Latvian Open Science Strategy

2021-2027

Ministry of
Education and Science
Republic of Latvia

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Definitions

Open data[1] – freely available and free-of-charge information without any restrictions for re-use that allows editing and automated processing with freely available software.

Open access[2] – permitting any user to read, download, copy, distribute, print, search, or link to the full text of scholarly articles, crawl them for indexing, pass them as data to software, or use them for any lawful purpose, without financial, legal or technical barriers other than those inseparable from gaining access to the internet itself. Can also apply to theses, books, book chapters, monographs and other content.

Hybrid Open Access Journal[3] **–** a publishing model in which subscription-based journals allow authors to make individual articles gold open access immediately on payment of an article publication charge.

Types of open access:

Gold access[4] – a publishing practice where the author or author institution can pay a fee to the publisher at publication time, the publisher thereafter making the material available 'free' at the point of access. The results of Open "gold" access scientific research can be published in open access journals, in a series of monographs, while retaining copyright for the work, or in hybrid journals, upon the selection of the open access option;

Green access[5] (or self-archiving) – a publishing practice where the author uploads the article to a repository, thereby making the publication open access to the rest of the world. Publishers may demand an embargo period, during which access is restricted;

Diamond access[6] – publication via diamond journals/platforms that do not charge author-facing publication fees (APCs). Diamond open access journals are journals where all articles are published free of charge and are freely accessible. Diamond open access journals are usually funded via library subsidy models, institutions or societies.

Open science – an approach to the scientific process that ensures public access to publications and research data in digital format without restrictions or with minimal restrictions, as well as extensive involvement of the public in the research process.

Data management plan[7] (*DMP*) – a document that describes the creation, collection, use, storage of research data that both covers the timeline, ethical and legal aspects of the research, and enables planning of the procedures for its accessibility after the end of the research.

[1] Paragraph 6, Section 1 of the Freedom of Information Law.
[2] https://casrai.org/term/open-access/
[3] https://publishingsupport.iopscience.iop.org/questions/what-is-a-hybrid-open-access-journal/
[4] https://www.openaccess.nl/en/lexicon/4#green_road
[5] https://www.openaccess.nl/en/lexicon/4#golden_road
[6] https://www.openaccess.nl/en/what-is-open-access
[7] https://www.izm.gov.lv/lv/media/4681/download

DOI[8] (*digital object identifier*) **–** a system used for identifying a product in a digital environment and is designed to ensure the perenniality of hypertext links. Dominant permanent identifier in the publication of scientific publications and data.

E-Infrastructures – environments that enable the sharing of research resources (hardware, software and information) to foster collaboration and more efficient research. In such environments, computing resources, experimental research facilities, data repositories, other research tools and resources, as well as organisational support for virtual collaboration in the sector of global research can be combined through computer networks.

Embargo period[9] – the period during which the publication is kept in the repository as "closed", i.e., the full text of the publication is not publicly accessible.

FAIR data principles[10] (*findable, accessible, interoperable, reusable*) – guidelines for stakeholders involved in the creation and management of research data, defined to maximise the use of research data; FAIR data are findable, accessible, interoperable and reusable.

Hirsch index[11] – a bibliometric indicator used to measure the author's productivity (number of scientific articles) and impact thereof (number of citations of scientific articles) in a complex way. The H-index is equal to the number of publications *h*, where each publication is cited at least *h* times.

Institutional Repository – a site where a research institution ensures long-term collection, storage and accessibility of digital objects of its researchers and students in an organised manner.

Licence[12] – permission to use the respective paper in the manner and under the conditions specified in the licence, for instance, an open licence (*Creative Commons, CC*)[13].

Metadata[14] – data on data; structured information that characterises a specific set of information.

Non-peer-reviewed manuscript *(preprint/ submitted manuscript)* – non-peer-reviewed version of the manuscript.

Persistent identifier (*PID*) – a constant reference (identifier) to a resource, publication, data set, software or researcher, organisation or other digital object that facilitates the unambiguous identification of a particular person or resource, improves search and facilitates findability, for instance, DOI, ORCID *(Open Researcher and Contributor ID),* ISBN (International Standard Book Number).

Research data – information that is not a scientific publication and that is summarised and/or created during scientific research and is used in the research process, or is necessary to confirm the results of scientific research. Research data can be generated independently of the existence of the research data management plan.

Research data management – the part of the research process, where research data are organised and processed, such as data

[8] https://publications.europa.eu/code/en/en-240400.htm#i443
[9] https://likumi.lv/ta/id/315147-eiropas-ekonomikas-zonas-finansu-instrumenta-un-norvegijas-finansu-instrumenta-2014-2021-gada-perioda-programmas-petnieciba
[10] European Commission, 2018. Turning FAIR into reality, Final report and action plan. Available at: https://op.europa.eu/en/publication-detail/-/publication/7769a148-f1f6-11e8-9982-01aa75ed71a1/language-en/format-PDF/source-80611283
[11] https://guides.lib.umich.edu/c.php?g=282982&p=1887449
[12] Section 42 of the Copyright Law https://likumi.lv/ta/id/5138-autortiesibu-likums
[13] https://www.wur.nl/en/article/What-are-Creative-Commons-licenses.htm
[14] https://likumi.lv/ta/id/50601-informacijas-atklatibas-likums

management planning, structured storage, description, curation, archiving, metadata augmentation, etc.

Article processing charge *(APC*) – publication fee or fee charged to authors for publishing a publication in an open access journal or a hybrid journal.

Peer-reviewed manuscript *(postprint/ accepted manuscript)* – a revised version of the manuscript before publication.

Citizen science[15] – research conducted by members of the public, frequently in co-operation with professional scientists and research institutions, or under their guidance. Citizen science is one of the components or directions of the development of Open Science.

Text and data mining[16] (*TDM*) – any automated analytical or computational technique designed to digitally analyse text and data to obtain information that includes, but is not limited to, patterns, trends, and correlations.

Journal impact factor[17] *(journal impact factor, JIF)* – a measure of the frequency with which the average article in a journal has been cited in a particular year.

[15] https://ec.europa.eu/digital-single-market/en/citizen-science
[16] Article 2 (2) of Directive (EU) 2019/790 of the European Parliament and of the Council of 17 April 2019. https://eur-lex.europa.eu/legal-content/LV/TXT/PDF/?uri=CELEX:32019L0790&from=PL
[17] https://researchguides.uic.edu/if/impact

1 Introduction

The open science movement[18] and its approach to the research process are based on public access to knowledge generated by research, research methods, data and results, thus fostering collaborative research work. Digital technologies and new collaboration tools play a key role in the implementation of open science, applying the principles of openness to the entire research process. The aim of open science is to make scientific information (including scientific publications and research data) freely accessible to the public, researchers, policy makers and other stakeholders, and to promote greater public involvement in research processes.

