

REPUBLIC OF CROATIA  
MINISTRY OF SCIENCE,  
EDUCATION AND YOUTH

# CROATIAN OPEN SCIENCE PLAN



Zagreb, May 2025

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## Foreword

Open science entails ensuring transparency throughout the entire research process — from the formulation of research questions to the dissemination of results. In doing so, it fosters collaboration, openness, and the inclusion of diverse stakeholders, including academia, industry, civil society, and citizens. Open science fosters fairness, sustainability, and democracy in the creation and dissemination of knowledge. It makes an exceptional contribution to enhancing the social relevance of scientific research and its practical applicability in addressing specific challenges.

At the level of the European Union, open science has long been a strategic priority within the European Commission's policies. This is reflected particularly in the EU Framework Programmes for Research and Innovation and in new approaches to evaluating scientific excellence and fostering cooperation within the European Research Area (ERA). At the same time, the Organisation for Economic Co-operation and Development (OECD), with which Croatia maintains close cooperation, continuously advocates the principles of openness while also emphasising the importance of integrity, accountability, and security within scientific systems.

The Croatian Open Science Plan was developed on the basis of the proposal for a National Open Science Plan, prepared by the Working group for drafting the proposal of the National open science plan, operating under the Croatian Open Science Cloud Initiative (HR-OOZ). This document reflects the Republic of Croatia's commitment to fostering a scientific system that is accessible, credible, responsible, and inclusive, and that grounds its scientific and artistic activities in open science as one of its core principles.

Open access to scientific content must comply with the highest standards of personal data protection, intellectual property rights, and national security, and must incorporate mechanisms for the responsible management of research data and results.

The Croatian Open Science Plan was developed with a clear goal: to align European and international open science principles with the needs and development priorities of Croatia's scientific system. Among other objectives, the Plan sets out specific goals related to accessibility of research results through ensuring open access to scientific publications and the sharing of research data. It also aims to increase the use and visibility of research results, promote the application of open science principles in the work of researchers and institutions, and strengthen connections between the scientific community and the wider public.

This Plan is the result of consultations with stakeholders from the academic community, public authorities, the science and innovation system, the business sector, and civil society. Its implementation will require a joint effort and cross-sectoral cooperation to build a scientific system that is open, secure, and resilient. The Plan represents a dynamic framework that will be adapted in line with technological developments, European integration processes, and the evolving needs of Croatian society. Through its implementation, we are creating the conditions for the science of the future — a science that is both accessible and responsible, nationally relevant, and globally connected.

Sincerely,

**Minister of Science, Education and Youth**

**Prof. Radovan Fuchs, Ph. D.**



## LIST OF ABBREVIATIONS

CARE – Collective benefit, Authority to control, Responsibility, Ethics

CERIC – Central European Research Infrastructure Consortium

CESSDA – Consortium of European Social Science Data Archives

CLARIN – Common Language Resources and Technology Infrastructure

CC licences – *Creative Commons* licences

CroRIS – Croatian Research Information System

CROSBI – Croatian Scientific Bibliography

CROSSDA – Croatian Social Science Data Archive

CSTP – Committee for Scientific and Technological Policy

Dabar – Digital Academic Archives and Repositories

DARIAH – Digital Research Infrastructure for the Arts and Humanities

EATRIS – European infrastructure for translational medicine

EHRI – European Holocaust Research Infrastructure

EC – European Commission

EOSC – European Open Science Cloud

EPOS – European Plate Observing System

ERIC – European Research Infrastructure Consortium

ESFRI – European Strategy Forum on Research Infrastructures

ESS – European Social Survey

EU – European Union

FAIR – Findable, Accessible, Interoperable and Re-usable

Hrčak – Portal of Croatian Scientific and Professional Journals

HR-OOZ – Croatian Open Science Cloud

HR-ZOO – Croatian Scientific and Educational Cloud

CSF – Croatian Science Foundation

ICT – Information and Communications Technology

ISVU – Higher Education Institutions Information System

MSEY – Ministry of Science, Education and Youth

NSK – National and University Library in Zagreb

NRRP – National Recovery and Resilience Plan 2021–2026

OECD – Organisation for Economic Co-operation and Development

OpenAIRE – Open Access Infrastructure for Research in Europe

OpenAIRE NOAD – Open Access Infrastructure for Research in Europe National Open Access Desks

ORE – Open Research Europe

PDC – Public Data Collections

POIROT – Database of project activities in science and higher education in the Republic of Croatia

Puh – Data storage and management

RDMP – Research Data Management Plan

RDA – Research Data Alliance

SHARE – Survey of Health, Ageing and Retirement in Europe

Srce – University of Zagreb, University Computing Centre

ŠESTAR – Database of scientific research instruments

UNESCO – United Nations Educational, Scientific and Cultural Organization

# 1. Introduction

## 1.1. Open Science

**This chapter provides a definition and an overview of the benefits of implementing open science, as well as an explanation of how open science contributes to achieving Croatia's and the European Union's strategic objectives.**

Open science is a set of principles and practices designed to make scientific research across all fields and languages accessible, reusable, and shareable for the benefit of both scientists and society as a whole. It ensures the accessibility and verifiability of scientific results, while also promoting inclusiveness, fairness, and sustainability in the creation and dissemination of knowledge. Open science entails the opening of the entire research process, meaning that scientific practice is conducted and information is exchanged in an open and collaborative manner, enabling participation in and transparent use of all research outcomes. Open science promotes not only open access to publications, research protocols, and data, but also openness throughout the entire knowledge creation process, scientific communication, the popularisation of science, open dialogue, peer review and evaluation, open formats, data and tools, open standards, open scientific infrastructures and open-source software, as well as open education and citizen science.

