available for reading, download and print. Where possible, the full text of published scientific publications must be available under the Open Access principles immediately, and no later than six months from the date of official publication – for natural sciences, or twelve months – for social sciences and humanities, in accordance with provisions of Horizon 2020 Framework Programme for Research and Innovation. At this stage, the obligation to deposit in the national repository will also apply to scientific publications published under the principle of the Gold Open Access.

It is very important to stress that publishing according to the Open Access principle must complete the same level of verification, i.e., peer-review, that is completed by publications published in subscription-based journals. In this way, the focus remains on quality, instead of quantity.

After depositing the publication in the repository, users will need to provide Open Access to the bibliographic metadata of the publication, which must be presented in a standard format.

Publication authors must have national identification attributes and must be uniquely recognised through identifiers that are permanent, unlicensed, open, and interoperable (e.g., ORCID⁶⁴ for author identifiers).

Metadata also must contain all of the following information:

- acronym of the funder,
- financing programme,
- project title, acronym and number of the grant agreement,
- date of publication and duration of embargo period, if applicable,
- permanent identifier.

A permanent identifier (for example, a digital object identifier, DOI, universal resource name, URN) permanently identifies an individual publication and the location of its published version. If a permanent identifier is recorded in the metadata of the peer-reviewed paper in the repository, it is possible to link to its published version.

6.1.1 OPEN ACCESS TO SCIENTIFIC JOURNALS AND MONOGRAPHS PUBLISHED IN MONTENEGRO

Journals published by Montenegro-based publishers that contain peer-reviewed papers and receive national public funding for their activities, in part or in full, must be openly available (under the Gold Open Access principle). Scientific papers in these journals must be publicly available immediately upon publication and copyright must be managed through Open Access licenses (e.g., Creative Commons). It is recommended that open access journal publishing software be compatible with the OpenAIRE guidelines. Journals must be included in the Directory of Open Access Journals (DOAJ).

Publishers of scientific monographs should strive to publish monographs through business models that will enable open access to the full text immediately upon publication, with their licensing pursuant to Open Access licenses (e.g., Creative Commons). Published open access scientific monographs must be included in the Directory of Open Access Books (DOAB).

Open access scientific monographs, licensed under Creative Commons open access licenses, must be open in a repository, in the form of a published monograph, at the latest upon their publication.

⁶² Machine-readable electronic versions of publications mean that publications must be in a format that can be used by computer software packages. Publications must be stored using standardised text file formats.

⁶³ A version of the scientific publication that is accepted for publication (Author Accepted Manuscript or postprint) and contains all the changes from the peer-review process, but the text is not yet graphically formatted for the journal.

⁶⁴ ORCID is an alphanumeric code for the unique identification of the authors of scientific and other documents (<http://orcid.org/>).

6.2 OPEN ACCESS TO RESEARCH DATA

As in the case of Open Access to publications, the first phase in this aspect of Open Science involves the establishment of a national repository for research data storage, as well as adoption of accompanying rules for its use.

Given that there is currently no such infrastructure at the national level, it is recommended that until the establishment of the national repository, all research data resulting from publicly funded research (partially or fully) be stored in one of the existing repositories⁶⁵. In doing so, it is recommended to use thematic repositories for appropriate areas, while in the absence of such repositories it is possible to use the Zenodo⁶⁶ digital archive.

Open access to research data should be provided immediately after the publication of a scientific paper to which they belong, with possible legal and/or ethical restrictions. Research data should be freely available in appropriate digital repositories that meet international interoperability standards. Interoperability standards refer to the use of repositories that offer metadata in accordance with the OpenAIRE/DataCite metadata guidelines as a minimum. Archived research data are needed to validate the results presented in the deposited scientific publications and should therefore be considered a key segment of publications.

If access to research data is restricted due to exceptions, or if an embargo period is established, which corresponds to the embargo period of publishing a scientific publication in accordance with the principle of Green Open Access, then at least openly available metadata must be prepared and immediately available for the digital repository catalogue, where the location and conditions for accessing research data will be indicated.

Research datasets must have unique identifiers (e.g., DataCite's DOIs⁶⁷ for research data identifiers).

Metadata also must contain all of the following information:

- acronym of the funder,
- financing programme,
- project's title, acronym and number of the grant agreement,
- date of publication and duration of embargo period, if applicable,
- permanent identifier.