Latvia's European Union Recovery and Resilience Facility Plan provides for a significant amount of funding to promote open science and digitalisation of science[19], where investment of *EUR* 3,440,000 has been earmarked for the period of 2021–2026 within investment 2.1.3.1. "Data Accessibility, Sharing and Analytics" for introducing open science in practice and developing solutions for the sharing of research data and participation in the European Open Science Cloud (EOSC), as well as funding from the European Structural and Investment Fund programme for 2021-2027, where funding for the digitalisation of research activity and participation in European Open Science Cloud (EOSC) has been earmarked in the amount of *EUR* 18,487,501 (ERDF component).

[18] http://www.unesco.org/new/en/communication-and-information/portals-and-platforms/goap/open-science-movement/
[19] https://likumi.lv/ta/id/322858-par-latvijas-atveselosanas-un-noturibas-mehanisma-planu

Benefits of the implementation of Open Science:

1. **Improved quality and integrity of science**, by providing wider, incl. international, research evaluation and validation of results, by accelerating discovery and promoting academic integrity, as well as adapting research topics to the resolution of current and global issues.
2. **Expanded accessibility and opportunities to re-use research data and results**, thus increasing the efficiency of research processes and reducing costs.
3. **Strengthening researchers' data management skills and promoting the digitalisation of science**, thus generally improving the efficiency of research processes.
4. **Promoting international cooperation among scientists**, as well as integrating Latvia into the European Research Area by using internationally recognised standards and approaches of research processes (including through re-use of international research data and participation in international joint projects).
5. **Promoting knowledge transfer and commercialisation of research results**, thus making research results (scientific publications and research data) available to companies for the development of new products and services.
6. **Fulfilling preconditions for the development of research- and evidence-based policymaking.**
7. **Increased public involvement in research processes**, incl. in the creation and use of research data, **improved public awareness and interest in science, increased value of science in society.**
8. **Improved system for monitoring research results** in order to evaluate and plan the efficiency of research funding.

2 Scope of the strategy and link to documents

Latvia's Open Science Strategy is drawn up as an informative report, as it includes general principles, explanations and other information that can be used in practice by any researcher, research institution employee, creator of a citizen science initiative or citizen scientist. The informative report focuses on three pillars (Figure 1), which outline horizontal measures to implement requirements and support systems, promote the accessibility and use of tools and e-infrastructures, strengthen skills at different levels, develop innovative / state-of-the-art solutions, as well as monitor open science.

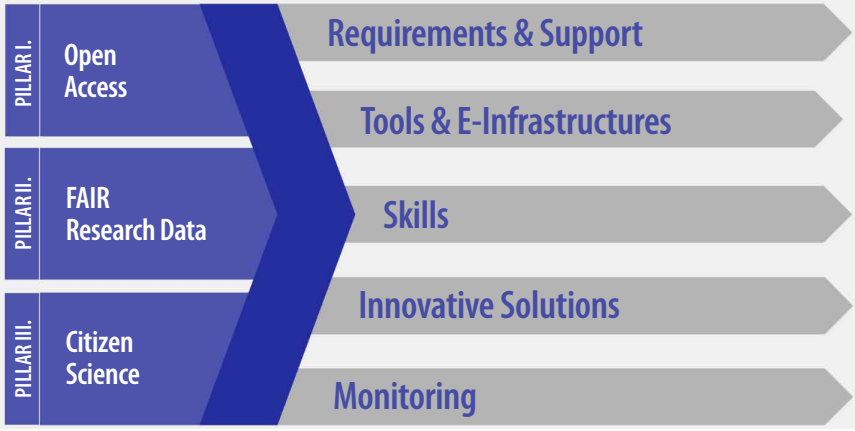

Figure 1. Structure of the Latvian Open Science Strategy.

In order to promote the implementation and relevance of Latvia's Open Science Strategy in the long term, the strategy is more prescriptive than descriptive. An in-depth description of the current situation in Latvia, as well as a comparative analysis of open science policies in other countries, can be found in the final report of the "Study on Open Science and Policy Roadmap" developed in 2020[20]. Up-to-date comparative data on the performance of Latvia in certain aspects of open science can be obtained from the *European Open Science Monitor*[21].
The Open Science Strategy has been developed taking into account Latvian legislation, long-term and medium-term national policy planning documents, international legislation and policy priorities and strategies, as well as guidelines and recommendations of international organisations:

[20] https://www.izm.gov.lv/sites/izm/files/petijums-atverta_zinatne_21_2.pdf
[21] https://ec.europa.eu/info/research-and-innovation/strategy/goals-research-and-innovation-policy/open-science/open-science-monitor_en

In Latvia

1. Section 9 of the Law on Scientific Activity[22]
2. Article 184 of Sustainable Development Strategy of Latvia until 2030 (Latvia 2030) [23]
3. Tasks 142 and 143 of the National Development Plan for 2021-2027 (NAP2027)[24]
4. Line of action 2.1 of the Science, Technology Development and Innovation Guidelines for 2021-2027[25]
5. Line of action 4.4.12 of the Digital Transformation Guidelines for 2021-2027[26]
6. Draft Information Report "On Updating Latvia's Participation in the European Strategy Forum on Research Infrastructures (ESFRI) European Roadmap for research Infrastructures and European Research Infrastructure consortia"[27]
7. Informative report "Latvia's Open Data Strategy" [28]
8. Final report of "Research on open science and on the development of a policy roadmap [29]
9. Open Science Guidelines for researchers conducting Covid-19 and SARS-CoV-2 Research[30]

In the European Union

1. European Commission Recommendation 2012/417/ EU of 17 July 2012 on Access to and Preservation of Scientific Information.[31]
2. Conclusions of the Council of the European Union on the Transition Towards an Open Science System 9526/16 (27 May 2016) [32]
3. Directive 2019/1024 of the European Parliament and of the Council (20 June 2019) on open data and the re-use of public sector information.[33]