The principles of open science have been applied in the European Union for many years, with the initial emphasis placed on open access to scientific publications. It is undeniable that open science today represents one of the political priorities of the European Commission (EC) and serves as a standard working method within its research and innovation funding programmes. The European Commission defines open science as a systemic transformation that enables better science through open and collaborative ways of producing and sharing knowledge and data as early as possible in the research process, as well as through open communication and the sharing of scientific results.

Open science contributes to enhancing the national research landscape, improving the quality and efficiency of the research system, and accelerating meaningful societal progress.

The implementation of open science requires the engagement of the entire scientific system, including research institutions, research teams, and individual researchers. This often entails organisational and cultural change, the adoption of a culture of sharing and collaboration, and adjustments to established practices, obligations, and norms. By sharing scientific data and results with the public, open science enables citizens to better understand scientific processes and findings, thereby strengthening public trust in science.

In addition to the open exchange of knowledge and information, open science fosters innovation, supports economic development, and contributes to addressing social challenges.

## 1.2. Open Science in the Republic of Croatia

This chapter provides an overview of the state of open science in the Republic of Croatia and outlines the policies implemented at the national level.

Croatia is part of the European Research Area and supports open science through various initiatives, primarily bottom-up efforts in the field of open access. It also participates in a number of international infrastructures and initiatives dedicated to open science, including EOSC, OpenAIRE, CESSDA, OPERAS, DARIAH, and CLARIN. Open-access activities in Croatia began in 1997 with the establishment of the Croatian Scientific Bibliography (CROSKI), which included open-access repository<sup>1</sup> functionalities. Since then, several national open-access initiatives have been launched, including: Who's Who in Science in Croatia, Hrčak – the portal of Croatian open-access journals, ŠESTAR – the database of scientific research instruments, DABAR – the national infrastructure for institutional and thematic repositories, Puh – the system for storing and exchanging research data during research, POIROT – the database of research projects, CroRIS – the Croatian Research Information System, and CROSSDA – the Croatian Social Science Data Archive, among others. CROSKI is integrated with the ŠESTAR and POIROT systems within CroRIS – the new, comprehensive Croatian Research Information System<sup>2</sup>, which will serve as the backbone for recording activities, enhancing visibility, and monitoring the performance of Croatian science in line with the principles and practices of open science. Furthermore, in 2021, the Croatian Science Foundation (CSF) decided to introduce the Research Data Management Plan (RDMP) as a mandatory document in the planning and implementation of research projects. This measure represents an important step towards the advancement of open science.

**Figure 1. Croatian National Open Access Initiatives**



### Croatian National Open Access Initiatives

- „Who's Who in Science in Croatia”
- **HRČAK**
- **ŠESTAR** – database of scientific research instruments
- **DABAR** – national infrastructure for institutional and thematic repositories
- **PUH** – system for storing and exchanging research data
- **POIROT** – database of projects
- **CroRIS** – Croatian Research Information System
- **CROSSDA** – Croatian Social Science Data Archive

Source: HR-OOZ Initiative Council (2023)

<sup>1</sup> CROSKI – Croatian Scientific Bibliography, 1997, URL: <https://www.bib.irb.hr:8443/>

<sup>2</sup> CroRIS – Croatian Research Information System, 2023, URL: <https://www.croris.hr/croris>

## Institutional Framework

Several state and public bodies play an important role in promoting, implementing, and monitoring open science at the national level in the Republic of Croatia:

- **The Ministry of Science, Education and Youth (MSEY)** is responsible for developing and implementing policies in the fields of science, education, and youth. This includes preschool, primary, and secondary education, as well as higher education and the system of scientific, technological, and innovation activities.
- **The Croatian Science Foundation (CSF)** is the central body for funding research across all scientific fields in the Republic of Croatia. It promotes scientific excellence, competitiveness in research funding, and both national and international cooperation and networking.
- **The National Council for Higher Education, Science and Technological Development** proposes measures for improving higher education, monitors progress, and defines scientific and artistic areas and fields. It also adopts national academic, scientific, and artistic criteria for individual disciplines and fields etc.
- **The Agency for Science and Higher Education** promotes the continuous development of quality assurance in science and higher education, with the aim of continuously improving the quality of higher education institutions and research institutes. It is also responsible for implementing external evaluation procedures for higher education and institutes.
- **Higher education institutions** in Croatia include universities, faculties, art academies, and polytechnics. They may be established as either public or private institutions to conduct higher education, research, artistic, and professional activities. An updated list of higher education institutions in the Republic of Croatia is available at <https://www.croris.hr/upisnici/ustanove/find/vu>.
- **The National and University Library in Zagreb (NSK)** ensures access to and use of electronic sources of scientific and professional information. It conducts various analyses to support the needs of the Croatian academic community, and provides training on electronic resources and open science.
- **Research institutes** are established to conduct research activities and may operate as either public or private institutions. There are 25 public research institutes operating in the Republic of Croatia. An updated list of public research institutes in the Republic of Croatia is available at <https://www.croris.hr/upisnici/ustanove/find/jzi>.
- **The University Computing Centre (Srce)** develops national infrastructure and services for open science and coordinates the integration of Croatia's open science components with the European Open Science Cloud (EOSC).