As a means of raising awareness regarding the issue of data collection, processing and dissemination, it is necessary to encourage the submission of a data management plan (DMP) in the first six months of the project. In this regard, DMP costs will be considered as eligible costs in research funding schemes at the national level. In the project evaluation process, grant beneficiaries will be required to report all deposited/open data.

Following the establishment of national infrastructure for storing research data obtained through publicly funded research (partially or fully), it will be mandatory to apply the Open Data principles, with a recommendation to adopt and practice the FAIR principles.

6.3 OPEN ACCESS TO RESEARCH INFRASTRUCTURES

A holistic approach is necessary in order to provide for the best possible use of research infrastructures by providing services and enabling access to users, but also to provide for the necessary funding. At the national level, scientific research infrastructures acquired or created as a result of publicly funded research (partially or fully) must be available to all researchers according to the Open Access principles.

Montenegro adopted the National Roadmap for Research Infrastructure (2015-2020) as the first country in the Western Balkans to do so, only to revise the document in 2019. A new document is planned to be drafted for the period of 2021-2025, based on the mapping of existing infrastructures and the plan of investment into new infrastructures which will, inter alia, contribute to a more efficient implementation of the Smart Specialisation Strategy of Montenegro. In this process, special attention will be devoted to application of the principle of Open Access to research infrastructures.

⁶⁵ Adequate repositories may be found via Registry of Research Data Repositories re3data.org or FAIRsharing.org.

⁶⁶ [Zenodo](https://zenodo.org/)

⁶⁷ [DataCite](https://datacite.org/) is an international organisation whose main purpose is to develop and support the discovery, identification and citation of research data and other research outputs.

It is desirable to open the research infrastructures for international/transnational use. This enables the research infrastructures to attract excellent researchers and gain access to relevant networks of researchers.

In this process, the first phase will involve the creation of a national digital registry for research infrastructures which will provide a simple overview and search of research infrastructures, equipment, services, etc., which exist at the national level. In this regard, it is necessary to consider the possibility of joining one of the existing, stable platforms (such as the Engage in the Romanian Research Infrastructures System Platform – ERRIS), especially from the aspect of financial sustainability. Furthermore, one of the possibilities is to expand the existing Montenegrin “Science Network” information system by developing a new module for research infrastructures.

The registry will initially contain information on the infrastructures and scientific research institutions holding them, and the services they offer, in accordance with the list compiled in 2019 (described in Chapter 4.3).

Furthermore, it is necessary to clearly define the rules of access and use of research infrastructures in accordance with the modalities and purpose of the access allowed, i.e., that access is focused on research, education, achieving market benefits. The rules must in any case comply with the principles of intellectual property protection and ownership rights over research results.

An active exchange of knowledge and experience with other research infrastructures is certainly recommended in order to keep up to date with new cost models for Open Access to research infrastructures, as well as with monitoring and management requirements.

6.4 EDUCATION AND PROMOTION OF OPEN SCIENCE

Adoption of Open Science policies, development of adequate infrastructures and integration of Open Science criteria in the process of evaluation and assessment of research can be achieved only by raising the awareness of all Open Science stakeholders. In order to adopt Open Science practices on a daily basis, researchers should be aware of the benefits it can bring them and should acquire new knowledge and skills through continuous training and support specific to their disciplines. In addition, higher education institutions should include topics related to Open Science in their curricula. This requires a comprehensive organisation responsible for awareness-raising, followed by action at sectoral levels.

In this regard, the activities that are of particular importance are:

- Organisation of promotional events (info-events, trainings, workshops);
- Education and training of doctoral students, through the modification of curricula;
- Training of researchers;
- Training of support staff;
- Providing discipline-specific guidance and training;
- Providing stakeholder-specific guidance and training.

Within the planned phased approach to the application of the Open Science principles in Montenegro, this is one of the most important activities in the first phase, the implementation of which can mostly begin regardless of when the national infrastructure for storage of scientific papers and research data will be established. The activity of changing the curricula for doctoral studies, in order to include topics related to the Open Science principles, will be proposed to universities in Montenegro.

6.5 RESEARCH ASSESSMENT CRITERIA

Changes in assessment practices with a view to recognizing Open Science activities (including Open and FAIR research data management) should include assessment of individual researchers (for promotion of researchers, engagement and research rewards), assessment of research groups and institutions, and inclusion of these metrics in the distribution of funding and evaluation of project proposals and results.