Other international documents

1. Organization for Economic Co-operation and Development (OECD) Principles and Guidelines for Access to Research Data from Public Funding[34]
2. Organization for Economic Co-operation and Development (OECD) Recommendation of the Council concerning Access to Research Data from Public Funding[35]
3. United Nations Educational, Scientific and Cultural Organization (UNESCO) Recommendation on Open Science [36]

[22] https://likumi.lv/ta/id/107337-zinatniskas-darbibas-likums
[23] https://www.pkc.gov.lv/sites/default/files/inline-files/Latvija_2030_6.pdf
[24] pkc.gov.lv/sites/default/files/inline-files/NAP2027_apstiprināts%20Saeimā_1.pdf
[25] http://tap.mk.gov.lv/lv/mk/tap/?pid=40492546
[26] http://tap.mk.gov.lv/doc/2021_07/VARAM_100621_DTP.1452.docx
[27] https://www.izm.gov.lv/lv/par-latvijas-dalibas-aktualizaciju-eiropas-petniecibas-infrastrukturu-strategijas-foruma-esfri-eiropas-petniecibas-infrastrukturu-cela-kartes-petniecibas-infrastrukturas-un-eiropas-petniecibas-infrastrukturu-konsorcijos
[28] http://tap.mk.gov.lv/doc/2019_08/VARAM_info_zin_dati_1308.1376.docx
[29] https://www.izm.gov.lv/sites/izm/files/petijums-atverta_zinatne_21_2.pdf
[30] https://www.izm.gov.lv/sites/izm/files/zinatne_vadlinijas_covid1.pdf
[31] https://eur-lex.europa.eu/summary/LV/2701_1
[32] https://data.consilium.europa.eu/doc/document/ST-9526-2016-INIT/en/pdf
[33] https://eur-lex.europa.eu/legal-content/LV/TXT/PDF/?uri=CONSIL:PE_28_2019_INIT&from=LV
[34] https://www.oecd.org/sti/inno/38500813.pdf
[35] https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0347
[36] https://unesdoc.unesco.org/ark:/48223/pf0000374409.page

3 Open Science Strategy

Pillar I: Open access to scientific publications

Section 9 of the Law on Scientific Activity stipulates that information regarding scientific research financed from the State or local government budget shall be open. An institution responsible for performing scientific research financed from the State budget or the budget of derived public persons, shall ensure general access to research results, as well as ensure that access to information related to scientific research may be restricted in the cases specified by Law[37]. Over the years, open access conditions and facilitating measures have been introduced in research programmes, various policy planning documents, strategic documents of research institutions, etc. Different support materials have also been developed to promote open access, for instance, Open Science Guidelines for researchers conducting Covid-19 and SARS-CoV-2 Research[38] and a number of information measures have been implemented. Like in other EU-27 countries, requirements, incentives and support for the facilitation of open access publishing practices have developed significantly over the last ten years, resulting in positive dynamics in the number of open access publications. Comparing the indicators for the number of publications available in open access with other EU-27 countries, Latvia is in an average position with 40.66% of publications in the *Web of Science* database available in open access in the time period from 2014-2020 (see Figure 2), while relative growth is rapid (see Figure 3). The alternative database of scientific publications – *Scopus* demonstrates a similar dynamic trend of open access publications to that provided in Figure 3, although there are differences in terms of absolute numbers.

[37] https://likumi.lv/ta/id/107337-zinatniskas-darbibas-likums
[38] https://www.izm.gov.lv/sites/izm/files/zinatne_vadlinijas_covid1.pdf

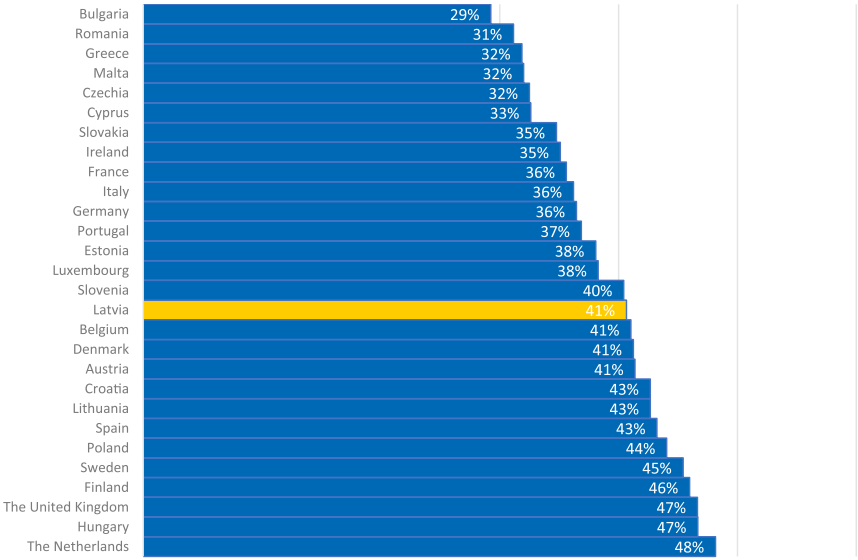

Image 2. Percentage of publications in open access (Web of Science InCites + ESCI database) in the 27 countries of the EU and the United Kingdom. Data exported: 8 July 2021, filter: max. 20 authors.

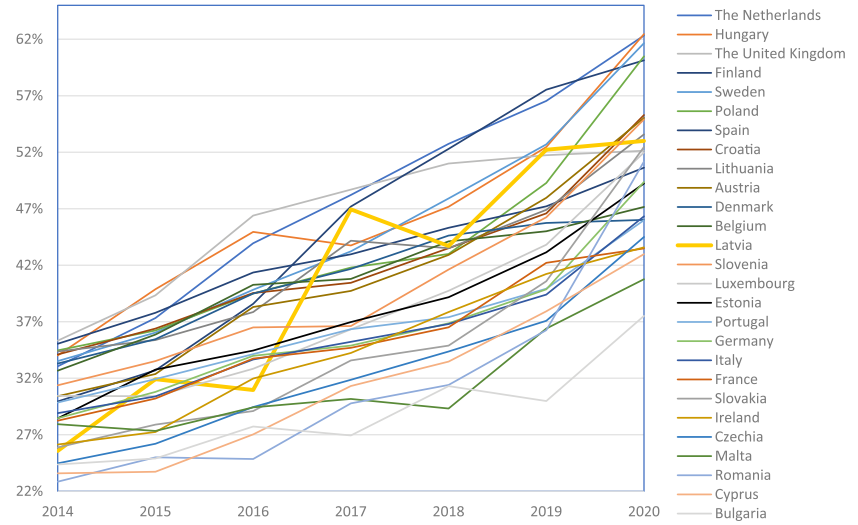

Figure 3. Trends for the percentage of publications in open access (Web of Science InCites + ESCI database) in EU-27 and the United Kingdom. Data exported: 8 July 2021, filter: max. 20 authors.