## Legislative and Strategic Framework

National policies in the fields of science and higher education fall under the competence of the Ministry of Science, Education and Youth (MSEY). The importance of open science is acknowledged in most of these policies.

The National Development Strategy of the Republic of Croatia until 2030<sup>3</sup> identifies “strengthening scientific excellence and promoting open science through investment in research infrastructure and internationally significant research projects” as one of the key priorities for policy implementation in the field of science and technology. It also highlights the need to diversify the economy and to “strengthen scientific excellence and promote open science, as well as to better connect the academic, research, and business sectors.” One of the strategic goals of the National Recovery and Resilience Plan 2021–2026 (NRRP) is to strengthen research and innovation capacity (Goal C3.2). Open science, in particular, can make a significant contribution to achieving this goal.

The Act on the Right of Access to Information (2022) emphasises the importance of research data accessibility through the adoption of open-access policies and action plans. These measures aim to ensure that all research organisations and research funding bodies implement policies.<sup>4</sup>

The Act on Higher Education and Scientific Activity (2022)<sup>5</sup> emphasises open science, the public availability of the results of scientific research and artistic creation, and the openness of higher education institutions towards the public, citizens, and the local community. These principles form the foundation of scientific and artistic activity and of higher education in Croatia. The obligation to publish theses in the repositories of higher education institutions, or in national repositories, is also prescribed.

Furthermore, the Regulation on Programme-Based Funding of Public Higher Education Institutions and Public Research Institutes in the Republic of Croatia is a legal act that defines the method of multiannual funding for public research institutes and higher education institutions in Croatia.<sup>6</sup> This Regulation enables the conclusion of four-year programme-based funding agreements between the Ministry of Science, Education and Youth and public higher education institutions, as well as public research institutes. The aim is to enhance scientific excellence, strengthen cooperation with the business sector, foster national and regional identity and culture, improve the relevance, quality, and efficiency of study programmes, and reinforce social responsibility. Programme-based funding agreements promote open science, and a specific objective titled Contribution to Open Science is included under the strategic goal Enhancing Scientific Excellence.

The Research Infrastructure Development Roadmap of the Republic of Croatia 2023–2027 states that open science is one of the key priorities of both European and national science policies. As a horizontal

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<sup>3</sup> National Development Strategy of the Republic of Croatia until 2030,

URL: <https://hrvatska2030.hr/wp-content/uploads/2021/02/Nacionalna-razvojna-strategija-RH-do-2030.-godine.pdf>

<sup>4</sup> The Act on the Right of Access to Information, 2022,

URL: [https://narodne-novine.nn.hr/clanci/sluzbeni/2022\\_06\\_69\\_1025.html](https://narodne-novine.nn.hr/clanci/sluzbeni/2022_06_69_1025.html)

<sup>5</sup> The Act on Higher Education and Scientific Activity, 2022,

URL: [https://narodne-novine.nn.hr/clanci/sluzbeni/2022\\_10\\_119\\_1834.html](https://narodne-novine.nn.hr/clanci/sluzbeni/2022_10_119_1834.html)

<sup>6</sup> The Regulation on Programme-Based Funding of Public Higher Education Institutions and Public Research Institutes in the Republic of Croatia, 2023,

URL: [https://narodne-novine.nn.hr/clanci/sluzbeni/2023\\_07\\_78\\_1245.html](https://narodne-novine.nn.hr/clanci/sluzbeni/2023_07_78_1245.html)

principle guiding the development and use of research infrastructures, the application of the FAIR principles and the implementation of open research data management are emphasised. The Plan provides a detailed description of the Croatian Research Information System (CroRIS) and the European Open Science Cloud (EOSC), as well as the Croatian Open Science Cloud (HR-OOZ), all of which further promote the principles of open science within Croatia's research ecosystem.

The Smart Specialisation Strategy of the Republic of Croatia until 2029 also highlights two objectives that clearly demonstrate how open science can play an important role in their implementation (4.2.1 Specific Objective 1: Improving scientific excellence, 4.2.2 Specific Objective 2: Bridging the gap between the research and business sectors). The academic and research communities are not the only groups that can benefit from open science. The demand from the business sector and the general public for access to research results is considerable. Scientists transfer knowledge to society, while entrepreneurs can apply that knowledge to drive social and economic progress.

The strategies and laws mentioned are closely linked to the goals of open science, which encompass several key aspects. Open science improves the quality of research by increasing transparency throughout the research process and by sharing data, methods, and research results with the wider research community and the public. In this way, open science fosters collaboration and trust among researchers, leading to higher-quality and more reliable scientific work.

Several institutions have made formal commitments to ensuring open access, including the Ruđer Bošković Institute, the University of Zagreb University Computing Centre (Srce), the University of Zagreb Faculty of Mechanical Engineering and Naval Architecture, and the Department of Physics at the University of Zagreb Faculty of Science. These commitments primarily apply to open-access publications. Formal open science policies have so far been adopted by the University of Zagreb<sup>7</sup>, the University of Rijeka<sup>8</sup>, the University of Zadar<sup>9</sup> and the University of Split<sup>10</sup>.

### **Inclusion of the Republic of Croatia in International Activities**

Croatia supports projects under the European Strategy Forum on Research Infrastructures (ESFRI) and is a member of nine research infrastructures with European Research Infrastructure Consortium (ERIC) status: SHARE, DARIAH, CERIC, CLARIN, ESS, CESSDA, EATRIS, EPOS, and EHRI. These research infrastructures support collaborative, transparent and accessible research and technological innovation and empower data-intensive science.