In order to promote the practice of the Open Science principles, it is necessary to introduce criteria for assessment and rewarding of researchers who follow the Open Science principles in their careers. In this regard, the key activities are:

- Additional acknowledgment of publications published according to the Open Access principle, in the assessment of research work at different levels;
- Integrating research data management, openness and FAIR principles into the process of assessment and evaluation of research at different levels;
- Promotion of researchers who practice the Open Science principles;
- Acknowledging the practice of the Open Science principles during:
 - Researcher recruitment procedures;
 - Evaluation of project proposals;
 - Evaluation of the institutions;
 - Awarding research rewards.

7. OPERATIONAL GOALS AND PERFORMANCE INDICATORS OF THE PROGRAMME OF IMPLEMENTATION OF OPEN SCIENCE PRINCIPLES IN MONTENEGRO (2020-2022)

Table 2: Overview of Operational Goals and Performance Indicators

Operational Goal	Performance Indicators
1. Improving legislative framework that enables the application of Open Science principles	1.1 The number of applied recommendations that have been incorporated into legislative framework
2. Establishing national infrastructure for Open Science to improve research and innovation activities	2.1 The number of established repositories and registries for Open Science
3. Enhancing the implementation of Open Science principles to improve excellence and relevance of scientific research activities	3.1 Proportion of papers published according to the Open Access principles
	3.2 Number of national scientific journals that support the Open Access principle
	3.3 Number of research datasets stored in data repositories
	3.4 Number of scientific research organisations that have provided Open Access to research infrastructures
4. Developing human capital through education and promotion of Open Science principles to strengthen competitiveness in the field of research	4.1 Growth in the number of researchers using national infrastructures for Open Science

8. ACTION PLAN OF THE PROGRAMME OF IMPLEMENTATION OF OPEN SCIENCE PRINCIPLES IN MONTENEGRO (2020-2022)

List of abbreviations used in the Action Plan:

- CEM – Chamber of Economy of Montenegro
- ERA-PSF – European Research Area – Policy Support Facility
- MoE – Ministry of Economy
- MoEdu – Ministry of Education
- MoPA – Ministry of Public Administration
- MoS – Ministry of Science
- SR – Scientific research

Table 3: A detailed overview of implementation of Operational Goal 1

Operational Goal 1: Improving legislative framework that enables the application of Open Science principles						
Performance Indicator	Base value 2020			Target value 2022		
1.1 The number of applied recommendations that have been incorporated into legislative framework	0			4		
Activity influencing the operational goal implementation of the operational goal	Result indicator	Responsible institutions	Starting date	Planned completion date	Funds planned for implementation of the activity	Funding source
A Drafting an analysis that will determine the impact of the Open Science principles on existing legislation and policies along with recommendations for their amendments	Accepted amendments to regulations and policies that are subject to the impact of Open Science principles	MoS, MoEdu, MoE, MoPA	IIIQ 2020	IIIQ 2021	EUR 50,000	European Commission via ERA-PSF instrument (MoS, MoEdu, MoE, MoPA)
B Drafting a study that will identify the necessary amendments to the rules for advancement in academic and research careers in terms of support for the Open Science principles	Accepted amendments to the rules for advancement in academic and research careers in terms of support to Open Science principles	European Commission via ERA-PSF instrument (MoS, MoEdu, MoE, MoPA)	IIIQ 2020	IIIQ 2021	EUR 5,000	European Commission via ERA-PSF instrument (MoS, MoEdu)

Table 4: A detailed overview of implementation of Operational Goal 2

Operational Goal 2: Establishing national infrastructure for Open Science to improve research and innovation activities						
Performance Indicator		Base value 2020			Target value 2022	
2.1 The number of established repositories and registries for Open Science		0			3	
Activity influencing the implementation of the operational goal	Result indicator	Responsible institutions	Starting date	Planned completion date	Funds planned for implementation of the activity	Funding source
A Drafting a feasibility study and terms of reference for a national Open Science repository (publications and data)	Feasibility study and terms of reference for a national Open Science repository prepared	MoS	IIIQ 2020	IVQ 2020	EUR 5,000	MoS
B Establishing a national Open Science repository	National Open Science repository established	MoS	IQ 2021	IIIQ 2021	EUR 30,000 initially + EUR 15,000 a year	MoS
C Drafting a study that will determine whether to develop a national research infrastructure registry or to join an international registry	Decision made about the research infrastructure registry	MoS	IIIQ 2020	IVQ 2020	Administrative	MoS
D Development of a national registry or enabled use of international registry	Developed national registry or active participation in an international registry	MoS	IQ 2021	IIIQ 2021	EUR 15,000 initially + EUR 3,000 a year	MoS
E Drafting a National roadmap for research (and innovation) infrastructure	National roadmap adopted	MoS	IVQ 2020	IIIQ 2021	EUR 4,000	MoS