Benefits of the implementation of open access:

1. By promoting open access publishing in the long term, it is possible to **reduce subscription fees to scientific publications**[39] **–** The inclusion of conditions on open access publication in licensing contracts allows avoid double payment – of publishing and, subsequently, for accessing the publication in the database.
2. **Research results are made accessible to a wider range of readers at an earlier stage of research**[40]. This increases the impact, commercialisation potential and citability of publications, and ensures that taxpayers who fund research have access to research results.
3. **Researchers can expect conditions similar to international research programmes**. Similar requirements have been introduced in the Horizon Europe Framework Programme and other international research programmes with Latvian researchers' participation. Researchers can use internationally available tools and information materials to implement open access practices.

Implementation of open access:

1. **Scientific publications created within the framework of all publicly funded research programmes launched as of 1 January 2023 must be freely available in green or gold open access without an embargo period**.
2. Subscribers of scientific journals may wish **to enter into *transformative agreements* with the publishers of scientific journals**. The agreements provide a transition in the scientific journal publishing business model from a subscription fee based business model, to a model where the publisher is fairly reimbursed for open access publishing services. Generally, an agreement to reduce article processing charges (APCs), is reached as a result of the conclusion of such agreements.
3. All open access publications and digital objects must **be provided with persistent identifiers** (such as DOI) and a licence type must be indicated, preferably *Creative Commons (CC)*[41] attribution licence, *CC BY*.
4. Researchers may, at their own discretion, **include the article processing charges** *(APC)* **in the project costs**.
5. Research institutions **need to introduce incentives promoting open access publishing** for researchers, academics and research teams. Incentives can be financial, career-related or other.
6. Researchers should strive to publish their articles in high-quality open science journals that demonstrate the application of true added value for article processing, as well as in diamond open access journals/ platforms.
7. As far as possible, researchers and research institutions should retain the copyright in their publications.
8. Research institutions should continue to **provide educational opportunities for researchers on open access publishing practices**, incl. through the OpenAIRE National Open Access Desk in Latvia[42].

[39] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC406350/
[40] https://www.springernature.com/gp/open-research/about/benefits
[41] https://creativecommons.org/about/cclicenses/
[42] https://www.napd.lu.lv/par-mums/openaire/

9. Universities and other Latvian publishers, as well as other representatives of the publishing industry, are encouraged to focus on open access, including piloting the implementation of open peer review[43].
10. In order to ensure the interoperability of scientific publication repositories, **research institutions should create their own publication repositories on the DSpace[44] platform in accordance with OpenAire guidelines**[45] using the OAI-PMH protocol[46] for integration with the National Scientific Activity Information System (NZDIS) and the European Open Science Cloud (EOSC).
11. **Open access monitoring must be performed**. The European Open Science Monitoring System should be used for transnational comparative analysis[47]. A monitoring system for publicly funded scientific research publications should be set up by using ready-made automated solutions such as *OpenAIRE Monitor,* by aligning the data with NZDIS.

Pillar II: FAIR research data

Research data includes statistical data, experimental results, measurements, survey results, interview records, images, metadata, specifications and other digital objects, etc. The amount of research data generated globally is growing exponentially, simultaneously increasing its re-use potential. Improving the reusability of research data contributes to research cost reduction and promotion of research productivity, reduces the costs of data collection, processing, licensing and storage, promotes greater research process quality, reduces the risk of double funding, promotes interdisciplinarity and the use of research data in the national economy[48].

Research data management practices in Latvia are also gradually improving; however, the study on open science[49] demonstrates that "the concept of publishing research data is relatively unfamiliar to most [researchers]. This is also demonstrated by answers given in interviews: in most cases, research data are stored on personal computers or personal cloud services". Since the publication of the study on open science, the with the availability of research data repositories has improved – *re3data* register of research data repositories[50] lists 3 repositories registered in Latvia. The open science study also identified the problem of limited experience and knowledge of most researchers about research data management. To address this problem, the most resource-intensive investments aimed at improving research data management are planned to address a lack of skills, information and support, rather than structures or specific digital tools.

The Open Science Strategy states that **research data, metadata and e-Infrastructures intended for long-term preservation and re-use should, as far as**

[43] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5437951/
[44] https://duraspace.org/dspace/
[45] http://dx.doi.org/10.5281/zenodo.1299203
[46] https://openarchives.org/pmh/
[47] https://ec.europa.eu/info/research-and-innovation/strategy/goals-research-and-innovation-policy/open-science/open-science-monitor/trends-open-access-publications_en
[48] https://op.europa.eu/s/oEZp
[49] https://www.izm.gov.lv/sites/izm/files/petijums-atverta_zinatne_21_2.pdf
[50] https://www.re3data.org/search?query=&countries[]=LVA

possible, comply with the *FAIR principles*, which are guidelines for stakeholders involved in the creation and management of research data, designed to promote maximum use of research data. The application of FAIR principles enables researchers and other stakeholders to easily find and navigate research data, improve machine reading of the digital objects, which simplifies automatic data search selection and use.

FAIR principles[51]:

Findable. The data must be described with full metadata and registered or indexed in the searchable resource (for instance, research data repository). Digital objects must have an internationally recognisable, unique and permanent identifier (*persistent identifier*).
Accessible. There should be a mechanism for accessing data through authorisation or a specific protocol for access to data (particularly important for sensitive research data in biomedicine). Metadata should also be available in situations where the data are no longer available.
Interoperable. Widely used formats, standards for the representation of data and metadata should be used, including clear references to help trace the interrelationships between different data, data sets and research results.
Reusable. Rich metadata, documentation and information regarding re-use conditions must be provided.

Research data must comply with the "open by default" principle, which provides that research data must be opened, or non-disclosure thereof must be justified. Reasons for non-disclosure of data may refer to data sets that contain sensitive data, situations, where the disclosure of data is impossible for legal or ethical reasons, or where the data set is very large and the dissemination thereof involves significant costs.