OpenAIRE (Open Access Infrastructure for Research in Europe) is a European infrastructure and network that supports open science and open access to research outputs, including scientific papers, data, and software. It develops tools, guidelines, and platforms for searching, publishing, and monitoring scientific outputs, thereby contributing to a more transparent and accessible scientific ecosystem in Europe. Through its network of National Open Access Desks (NOADs), OpenAIRE supports the implementation of open science at the national level by connecting local and European

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<sup>7</sup> Open Science Policy of the University of Zagreb, 2024, URL:

[https://www.unizg.hr/fileadmin/rektorat/O\\_Sveucilistu/Dokumenti\\_javnost/Dokumenti/Javne\\_rasprave/Pet\\_strateskih\\_dokumenata\\_01.2014/Ostali\\_strateski\\_dokumenti/UniZg\\_Open\\_Science\\_Policy.pdf](https://www.unizg.hr/fileadmin/rektorat/O_Sveucilistu/Dokumenti_javnost/Dokumenti/Javne_rasprave/Pet_strateskih_dokumenata_01.2014/Ostali_strateski_dokumenti/UniZg_Open_Science_Policy.pdf)

<sup>8</sup> UniRi – Open Science, 2023, URL: <https://uniri.hr/en/open-science-policy/>

<sup>9</sup> Declaration on the Application of Open Science Principles at the University of Zadar, 2019, URL:

[https://www.unizd.hr/Portals/0/doc/eng\\_web/Declaration\\_on\\_the\\_Application\\_of\\_Open\\_Science\\_Principles\\_20200113.pdf](https://www.unizd.hr/Portals/0/doc/eng_web/Declaration_on_the_Application_of_Open_Science_Principles_20200113.pdf)

<sup>10</sup> Open Science Policy of the University of Split, 2023, URL:

[https://www.unist.hr/Portals/0/adam/Content/MTFpN1gg7UWPtdTBDVky9A/Image/UNIST\\_Politika\\_otvorene\\_znanosti.pdf](https://www.unist.hr/Portals/0/adam/Content/MTFpN1gg7UWPtdTBDVky9A/Image/UNIST_Politika_otvorene_znanosti.pdf)

infrastructures, offering community consultations, and providing education and dissemination activities. In Croatia, the role of NOAD has been performed by the Ruđer Bošković Institute since 2011.

The Research Data Alliance (RDA) is a global organisation dedicated to developing the social and technical conditions for the open sharing and reuse of data and to fostering data-driven innovation. In 2019, the Croatian national RDA node was established at Srce. It supports the development of a sustainable and reliable national infrastructure for research data aligned with the FAIR principles, raises awareness of the benefits of sharing research data, and provides training for librarians and researchers.

Croatia became a member of EOSC in January 2021, when the Ministry appointed the University Computing Centre Srce as the mandated organisation. By doing so, Croatia joined the European community working on the development of open science and on improving access to research data and services within the EOSC platform.

In July 2021, the University Computing Centre Srce launched the Croatian Open Science Cloud Initiative (HR-OOZ)<sup>11</sup> with the aim of establishing an organisational and technological environment that encourages, supports, and enables open science. HR-OOZ will connect with the EOSC by establishing and coordinating a national EOSC node. This node will create a virtual environment for European scientists and researchers, enabling them to access, share, and use research-related data and services. EOSC aims to improve the interoperability of data and resources, promote open science and accelerate innovation with open access to scientific information. EOSC provides infrastructure and services that enable researchers to easily access large volumes of data from different scientific disciplines. It also offers tools for data processing, storage, analysis, and the sharing of research results at the European level. EOSC facilitates collaboration among researchers, reduces the fragmentation of research resources, and ensures the more efficient use of European scientific data.

At the 2022 meeting of the Ministerial Council of the Organisation for Economic Co-operation and Development (OECD), the OECD member countries adopted the Accession Plan for the Republic of Croatia<sup>12</sup>. Croatia received 12 legal instruments (10 recommendations and 2 declarations) for review. These instruments fall under the jurisdiction of the OECD Committee for Scientific and Technological Policy (CSTP). In 2024, it was officially confirmed that Croatia is fully compliant with the OECD's recommendations on open science and open access —Recommendation of the Council concerning Access to Research Data from Public Funding<sup>13</sup>.

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<sup>11</sup> Croatian Open Science Cloud Initiative (HR-OOZ), 2021, URL: <https://www.srce.unizg.hr/hr-ooz/o-inicijativi>

<sup>12</sup> OECD, 2024. Roadmap for the OECD Accession Process of Croatia, URL: <https://www.oecd.org/mcm/Roadmap-OECD-Accession-Process-Croatia-EN.pdf>

<sup>13</sup> Recommendation of the Council concerning Access to Research Data from Public Funding (OECD/LEGAL/0347) Daejeon Declaration on Science, Technology and Innovation Policies for the Global and Digital Age (OECD/LEGAL/0416) OECD/LEGAL/0463 – Recommendation of the Council on Enhanced Access and More Effective Use of Public Sector Information

## 2. Open Science Principles

**This chapter provides an overview of the open science principles that this Plan, through its recommendations and activities, seeks to implement in the Republic of Croatia.**

The promotion, encouragement, and application of open science principles stem from the need to align with global and international, and particularly European good practices, organisational, managerial, and publishing trends, as well as with the recent conclusions of the European Commission, UNESCO, and organisations that fund and conduct research.