Table 5: A detailed overview of implementation of Operational Goal 3

Operational Goal 3: Enhancing the implementation of Open Science principles to improve excellence and relevance of scientific research activities						
Performance Indicator		Base value 2020			Target value 2022	
3.1 Proportion of papers published according to the Open Access principles		Not possible to assess			70% of papers resulting from publicly funded research	
3.2 The number of national scientific journals that support the Open Access principle		9			12	
3.3 Number of research datasets stored in data repositories		Not possible to assess			10	
3.4 Number of scientific research organisations that have provided Open Access to research infrastructures		Not possible to assess			10	
Activity influencing the implementation of the operational goal	Result indicator	Responsible institutions	Starting date	Planned completion date	Funds planned for implementation of the activity	Funding source
A Creating national rules for Open Access to scientific publications	Set of national rules adopted for storing scientific publications under the Open Access principles	MoS	IIQ 2021	IIIQ 2021	Administrative	MoS
B Creating national rules for supporting national scientific journals	Set of national rules adopted for support to national scientific journals supporting Open Access principles	MoS	IIQ 2021	IIIQ 2021	Administrative	MoS
C Creating national rules for publishing open research data	Set of national rules adopted for storing open research data in a digital repository	MoS	IIQ 2021	IIIQ 2021	Administrative	MoS
D Creating national rules for the registry of open research infrastructures	Set of national rules adopted for the use of national or international registry	MoS	IIQ 2021	IIIQ 2021	Administrative	MoS

Table 6: A detailed overview of implementation of Operational Goal 4

Operational Goal 4: Developing human capital through education and promotion of Open Science principles to strengthen competitiveness in the field of research						
Performance Indicator		Base value 2020			Target value 2022	
4.1 Growth in the number of researchers using national infrastructures for Open Science		0			Target value to be defined following the establishment of the infrastructure	
Activity influencing the implementation of the operational goal	Result indicator	Responsible institutions	Starting date	Planned completion date	Funds planned for implementation of the activity	Funding source
A Organisation of educational and promotional events	1. The number of educational and promotional events held - Base value 2020: 1 - Target value 2022: 5	MoS, MoEdu, CEM, Licensed SR institutions	IIQ 2021	IVQ 2022	EUR 30,000	MoS
	2. The number of researchers who have completed the training - Base value 2020: 3 - Target value 2022: 50					
B Analysis of the study programmes (curricula) at the level of doctoral studies, with a view to include Open Science principles in the learning outcomes	Open Science study course created as an integral part of the doctoral studies curriculum	MoS, MoEdu	IIIQ 2020	IIQ 2021	Administrative	MoS, MoEdu
C Incentives for participation in Open Science activities in line with the call for	The number of researchers who have taken part in Open Science activities	MoS, MoEdu	IIIQ 2020	IVQ 2022	EUR 40,000	MoS

Table 7: Overview of implementation of the Action Plan

OPEN SCIENCE - ACTION PLAN	IIIQ 2020	IVQ 2020	IQ 2021	IIQ 2021	IIIQ 2021	IVQ 2021	IQ 2022	IIQ 2022	IIIQ 2022	IVQ 2022
Operational Goal 1: Improving legislative framework that enables the application of Open Science principles										
A) Drafting an analysis that will determine the impact of the Open Science principles on existing legislation and policies along with recommendations for their amendments										
B) Drafting a study that will identify the necessary amendments to the rules for advancement in academic and research careers in terms of support for the Open Science principles										
Operational Goal 2: Establishing national infrastructure for Open Science to improve research and innovation activities										
A) Drafting a feasibility study and terms of reference for a national Open Science repository (publications and data)										
B) Establishing a national Open Science repository										
C) Drafting a study that will determine whether to develop a national research infrastructure registry or to join an international registry										
D) Development of a national registry or enabled use of international registry										
E) Drafting a National roadmap for research (and innovation) infrastructure										
Operational Goal 3: Enhancing the implementation of Open Science principles to improve excellence and relevance of scientific research activities										
A) Creating national rules for Open Access to scientific publications										
B) Creating national rules for supporting national scientific journals										
C) Creating national rules for publishing open research data										
D) Creating national rules for the registry of open research infrastructures Operational										
Goal 4: Developing human capital through education and promotion of Open Science principles to strengthen competitiveness in the field of research										
A) Organisation of educational and promotional events										
B) Analysis of the study programmes (curricula) at the level of doctoral studies, with a view to include Open Science principles in the learning outcomes										
C) Incentives for participation in Open Science activities in line with the call for proposals for scientific research activities										