Requirements and support

The Open Science Strategy envisages the introduction of standardised research data management practices throughout the data management cycle, **introducing mandatory requirements for the researchers to develop data management plans** for all projects of publicly funded research programmes. The template for the data management plan shall be in an electronic, machine-readable format and as close as possible to the template used for *Horizon Europe*. Data management plans should minimise the administrative burden on researchers by only requiring the most important information and respecting the "*once-only principle*"[52], while maintaining the obligation for the researcher to update the data management plan if there is a change in data management during the course of the study. The existence and implementation of data management plans needs to be monitored by both research institutions and the funders of research.

Data and its metadata for publicly funded research programmes must be by default

[51] European Commission, 2018. Turning FAIR into reality, Final report and action plan. Available at: https://op.europa.eu/en/publication-detail/-/publication/7769a148-f1f6-11e8-9982-01aa75ed71a1/language-en/format-PDF/source-80611283
[52] https://ec.europa.eu/cefdigital/wiki/display/CEFDIGITAL/Once+Only+Principle

deposited in a secure repository and must be available under a universal *Creative Commons (CC0, CC-BY)* or equivalent licence, following FAIR principles and specifying at least the following metadata:

a. author(s);
b. title;
c. date of publication;
d. programme/activities/grant No.;
e. licensing terms;
f. persistent identifier of the publication (for instance, DOI[53] or Handle[54]);
g. author ID (e.g. ORCID[55] ; ResearcherID[56]);
h. institution identifier (for instance ROR[57]).

Researchers should estimate the costs of preparing data sets when preparing project applications.

Research institutions must **include a research data management criterion in assessing the performance of research personnel**, by open science and related skills' acquisition in research reports and encouraging the use of open citation[58], as well as by ensuring that the academic career system supports and rewards researchers who participate in the research sharing movement. The Ministry of Education and Science plans to integrate open science into the criteria "Research Infrastructure and Governance" and "Economic and Social Impact" of the International Evaluation of Scientific Institutions in 2025.

E-Infrastructure and services

Modern research data management practices cannot be implemented without investments in state-of-the-art e-Infrastructures, tools and digital services. At the European level, the European Open Science Cloud (EOSC) is a major initiative for the development of research data management technologies[59], which will offer a secure digital platform (portal) to researchers[60], promote the availability and interoperability of research data, create a catalogue of services at all stages of research data management cycle[61], and will federate a number of public research e-Infrastructures[62]. In 2020, the EOSC Association was founded[63], bringing together e-Infrastructure and digital service providers, research institutions and other industry players to promote the implementation of FAIR principles and the design and development of modern services. The Open Science Strategy envisages that **research insitutions from Latvia should ensure participation in the EOSC association** and attract funding from Horizon Europe[64] to develop digital services and e-Infrastructures.

Latvian research universities (University of Latvia, Riga Technical University, Rīga

[53] https://www.doi.org/factsheets/DOIKeyFacts.html
[54] https://www.handle.net/
[55] https://info.orcid.org/what-is-orcid/
[56] https://www.researcherid.com/
[57] https://ror.org/about/
[58] https://i4oc.org/#about
[59] https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX:52016DC0178
[60] https://www.eosc-portal.eu/
[61] https://marketplace.eosc-portal.eu/
[62] https://www.eosc-hub.eu/
[63] https://ec.europa.eu/info/sites/info/files/research_and_innovation/funding/documents/ec_rtd_he-partnership-open-science-cloud-eosc.pdf
[64] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52018PC0435

Stradiņš University, Latvia University of Life Sciences and Technologies) need to **establish a Shared IT Services Centre for Higher Education and Research Information (VPC),** which will promote the development and international competitiveness of Latvian higher education and research institutions by integrating, developing and providing high-quality share information technology services. VPC must ensure publicly funded basic services to all research institutions, as well as provide for the possibility of other research institutions to be involved in the operation of the organisation, at least at the level of an associate member. The VPC must provide a valuable, high-quality and secure open data infrastructure based on international specifications and standards by using open source systems and software. The VPC plays a key role in the implementation of open science, as it will provide the necessary digital sharing infrastructure for research institutions and researchers, as well as facilitate involvement in international initiatives. In order to facilitate the establishment of the VPC, in addition to the contribution of research universities to the operation of the VPC, the Ministry of Education and Science plans to co-finance the VPC in the amount of EUR 100,000 annually beginning in 2022, and to evaluate the delegation of specific services to VPC, which are currently provided or planned to be provided by the Ministry. The co-financing will be used primarily for the remuneration of VPC employees, as well as for the participation of VPC in international organisations (including the European Open Science Cloud Association[65]), for the lease of VPC office space and the purchase of licences. The Ministry of Education and Science plans to provide appropriate co-financing for the establishment, maintenance and development of higher education and research sharing information technology services, incl. from the financing of the European Union Recovery and Resilience Facility. In addition, the Ministry of Education and Science sees the potential of involving the VPC in the planning of the digitisation policy of the sector, as well as providing the VPC with mandated status within EOSC.

Research institutions need to develop research data repositories that conform to FAIR principles and the OAI-PMH protocol[66]. As an organisation with technical competence and close cooperation with research institutions, VPC must, with the support of the Ministry of Education and Science, **establish a network of general-purpose research data repositories – *DataverseLV*[67]**, which will provide an opportunity for all stakeholders to find and access research data of Latvian researchers. Any research institution in Latvia is invited to create its own research data repository on the *Dataverse* platform[68]. The *DataverseLV* network will ensure the interoperability of the repositories within the network and the exchange of metadata, as well as allow researchers, whose research institutions do not offer their research data repositories, to deposit research data therein. Metadata exchange with the European Open Science Cloud (EOSC) and the National Scientific Activity Information System (NZDIS) will also be provided. Regular analysis of the degree of FAIR maturity will be conducted on the *DataverseLV* network.

[65] https://www.eosc.eu/
[66] https://openarchives.org/pmh/
[67] https://www.dataverse.lv/
[68] https://dataverse.org/about

Many of Latvia's e-Infrastructures are European Research Infrastructure Roadmap Consortia *(ERIC)* of the European Strategy Forum for Research Infrastructures *(ESFRI*). Latvian participation in ERICs are summarised in the draft Information Report "On Updating Latvia's Participation in the European Strategy Forum on Research Infrastructures (ESFRI) European Roadmap for research Infrastructures and European Research Infrastructure consortia"[69] (hereinafter – ESFRI roadmap). ESFRI infrastructures are closely linked to Open Science, as the development of existing infrastructures in Latvia will require raising the degree of their FAIR maturity[70].