The EC<sup>14</sup>, OECD<sup>15</sup> and UNESCO<sup>16</sup> set out the key principles of open science, which include:

1. Open access and early sharing of all scientific research results
  - Application of the FAIR and CARE principles, and the early and open sharing of research data, publications, educational content, and other research outputs
2. Open science infrastructure
  - A unified infrastructure ecosystem that enables the scientific community to implement, share, process, publish, and disseminate research results
3. Monitoring the implementation of open science
  - Development of a system for monitoring the success of open science implementation across all publicly funded research
4. Responsible evaluation and the necessity of scientific integrity
  - The evaluation system takes open science activities into account when assessing scientific activities and promotes the responsible and ethical conduct of research
5. Open education, competencies and citizen science
  - Production and publication of open educational content accessible to a wide range of users, along with collaboration with citizens and their involvement in scientific processes

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<sup>14</sup> European Commission, Open Science, URL: <https://www.consilium.europa.eu/media/56958/st10126-en22.pdf>

<sup>15</sup> OECD, 2015. Making Open Science a Reality. OECD Science, Technology and Industry Policy Papers, No. 25, OECD Publishing, Paris, URL: <http://dx.doi.org/10.1787/5jrs2f963zs1-en>

<sup>16</sup> UNESCO, 2021. UNESCO Recommendation on Open Science, URL: <https://unesdoc.unesco.org/ark:/48223/pf0000379949>

### 3. Vision and Main Goals of the Croatian Open Science Plan

#### Vision

*Science, research, and higher education rely on the principles, values, and practices of open science and, as a result, effectively contribute to faster progress, sustainable development, and the international relevance of Croatian science.*

#### The main goals of the Croatian Open Science Plan:

1. Increase the availability of research results through open access to scientific publications and other research outputs, as well as through the sharing of research data.
2. Increase the use and visibility of publicly funded research results.
3. Apply the principles of open science and open education in the work of researchers and institutions.
4. Include open science as a criterion in the evaluation of researchers, research projects, and institutions.
5. Facilitate connection and cooperation between the scientific community and the general public.
6. Encourage the production of open educational content.

## 4. Recommendations and Activities for the Implementation of Open Science Principles in the Republic of Croatia

The Croatian Open Science Plan is based on international open science principles defined by the UNESCO<sup>17</sup>, the EC and OECD<sup>18</sup>.

### 4.1. Open Access to Publications

Open access to scientific and professional publications provides users with free access to scientific information and enables its reuse.<sup>19</sup> It refers to free and unrestricted online access, provided free of charge, which allows reading, storing, distributing, searching, retrieving, indexing, and other lawful uses. In this context, “free” means permanently free from any restrictions or conditions on access and use.<sup>20</sup> This set of recommendations aims to promote open access and the sharing of scientific and professional papers.

#### Recommendations

- Increase awareness of the benefits of open access, copyright retention, and the use of open licences for publications containing research results.
- Researchers and authors should have the freedom to choose the publishers that will publish the results of their scientific research, in line with good scientific publishing practices and with due consideration of open access.
- Publications, educational materials, theses, and other resources presenting the results or procedures of research that are fully or partially funded by public funds should be made available in open access through institutional, thematic, or other digital repositories under an appropriate open licence immediately after publication. If this is not possible, they should be made available after a short embargo period.
- Domestic publishers of scientific and professional publications should provide open access, apply the CC BY or another suitable open licence, and publish content on the Portal of Croatian Scientific and Professional Journals — Hrčak. The portal ensures the long-term preservation of publications and provides access to the thesis archive.
- Public higher education institutions and public research institutes are encouraged to adopt institutional open science policies that, among other things, establish the obligation to deposit publications, theses, and other materials containing scientific information in institutional open-access digital repositories.

<sup>17</sup> UNESCO, 2021. UNESCO Recommendation on Open Science,

URL: <https://unesdoc.unesco.org/ark:/48223/pf0000379949>

<sup>18</sup> OECD, 2015. Making Open Science a Reality. OECD Science, Technology and Industry Policy Papers, No. 25, OECD Publishing, Paris, URL: <http://dx.doi.org/10.1787/5jrs2f963zs1-en>

<sup>19</sup> DIRECTORATE-GENERAL FOR RESEARCH AND INNOVATION (RTD), BACKGROUND NOTE ON OPEN ACCESS TO SCIENTIFIC PUBLICATIONS AND OPEN RESEARCH DATA. Brussels, April 2016 (update: July 2016). rtd.ddg1.a.6(2016)2395458, URL: [https://research-and-innovation.ec.europa.eu/strategy/strategy-2020-2024/our-digital-future/open-science/open-access\\_en](https://research-and-innovation.ec.europa.eu/strategy/strategy-2020-2024/our-digital-future/open-science/open-access_en)

<sup>20</sup> CROATIAN OPEN ACCESS DECLARATION, 2012, URL : <https://www.fer.unizg.hr/oa2012/declaration>

### Activities

- Public higher education institutions and public research institutes shall adopt institutional policies and action plans for open science that, among other things, require authors to deposit publications, theses, and other materials containing scientific information in institutional open-access digital repositories under one of the open licences immediately after publication. If this is not possible, the materials should be made available after a short embargo period.
- Authors are encouraged to publish their research results in publications that provide open access under open licences, where neither authors nor readers are required to pay fees for publishing or for accessing the content.
- Authors are encouraged to permanently store publications, theses, and other materials containing scientific information in open access in publicly available and open repositories under one of the open licences immediately after publication, and if this is not possible, after an embargo period.
- When choosing a publisher, authors make informed decisions by considering the open access and archiving-only options offered by selected journals and, when all other conditions are equal, give preference to publisher that supports immediate open access.