Table 8: Overview of the funds needed for programme implementation

No.	Operational Goal / Activity	2020	2021	2022	Total
1	Improving legislative framework that enables the application of Open Science principles	0.00 €	55,000 €	0.00 €	55,000 €
A	Drafting an analysis that will determine the impact of the Open Science principles on existing legislation and policies along with recommendations for their amendments		50,000 €		50,000 €
B	Drafting a study that will identify the necessary amendments to the rules for advancement in academic and research careers in terms of support for the Open Science principles		5,000 €		5,000 €
2	Establishing national infrastructure for Open Science to improve research and innovation activities	5,000 €	49,000 €	18,000 €	72,000 €
A	Drafting a feasibility study and terms of reference for a national Open Science repository (publications and data)	5,000 €			5,000 €
B	Establishing a national Open Science repository		30,000 €	15,000 €	45,000 €
C	Drafting a study that will determine whether to develop a national research infrastructure registry or to join an international registry				0.00 €
D	Development of a national registry or enabled use of international registry		15,000 €	3,000 €	18,000 €
E	Drafting a National roadmap for research (and innovation) infrastructure		4,000 €		4,000 €
3	Enhancing the implementation of Open Science principles to improve excellence and relevance of scientific research activities	0.00 €	0.00 €	0.00 €	0.00 €
A	Creating national rules for Open Access to scientific publications				0.00 €
B	Creating national rules for supporting national scientific journals				0.00 €
C	Creating national rules for publishing open research data				0.00 €
D	Creating national rules for the registry of open research infrastructures				0.00 €
4	Developing human capital through education and promotion of Open Science principles to strengthen competitiveness in the field of research	0.00 €	35,000 €	35,000 €	70,000 €
A	Organisation of educational and promotional events		15,000 €	15,000 €	30,000 €
B	Analysis of the study programmes (curricula) at the level of doctoral studies, with a view to include Open Science principles in the learning outcomes				0.00 €
C	Incentives for participation in Open Science activities in line with the call for proposals for scientific research activities		20,000 €	20,000 €	40,000 €
	TOTAL	5,000 €	139,000€	53,000€	197,000€

9. MANAGEMENT, REPORTING AND EVALUATION OF THE PROGRAMME OF IMPLEMENTATION OF OPEN SCIENCE PRINCIPLES IN MONTENEGRO WITH THE ACTION PLAN (2020-2022)

Open Science is still in the early stages of its evolution, but the monitoring of its progress is necessary in this initial phase as well, in order to timely and adequately harmonise further policies related to Open Science in Montenegro.

Management of the implementation of the Open Science principles will be performed with the help of two organisational structures for reasons of simplicity and efficiency. At the strategic level, the Inter-Agency Working Group for the Application of the Open Science Principles, composed of representatives of the business, public, academic and civil sectors, will perform its tasks, while at the operational level, the Working Group for Open Science will operate. The Ministry of Science will be in charge of monitoring the activities of these two organisational structures.

Reporting on the implementation of the Programme of Implementation of Open Science Principles in Montenegro (2020-2022) will be performed through a stand-alone document in line with Article 19 of the Decree on the manner and procedure of drafting, harmonisation and monitoring the implementation of strategic documents. In addition, certain activities from the report will constitute inputs for reporting on relevant strategies (smart specialisation, scientific research and innovative activities). With a view to preparation of this report, the Working Group for Open Science will convene four times a year. The Inter-Agency Working Group for Open Science will be responsible for collection and analysis of data for each relevant Operational Goal.

The evaluation of the Programme of Implementation of Open Science Principles in Montenegro (2020-2022) will, if possible, i.e., if funding is available, be done after two years (mid-2022) in the form of an independent external evaluation. Funds can be planned from EU funds (Instrument for Pre-Accession Assistance (IPA)/Horizon Europe). In case international funds are not available, the evaluation can be done with resources available at the national level.