A single e-resource subscription/licensing and acquisition centre or consortium will be established in Latvia in order to make effective use of the advantages of collective subscription to e-resources (databases of scientific publications) and the available funding, and to enter into transformative agreements with publishers of scientific journals. The Ministry of Culture has initiated the establishment of a joint subscription database administration and management centre at the National Library of Latvia, thus transferring the functions of the current Cultural Information System Centre (KISC) that involve subscriptions to e-resources.

Skills

In order to develop researchers' skills and a culture of quality research data management, **research institutions are encouraged to introduce Data Stewards** that develop general and field-specific data management skills of researchers, promote the use of e-Infrastructures and tools, help plan data management and complete data management plans (DMPs), and publish and archive research datasets. Data stewards require industry-specific knowledge and good knowledge of internationally available resources and best practices. Research institutions are also invited to **identify data champions** – existing researchers who are well-versed in research data and are ready to support colleagues and share their knowledge.

In certain sectors (high-performance computing, language and quantum technologies), the establishment of **high-level skills competence centres** is planned (Investment 2.3.1.1.i. "Ensuring the acquisition of high-quality digital skills" of 2.3. reform and investment direction "Digital Skills" of European Union Recovery and Resilience Mechanism 2nd component "Digital transformation"), which is closely linked to the management of research data. In other sectors, research institutions and policy makers are encouraged to develop high-level skills competence centres that can also be used as resources by researchers in any research institution.

Data stewards and high level centres of excellence will work primarily with researchers who possess basic research data management skills. However, there is a significant number of researchers who have little experience and/or poor skills in work with digital technologies.

[69] https://www.izm.gov.lv/lv/par-latvijas-dalibas-aktualizaciju-eiropas-petniecibas-infrastrukturu-strategijas-foruma-esfri-eiropas-petniecibas-infrastrukturu-cela-kartes-petniecibas-infrastrukturas-un-eiropas-petniecibas-infrastrukturu-konsorcijos

[70] https://www.eosc-nordic.eu/content/uploads/2020/04/EOSC-Nordic_workshop_-_FAIRification_of_NordicBaltic_data_repositories.pdf

Academic libraries and initiatives such as OpenAIRE National Open Access Service **play an important role** in improving the skills of these researchers.

In order to promote open science, it is important to promote the development of researchers' overall digital skills; therefore, in implementing the measures outlined in Chapter 4 of the Strategy, it is necessary to create synergies with Line of Action 4.1. "Digital Skills and Education", as well as Line of Action 4.1.1. "Development of society's digital skills in the educational process" of "Guidelines of Digital Transformation of 2021-2027", within the framework of which high-level digital skills will be developed as cross-cutting skills within the content of vocational education and higher education, including cyber security, work with big data, acquisition of digital technologies in the industry, public administration services, thus promoting the result of "Higher Education Institutions Act as Centres of Digital Innovation".

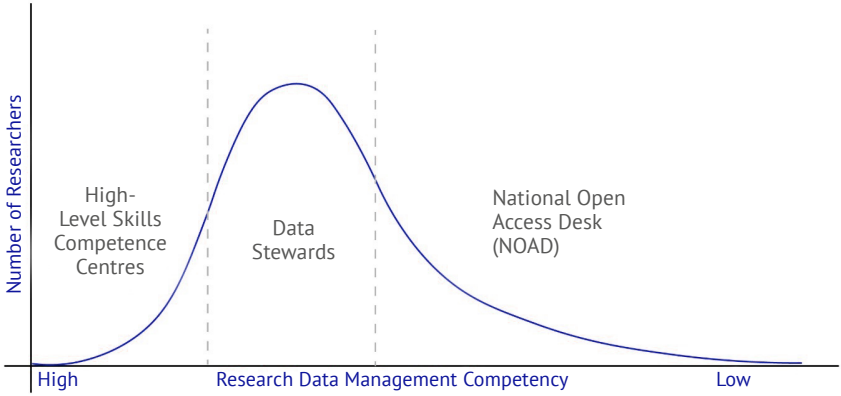

Figure 4. Strengthening research data management skills at different levels of competence

Pillar III: Citizen Science

Citizen science, is a broad concept that includes the involvement of society in the research process and the co-creation of knowledge with professional scientists in all areas of science[71]. Within the Open Science Strategy, citizen science is defined as scientific work conducted by the public in co-operation with professional scientists and research institutions, or under their guidance. In 2020, more than 15 citizen science initiatives were in progress in Latvia[72] in a wide range of scientific fields – natural sciences, agricultural, forestry and veterinary sciences, as well as social sciences and humanities. Within the framework of citizen science activities, new, scientifically valuable knowledge is created, and society is introduced to and informed about scientific activity in general, the research process and specific scientific fields and research topics.

Citizen science is an essential part of the strategic communication of science. "Knowledge Society", "Value Creation", "Towards Integrated Science" and "European Dimension" are four important topics that unify and at the same time articulate differences and value propositions or narratives in the strategic positioning of Latvian science "researchLatvia"[73]. Alongside the motto "Value of Knowledge", the main theme of communication is the "Knowledge Society", which aims to create a society that benefits from knowledge, learning and the practical application of all kinds of knowledge. Public involvement and participation in research activities, creation and use of research data, etc. develops critical thinking and allows one to not only "*inform about science*" and create a one-way flow of information from scientists to society, but also to develop dialogue and two-way communication. The consolidation of citizen science culture is one of the preconditions for the knowledge society.

The Open Science Strategy envisages the promotion of citizen science by providing free advertising for citizen science initiatives and access to scientific e-Infrastructures (for instance, research data repositories); implementation of citizen science principles; integration of citizen science into Latvian science communication activities; as well as the involvement of Latvian participants in international initiatives and networks, such as the European Citizen Science Platform (ECSP)[74] and the European Citizen Science Association (ECSA)[75].