## 4.2. Open Research Data

Research data is all collected or generated data whose analysis leads to new, original research results or verifies existing results. The set of recommendations encourages the creation of a transparent, accountable and open environment for the conduct of scientific research and the reuse of research data in Croatia.

### Recommendations

- When planning and conducting research, it is necessary to take into account the research data that will be collected and processed, or to create a research data management plan that includes the collection, organisation and structuring, documentation, protection, short-term and long-term storage, and dissemination of research data.
- Research data, software and software code created on the basis of research that is partially or fully funded by public funds are stored in appropriate disciplinary, institutional or general purpose digital repositories in line with the “as open as possible, as closed as necessary” principle, under an appropriate open licence that allows free use of the data, such as CC BY or CC0 licences, if possible.
- Repositories should implement procedures that build the scientific community’s trust in their operation and ensure that their content complies with the FAIR principles.
- The FAIR and CARE principles must be applied in the data storage process.
- Stored data should be well documented, and access should be provided to the protocols, instruments, software, and other tools used to collect and analyse the data.

- Research data should be made openly available for reuse, provided that it does not contain information related to national security, disclose personal identities or business interests, or fall under intellectual property or other legal and ethical restrictions. In such cases, data may be shared under controlled conditions.
- Public higher education institutions and public research institutes are encouraged to adopt institutional open science policies that, among other things, include provisions on research data management, establish rules for handling intellectual property, and enable data reuse.

### Activities

- Public higher education institutions and public research institutes shall adopt institutional policies and action plans for open science that, among other things, include provisions on research data management, establish rules for handling intellectual property, and enable data reuse.
- Public higher education institutions and public research institutes should provide researchers with support in managing research data and in depositing data in open access repositories.
- Scientists should ensure the clarity, transparency, reproducibility, and verifiability of their research by managing research data from the earliest stages and by sharing them through appropriate disciplinary, institutional, or general purpose digital repositories.
- Scientists should store their data in appropriate digital repositories, such as those within the Dabar system, repositories that are part of European research infrastructures (e.g. CESSDA–CROSSDA, CLARIN-HR, DARIAH-HR), or in widely recognised international open repositories such as Zenodo or, for software code, GitHub.
- Scientists store data in open formats (.csv, .txt, .mp3, .mp4, .pdf, .ods, .tiff, etc.).<sup>21</sup>
- Scientists define data usage rights by assigning appropriate licences that enable data sharing, such as CC BY or CC0<sup>22</sup> licence.
- Scientists store research data, software and code in digital repositories, where they are assigned persistent identifiers (DOI, URN-NBN and/or others) and linked to publication records whenever possible.
- Principal investigators of scientific projects create a research data management plan for all research that is partially or fully funded by public funds and ensure its storage and updating in open access within an institutional or other appropriate repository.
- The Croatian Science Foundation evaluates and periodically updates the Research Data Management Plan template for publicly funded projects.

<sup>21</sup> Open formats are file formats that are publicly released and available for everyone to use. A file format is a standardized method of encoding data for storage on a computer. Open file formats are often recommended for archiving purposes, as they can usually be opened without the need for specialised software, URL <https://dans.knaw.nl/en/file-formats/>

<sup>22</sup> This licence allows free use, processing, adaptation and building upon the material in any media and format, provided that the author is cited, URL: <https://creativecommons.org/share-your-work/cclicences/>



### 4.3. Open Science Infrastructure

To achieve high standards in research, it is necessary to ensure access to high-quality research infrastructure, e-infrastructure, and digital services. Research infrastructures provide resources and services to research communities to conduct research and foster innovation.<sup>23</sup> They are essential for sharing resources, tools and access to high-quality data. Open science infrastructures include open, interoperable, and non-profit systems for scholarly publishing and the dissemination of research results, adapted to the needs of specific scientific fields.<sup>24</sup> In the context of the accelerated development of artificial intelligence, it is the availability of open research data and robust infrastructures that enables the training of advanced AI models, thereby further promoting scientific progress and the creation of innovative solutions.

#### Recommendations

- It is necessary to ensure the availability and continuous enhancement of the capacities and capabilities of research infrastructures, e-infrastructure, and digital services required for conducting research throughout the entire research process, as well as for collecting, processing, and effectively managing research results, and for communicating and publishing scientific findings.
- It is necessary to plan, fund, and develop open research infrastructures and services, including e-infrastructure, in a coordinated manner to ensure the long-term sustainability and interoperability of research resources.
- Scientists should actively use and contribute to the development of existing and future research infrastructures.

#### Activities

- MSEY, Srce, public higher education institutions and public research institutes shall ensure the functionality of Croatia's research infrastructures and e-infrastructure and promote their integration with European research infrastructures.
- Guided by the Research Infrastructure Development Roadmap of the Republic of Croatia 2023–2027<sup>25</sup>, public higher education institutions, public research institutes, and other stakeholders in the science and higher education system, together with MSEY, coordinate and plan the creation, maintenance, development, and use of open research infrastructures and services, including e-infrastructure. Particular attention is devoted to ensuring their sustainability, integrity, and interoperability.

<sup>23</sup> European Research Infrastructures, 2020, URL: [https://research-and-innovation.ec.europa.eu/strategy/strategy-2020-2024/our-digital-future/european-research-infrastructures\\_en](https://research-and-innovation.ec.europa.eu/strategy/strategy-2020-2024/our-digital-future/european-research-infrastructures_en)

<sup>24</sup> EU Council conclusions on high-quality, transparent, open, trustworthy and equitable scholarly publishing, Brussels, URL: <https://data.consilium.europa.eu/doc/document/ST-9616-2023-INIT/en/pdf>

<sup>25</sup> Research Infrastructure Development Roadmap of the Republic of Croatia 2023–2027, URL: <https://mzom.gov.hr/UserDocsImages/dokumenti/Znanost/ZnanstvenaInfrastruktura/ZnanstvenaOprema/znan-oprema-29-12-2023/Research-Infrastructure-Development-Roadmap-of-the-Republic-of-Croatia-2023-2027.pdf>

- Public higher education institutions, public research institutes, and other stakeholders in the science and higher education system inform and educate scientists about the possibilities that research infrastructures offer for sharing resources and data, and for improving the quality and efficiency of research.
- Srce provides institutions in the science and higher education system with support, infrastructure and e-infrastructure for collecting, managing, processing, and data storage throughout the entire research process.

#### 4.4. Open Science Evaluation System

The efforts of individual scientists to integrate the values and practices of open science should be properly recognised and rewarded. National and institutional systems for evaluating scientists, institutions, and research should support the implementation of open science practices, recognise diverse forms of communicating scientific results, and encourage early sharing and collaboration. Existing metrics should be used responsibly and all forms of scientific contribution should be accepted.<sup>26</sup>

This set of recommendations aims to place greater emphasis on incentivising and rewarding researchers for their participation in open science activities.

##### Recommendations

- Decision-makers in organisations and institutions that manage the science and innovation system, fund or conduct research, or provide the infrastructure and services necessary for research should be familiar with the principles of open science and promote and support them in planning and decision-making processes.
- A new generation of metrics is being developed, referring to the creation of new indicators that complement traditional measures of research quality and impact.
- The national criteria adopted by the National Council for Higher Education, Science and Technological Development, together with additional criteria set by universities and research institutions, define the set of rules, standards, and benchmarks used to evaluate scientific and teaching activities for the purposes of promotion, selection for academic positions, and the awarding of academic or research titles. These criteria also recognise contributions to open science.

##### Activities

- MSEY, public higher education institutions, public research institutes, and other stakeholders in the science and higher education system provide support to scientists in implementing open

<sup>26</sup> EU Council conclusions on Research assessment and implementation of Open Science, Brussels, URL: <https://www.consilium.europa.eu/media/56958/st10126-en22.pdf>

science. This includes promoting open science within doctoral study procedures, organising activities to help researchers acquire knowledge and skills in open science, and establishing a framework for identifying and recognising researchers who have achieved notable results in the field of open science.

- When evaluating the work of researchers and teaching staff, public higher education institutions and public research institutes should take into account the storage and publication of research data, and original research software in open access, wherever possible, taking into consideration potential risks, in all forms of scientific and professional work.
- Public higher education institutions and public research institutes should develop and adopt internal documents and policies that encourage and reward scientists who apply the principles of open science in their work.

## 4.5. Support, Education, Competencies and Citizen Science

For the successful implementation of open science principles, it is essential to provide researchers with adequate support, education, and training. The European Commission<sup>27</sup> classifies researchers' open science competencies into four categories: competencies for publishing in open access, for managing research data, for conducting research responsibly, and for engaging in citizen science.

This set of recommendations aims to establish a sustainable framework that fosters high-quality professional support for researchers and equips them with the knowledge and skills needed to use the systems, tools, and services essential for open science.

### Recommendations

- Ensure high-quality and sustainable professional support, as well as education and training for the use of systems, tools, and services necessary for implementing open science principles and managing research data.
- Informal open educational materials on the principles, skills, and tools of open science and research data management should be developed.
- Recognise citizen science as an increasingly important component of the European Research Area that contributes to the advancement of research. Citizen science is conducted with the aim of strengthening cooperation between academia and society.
- Strengthen trust in science by involving citizens in the process of scientific research.
- Inform the public through transparent communication, and the use of accessible and inclusive language.
- Regularly organise training for scientists to ensure they are familiar with the principles of open science, recognise the benefits of applying these principles in the research process, and actively participate in their implementation.

<sup>27</sup> European Commission, Directorate-General for Research and Innovation, O'Carroll, C., Hyllseth, B., Berg, R. (2017). *Providing researchers with the skills and competencies they need to practise Open Science*, Publications Office, URL: <https://data.europa.eu/doi/10.2777/121253>

### Activities

- Public higher education institutions, public research institutes, and other stakeholders in the science and higher education system should regularly organise training and activities for researchers and professional staff. These should aim to raise awareness and build capacity in applying open science principles, managing research data, and protecting copyright and related rights.
- Public higher education institutions and public research institutes should encourage participation in open science training and workshops through their institutional policies.
- Public higher education institutions should encourage the creation and use of open educational resources in teaching.
- Public higher education institutions and public research institutes should strengthen cooperation between the academic community and society through the implementation of citizen science. This can be achieved, for example, by developing guidelines for communicating scientific topics to the public etc.
- Libraries within the science and higher education system, together with national service providers and research funders, provide guidance to the Croatian research community on matters related to open access and research data management.