[71] https://era.gv.at/object/document/3366/attach/hlg_2017_report.pdf
[72] https://data.gov.lv/dati/eng/dataset/citizen-science-initiatives-in-latvia
[73] https://drive.google.com/file/d/1HTHiba9SC_O416MyHvpgkhCEFcCven_h/view
[74] https://eu-citizen.science/
[75] https://ecsa.citizen-science.net/

Principles of citizen science[76]:

1. **Citizen science projects actively involve citizens in scientific endeavour that generates new knowledge or understanding.** Citizen scientists may act as contributors, collaborators, or as project leader and have a meaningful role in the project.
2. **Citizen science projects have a genuine science outcome.** For instance, they provide answers to research hypotheses, inform evidence-based policies, etc.
3. **Both the professional scientists and the citizen scientists benefit from taking part.** Benefits may include the publication of research outputs, learning opportunities, personal enjoyment, social benefits, and satisfaction through contributing to scientific evidence.
4. **Citizen scientists may, if they wish, participate in multiple stages of the scientific process.** This may include developing the research question, designing the method, gathering and analysing data, and communicating the results.
5. **Citizen scientists receive feedback from the project.** For example, how their data are being used and what the research, policy or societal outcomes are.
6. **Citizen science is considered a research approach like any other, with limitations and biases that should be considered and controlled by the project manager.**
7. **Citizen science project data and meta-data are made publicly available, based on the "open by default" principle and the FAIR data principles.** Data need not be disclosed if there are ethical, security or privacy concerns that prevent this.
8. Research project results should appropriately **reflect the contribution of citizen scientists to the research**, preferably by acknowledging citizen scientists in publications.
9. **Citizen science programmes are evaluated for their scientific output, data quality, participant experience and wider societal or policy impact.**
10. **The leaders of citizen science projects take into consideration legal and ethical issues surrounding copyright, intellectual property, data sharing agreements, confidentiality, attribution, and the environmental impact of any activities.**

[76] Based on ECSA's "Ten principles of citizen science" https://ecsa.citizen-science.net/wp-content/uploads/2021/05/ECSA_Ten_Principles_of_CS_English.pdf

4 Action Plan of Latvian Open Science Strategy 2021-2027

Responsible authorities are encouraged to implement the activities outlined in the action plan in accordance with their respective competences and the deadlines set out in the action plan.

No.	Activity	Responsible authority	Co-responsible authority	Pillar	Deadline	Notes
1.	Introducing a Green/Gold Open Access mandate without an embargo period for all scientific publications created within publically funded research programmes launched after the 1st of January, 2023.	Latvian Council of Science	Ministry of Education and Science, Cross-Sectoral Coordination Centre, and ministries of other sectors (within the framework of state research programmes)	I	1 January 2023	The application of the measure includes prioritisation of national research programmes and basic and applied research projects.
2.	Introducing a Data Management Plan requirement for all publicly funded research programmes.	Ministry of Education and Science, Latvian Council of Science	Shared IT Services Centre for Higher Education and Research Information (VPC), sectoral ministries (within the framework of State Research Programmes)	II	1 December 2022	Data management plans must follow an internationally recognised, standardised template. Data management plans should be completed electronically, automating the process as much as possible without imposing a heavy administrative burden on researchers. As far as possible, the measure should be extended to publicly funded research programmes.

No.	Activity	Responsible authority	Co-responsible authority	Pillar	Deadline	Notes
3.	Setting up a Shared IT Services Centre for Higher Education and Research Information (VPC)	University of Latvia, Riga Technical University, Rīga Stradiņš University, Latvia University of Life Sciences and Technologies	Ministry of Education and Science, Ministry of Health, Ministry of Agriculture	I, II.	28 February 2022	Shared IT Services Centre for Higher Education and Research Information (VPC) should be given a national mandate within the EOSC Association.
4.	Creating a *DataverseLV* network of general research data repositories in Latvia.	Ministry of Education and Science	Shared IT Services Centre for Higher Education and Research Information (VPC), Research institutions included in the Register of Research Institutions	II	15 January 2023	The concept of the *DataverseLV* general research data repository network is available at www.dataverse.lv
5.	Planning and developing a national *Data Stewards* programme.	Ministry of Education and Science	Shared IT Services Centre for Higher Education and Research Information (VPC), national research institutions included in the Register of Research Institutions	II	1 December 2022	
6.	Promoting the implementation of open science principles in research institutions, incl. by including open science principles in strategies, declarations and other documents.	Ministry of Education and Science	Ministry of Agriculture, Ministry of Health, Ministry of Culture, research institutions included in the Register of Research Institutions, Shared IT Services Centre for Higher Education and Research Information (VPC)	I, II, III.	Continuously	In order to facilitate the implementation of the task, it is possible to sign cooperation memoranda with research institutions regarding the implementation of open science principles.

No.	Activity	Responsible authority	Co-responsible authority	Pillar	Deadline	Notes
7.	Introducing data management principles for all new publicly funded research programmes: compliance with FAIR principles and "open by default".	Ministry of Education and Science	Latvian Council of Science	II	Continuously	In cases where research is funded by international partners, efforts should be made to include conditions in the rules of tenders through the programme committees.
8.	Appointing a national open science coordinator at the Ministry of Education and Science and an open science coordinator at the Latvian Science Council.	Ministry of Education and Science	Latvian Council of Science	I, II, III.	1 December 2022	The National Open Science Coordinators will support the introduction and implementation of the Latvian Open Science Strategy, and will participate in international formats, including the Standing Working Group on Open Science and Innovation of the European Research Area and Innovation Committee (ERAC SWG OSI) and the Council of National Open Science Coordination (CoNOSC).
9.	Defining the concept of open science in the Law on Scientific Activity.	Ministry of Education and Science		I, II, III.	II Quarter of 2023	
10.	Including the open science criteria in the International Evaluation of Scientific Institutions (ZISI) in 2025.	Ministry of Education and Science	Research institutions included in the Register of Research Institutions	I, II, III.	2025	The criteria shall be included as sub-criteria in "Impact of research activity on the relevant field of science", "Economic and social impact of scientific activity" and "Infrastructure and its compliance with the activity of a research institution" sections.

No.	Activity	Responsible authority	Co-responsible authority	Pillar	Deadline	Notes
11.	Establishing a system for open science monitoring.	Latvian Council of Science	Ministry of Education and Science, Shared IT Services Centre for Higher Education and Research Information (VPC)	I	1 January 2023	The monitoring system can be set up in the form of reports or as an online dashboard. It can be built on the basis of *OpenAIRE Monitor*.
12.	Establishing an organisational framework for joint e-resource licence and subscription procurement.	National Library of Latvia	Ministry of Culture, Ministry of Education and Science, Research Institutions Registered in the Register of Research Institutions, Association of Latvian Academic Libraries	I	31 December 2023	Within the framework of the reform of KISC services, a single centre for the procurement of databases and licences is being established at the LNL. Subscription to Scopus, SciVal, Science Direct, Web of Science, InCites should also be transferred to the LNL.
13.	Signing *transformative agreements* with publishers of scientific journals.	National Library of Latvia	Association of Latvian Academic Libraries, Ministry of Education and Science, Research Institutions Registered in the Register of Research Institutions	I	31 December 2024	
14.	Developing principles, guidelines and recommendations for covering the costs of APCs for Latvian researchers in high-impact peer-reviewed "gold" open access journals.	Latvian Council of Science	Ministry of Education and Science	I	1 January 2023	