## 5. Monitoring of Implementation

Monitoring the implementation of the Croatian Open Science Plan is essential to ensure its successful realisation and to achieve the goals of transparency, accessibility, and collaboration in scientific research.

The Ministry of Science, Education and Youth will appoint a body responsible for monitoring the implementation and development of the Croatian Open Science Plan. The responsible body will be composed of representatives of various stakeholders, including the Ministry of Science, Education and Youth, the Croatian Science Foundation, universities, research institutions, the National and University Library, and scientists and experts in the field of open science. The responsible body shall regularly evaluate the implementation of the recommendations and activities set out in the Croatian Open Science Plan and submit a report, together with proposals for revising the Plan, at least every five years. The evaluation include an analysis of data on the number of open access publications, the establishment of repositories, and the number of papers stored in them, as well as the opening and storage of scientific data. It also covers institutional cooperation with international bodies and initiatives in the field of open science, such as the European Commission, OpenAIRE, EOSC, CoARA, and RDA, the implementation of training on open science principles at the institutional level, the integration of these principles into higher education curricula, and the implementation of citizen science projects.

The Croatian Open Science Plan will be published on the website of the Ministry of Science, Education and Youth.

## GLOSSARY OF TERMS

**European Open Science Cloud (EOSC)** is an integrated, open, and multidisciplinary environment developed under the auspices of the European Commission. It enables European researchers, innovators, companies, and citizens to publish, discover, and use data, tools, and services essential for research, innovation, and education.

**Public funding** refers to financing the regular activities of research institutions, as well as programmes and projects in the field of science and higher education in the Republic of Croatia, using public sources. Public sources include funds from the state budget and the budgets of counties, cities, and municipalities, as well as public funds and revenues from public companies and other public institutions, European Union funds, and other foreign public sources. An activity is considered to be funded with public funds when it is financed, in whole or in part, from those funds.

**The Croatian Open Science Cloud (HR-OOZ)** is an organisational and technological environment that promotes and enables open science. It provides Croatian scientists, innovators, organisations, and citizens with a reliable, integrated, and open multidisciplinary environment for publishing, discovering, and reusing services and resources for research, innovation, and education.

**Citizen science**, as defined by the European Citizen Science Platform, encompasses all activities that involve the public in scientific research and has the potential to connect science, policymakers and society as a whole. Citizen science is not only a way of engaging the public, but also an approach to scientific work that can be applied as part of broader scientific activities.

**Research infrastructures** are systems, facilities, equipment, and resources, including information and data, as well as their collections, that are necessary for conducting scientific research and promoting innovation. Research infrastructures also include a variety of services, as well as social and communication networks that are essential for researchers both in conducting research and in communicating their results. Open infrastructure, on the other hand, refers to infrastructure that supports the implementation of open science, including the collection and processing of FAIR data. It is characterised by transparency in the rules and conditions of use, open and equitable access based on those published rules, sustainability and operational stability, interoperability with other infrastructures, systems, and tools, and the involvement of all stakeholders, especially scientists, in its governance and management.

**Research data** include statistics, laboratory notebooks, experimental results, surveys, measurements and field observations, interview recordings, and other types of recordings, images, and digital or physical materials created or collected during scientific research. The term also includes metadata, specifications and other accompanying digital objects.

**Research software** includes source code files, algorithms, scripts, computer procedures and executable files created during the research process or for research purposes. Software components (e.g. operating systems, packages, or scripts) that are used in research but were not created during the research process or for specific research purposes should not be considered research software, but rather software used in research.

**Open science (OS)** is a concept that envisions the entire research process as transparent and open to participation, collaboration, and the contribution of all interested stakeholders. It ensures that research results, methods, collected and processed data, and other elements of the research process, as well as publications resulting from the research, are freely shared and made available under conditions that allow their reuse, further dissemination, and the replicability of the research itself.

**Open educational content** includes materials, tools, and processes for learning, teaching, and research that can be freely used, shared, and repurposed in a networked environment without legal, technical, or financial barriers. Typically, permission to share, use and modify is granted through the use of open licences (such as CC licences).

**Open access (OA)** refers to free and unrestricted online access, provided free of charge, to digital scientific information that enables reading, storing, distributing, searching, retrieving, indexing, and other lawful uses. In this context, “free” means permanently free from any restrictions or conditions on access and use.

**Open innovations** include cooperation among stakeholders from the academic community, industry, and the entire value chain of a given sector as part of the research, development, and commercialisation process. They are based on the internal and external knowledge and related technologies of all stakeholders involved, with the aim of creating new licences, spin-out companies, and market opportunities. Collaboration among the stakeholders involved is characterised by openness in sharing ideas, knowledge, and resources among researchers from different scientific fields and areas of expertise, in order to foster creativity and innovation.

**Publication** in this context, refers to monographs, conference proceedings, scientific journals, and all types of scientific, professional, and popular science papers published in journals, proceedings, monographs, online publishing platforms, or by other means.

**Repositories** are digital information systems that collect, store, preserve for the long term and provide access to digital content.

**Persistent identifiers (PIDs)** are long-lasting links to a dataset, document, file, web page, or other objects. The term is typically used in the context of digital objects available via the Internet. Such an identifier is not only persistent but also executable, i.e. it acts as a web link. An important aspect of persistent identifiers lies in the services and infrastructures required to maintain them, as their durability depends on the systems or institutions responsible for resolving them.

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