No.	Activity	Responsible authority	Co-responsible authority	Pillar	Deadline	Notes
15.	Ensuring the availability of ESFRI digital research infrastructures for the planning period of 2021-2027.	Ministry of Education and Science		II	IV Quarter of 2022	
16.	Developing the national repository *Academia* as a FAIR principles compliant service for scientific institutions, ensuring the exchange of metadata with repositories of other research institutions, NZDIS and OpenAIRE.	National Library of Latvia	Ministry of Culture, Research institutions registered in the Register of Research Institutions, Ministry of Education and Science, Cross-Sectoral Coordination Centre	I	1 December 2022	
17.	Developing the content of the educational course on open science.	National Library of Latvia	Ministry of Culture, Ministry of Education and Science	I, II, III.	1 January 2022	On-site further education programme with local lecturers and a final document that certifies a training achievement. Target audience – science administration specialists (in universities and scientific institutions) and employees of academic libraries. In order to include sector-specific issues in the content of the further education programme, academic libraries can also play an important role in developing the content of the continuing education programme.

No.	Activity	Responsible authority	Co-responsible authority	Pillar	Deadline	Notes
18.	Organizing events and implementing trainings on Open Science, FAIR principles, research data management, etc.	Latvian Council of Science	Ministry of Education and Science, OpenAIRE, research institutions registered in the Register of Research Institutions	I, II, III.	Continuously	To the extent possible, the MES shall support the implementation of measures.
19.	Ensuring the participation of at least two Latvian partners in the European Open Science Cloud (EOSC) association.	State research institutions included in the Register of Research Institutions	Ministry of Education and Science	I, II.	1 April 2022	Participation in the status of an associated partner is planned by Rīga Technical University, Rīga Stradiņš University.
20.	Granting a national mandate to a Latvian member in the EOSC association.	Ministry of Education and Science	Shared IT Services Centre for Higher Education and Research Information (VPC)	I, II.	1 April 2022	The mandate will be provided to the unified Centre for Higher Education and Research Information Technology Service Sharing (VPC).
21.	Promoting the compliance of national and institutional infrastructures with the technical and content quality requirements of the EOSC (including FAIRification and integration with the EOSC).	Ministry of Education and Science	Shared IT Services Centre for Higher Education and Research Information (VPC), Latvian Council of Science, research institutions	II	Continuously	
22.	Facilitating the registration of scientific personnel in ORCID.	State research institutions included in the Register of Research Institutions	Ministry of Education and Science, Shared IT Services Centre for Higher Education and Research Information (VPC), Latvian Council of Science	I, II.	Continuously	ORCID identifiers should also be included in the register of persons elected to academic positions at research institutions of NZDIS.

No.	Activity	Responsible authority	Co-responsible authority	Pillar	Deadline	Notes
23.	Signing agreements with DOI agencies and to promote the assigning DOIs to scientific publications and published research data sets.	National Library of Latvia	Ministry of Education and Science, research institutions registered in the Register of Research Institutions	I, II.	Continuously	
24.	Making data infrastructures (repositories) available for Latvian citizen science initiatives.	Ministry of Education and Science	Shared IT Services Centre for Higher Education and Research Information (VPC), Organisations with citizen science initiatives, National Library of Latvia, Ministry of Education and Science	III	1 January 2023	The infrastructure would be provided as part of the DataverseLV network of general research data repositories.
25.	Coordinating the implementation of scientific communication activities and the goal of promoting public involvement in science.	Ministry of Education and Science	Research institutions included in the Register of Research Institutions, Latvian Council of Science	III	Continuously	
26.	Promoting the use of *Creative Commons* licence identification.	Research institutions included in the Register of Research Institutions	Ministry of Education and Science, Latvian Council of Science, OpenAIRE	I, II.	Continuously	
27.	Archiving historical *(legacy)* scientific publications and data sets in repositories.	National Library of Latvia	Ministry of Culture, Ministry of Education and Science, research institutions registered in the Register of Research Institutions	I, II.	Continuously	

No.	Activity	Responsible authority	Co-responsible authority	Pillar	Deadline	Notes
28.	Promoting wider representation of Latvian research institutions and researchers at international organisations, networks and consortia (for instance, CESSDA[77] RDA[78], OpenAIRE[79], *EOSC Executive Board Working Groups*[80]).	Research institutions included in the Register of Research Institutions	Ministry of Education and Science, Shared IT Services Centre for Higher Education and Research Information (VPC)	I, II.	Continuously	
29.	Implementing open science principles and best practices in the public administration research database petijumi.mk.gov.lv, integrating the platform into the networks of research output repositories and research data repositories.	Cross-Sectoral Coordination Centre	Ministry of Education and Science, Shared IT Services Centre for Higher Education and Research Information (VPC)	I, II.	1 January 2023	
30.	Creating a section on open science in the MES website and ensuring that information is updated regularly.	Ministry of Education and Science	Latvian Council of Science	I, II, III.	1 December 2022	The section should contain information in Latvian and English.
31.	Providing funding for the accessibility of tools, services and e-Infrastructures to researchers and research institutions in order to promote open science.	Ministry of Education and Science	Shared IT Services Centre for Higher Education and Research Information (VPC), research institutions included in the Register of Research Institutions	II	1 January 2027	

[76] https://www.cessda.eu/
[77] https://www.rd-alliance.org/
[78] https://www.openaire.eu/
[79] https://www.eoscsecretariat.eu/eosc-working-groups

No.	Activity	Responsible authority	Co-responsible authority	Pillar	Deadline	Notes
32.	Promoting transparency of the National Scientific Activity Information System (NZDIS), by opening application programming interfaces (APIs) and introducing open science principles into the system, as well as by making the system more modular.	Ministry of Education and Science	Shared IT Services Centre for Higher Education and Research Information (VPC)	I, II.	1 January 2023	
33.	Integrating persistent identifiers in the National Scientific Activity Information System (NZDIS), as well as linking the project identifiers of the Latvian Science Council with research results.	Ministry of Education and Science	Latvian Council of Science	I, II.	1 January 2023	Including the introduction of ROR identifiers at all scientific institutions.