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Instrumente Structurale 2014-2020

The White BOOK of the transition to

OPEN SCIENCE

2023-2030

Bucharest
June 2023

message from the authors

The White Paper is about vision, transformation, and action, about the determination to make the ambition and promise a reality. We encourage all researchers to engage and contribute, in a sustainable and sustained manner in their research practice, to change the research culture, increase trust in science, and make research more transparent, collaborative, accessible, and relevant to society.

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The White BOOK of the transition to OPEN SCIENCE 2023-2030

Strategy paper on the framework for developing open science in Romania

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Developed in UEFISCDI INNOVATION AND CREATIVITY

With the support of United Nations Educational, Scientific and Cultural Organization · UNESCO Chair on Science and Innovation Policies, SNSPA, Bucharest, Romania

Thanks to those who contributed to the development of the strategy document at various stages: Ioana Spanache, Valentin Cojanu and other colleagues from the SIPOCA 592 project, the coordinators of the Cloud National Open Science Initiative (RO-NOSCI), colleagues from the UNESCO Chair on Science and Innovation Policies - SNSPA, the Ministry of Research, Innovation and Digitisation (MCID), and those who participated in the dialogue and consultation process on behalf of the research, development and innovation community.

Document developed in the ESIF project "Increasing the capacity of the RDI system to respond to global challenges. Strengthening anticipatory capacity for evidence-based public policy making" SIPOCA 592 | MySMIS Code 127557.

Document available online at https://www.open-science.ro/resurse/cartea-alba-a-tranzitiei-catre-stiinta-deschisa-2023-2030

Co-funded by the European Union

The contents of this publication do not necessarily reflect the position or opinion of the European Commission or of the Government of Romania.

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This Strategy Paper on the Framework for Developing Open Science in Romania - The White Book of the Transition to Open Science 2023-2030 (the White Book) was developed by the experts from Activity A4.1 "Development of the strategic and functional framework for open science and open access" of the SIPOCA 592 project, as part of the UEFISCDI Open Science Knowledge Hub (OSKH) strategic and functional framework.
The White Book was developed in a participatory process organised in multiple rounds through a series of workshops and mutual learning events, dissemination activities, and surveys for understanding the needs and degree of awareness regarding various aspects of open science. The public consultation on the Green Paper version was conducted by OSKH from August 18 to September 30 2022.
The background work generated a series of analyses and supporting documents which can be accessed on the open science national portal at https://www.open-science.ro/resurse-open-science and on the UEFISCDI website at https://uefiscdi.gov.ro/open-science-in-romania.

- **december 2022** — The consolidated White Book & launch of the OS national portal
- **summer 2022** — Objective 1.2 of SNCISI; The Green Book version & consultation; OS portal online
- **2021** — Analyses & support guides; workshops & consultations; establishment of RO-NOSCI
- **march 2020** — First mutual learning workshop with stakeholders, starting the dialogue and dissemination on OS

The White Book provides detailed information on the implementation of the principles, challenges, and actions included in Objective 1.2, "Ensuring the Transition to Open Science and Facilitating the Path to Excellence in Scientific Research" of the National Strategy for Research, Innovation, and Smart Specialization 2022-2027 (SNCISI). This objective is dedicated to the adoption of practices that support open science at the national level.

Open science is a component of science policy that aims to achieve a higher level of integration of scientific results into societal development through (1) open access to publicly funded scientific publications and research data and by (2) facilitating open processes of knowledge production through innovation (open innovation), education (open educational resources), and collaborative citizen involvement in research and innovation at various stages and levels - from the formulation of research agendas and policies to data collection and results evaluation (citizen science).
Open science involves a rethinking of the entire research process to intensify cooperation and the systematic exchange of knowledge and tools as openly and as early as possible in the research stages.
The joint effort of EU member states is guided by two fundamental objectives for achieving open science: free access to all publicly funded publications and a completely new approach to research data management (FAIR[endnote 1] and open data as much as possible) - as a standard for all publicly funded research.
In this context, there is a necessity to adapt the evaluation systems of researchers' careers, research projects, research institutions, and researchers' reward systems for implementing specific open science practices, such as early research result sharing, open collaboration, free access to research results, and societal actors involvement. It is also necessary to coordinate policies, co-create and exchange best practices at the European level to increase clarity and comparability for all parties involved, and carry out joint and concerted actions.
Currently, open access has become a common option for researchers to disseminate research results, although it is not yet widespread. Regardless of the nature of research funding, whether public or not, and regardless of usage conditions, open access should be encouraged by the scientific community for its stimulating effects on research practices[2]. The motivations supporting this initiative primarily relate to the fact that scientific research is currently mainly supported by public funding, which imposes (1) the responsibility to make results accessible to those who fund it and to society as a whole; (2) informing society about scientific discoveries and the broader integration of science[3] into society, both in terms of result dissemination and the involvement of individuals outside research organizations in knowledge production; (3) improving the communication of ideas in the scientific space and increasing the visibility of researchers by removing barriers to information flows[4]; (4) creating a better context for promoting international and interdisciplinary collaborations; (5) achieving higher quality results by eliminating costly research duplication, facilitating research replication, and combating scientific fraud[5]; (6) the irreversible shift towards storing the knowledge base from printed materials archived in libraries to digital content stored in digital repositories, making better use of the advantages of digital documents[6].
The White Book addresses these development substrates of the open science ecosystem through proposals aimed at strategic policy orientations at the national level.

To begin the reading with a promisingly compelling text on briliance, for knowing or for recollecting, here is a quick glimpse into the profiles of 28 Romanian science luminaries. Our exceptional scientific tradition is our starting point and its hallmark is, especially today when looking back, the assurance that we can.

A→Z — a selection

1 2 3 4 5 6 7 8 9 10 — 1900 — AD 1799 — 2008

28
1 **Ion I. Agârbiceanu** (1907-1971), atomic physicist, was co-inventor of the first gas laser in Romania in 1961-62 and founder of the laboratory for Optical Methods in Nuclear Physics (1956) at the Institute of Atomic Physics in Măgurele.
2 **Grigore Antipa** (1867-1944), naturalist, zoologist, ichthyologist, ecologist, oceanologist, Darwinist biologist, a scientific authority in the Lower Danube and the Danube Delta; he is considered to be the first person to modernize the diorama and its use in a museum setting and was director of the Bucharest Natural History Museum which now bears his name.
3 **Ana Aslan** (1897-1988), biologist and physician, specialist in gerontology, discovered the first anti-aging remedy called Gerovital H3 vitamin, and founded the world's first institute of geriatrics (1952), the National Institute of Geriatrics and Gerontology which now bears her name; her notable scientific profile earned her numerous international distinctions.
27
4 **Victor Babeș** (1854-1926), physician, bacteriologist, and academician, the father of serotherapy, one of the founders of modern microbiology, precursor to modern immunology, and the founder of the modern Romanian medical school; he wrote the world's first bacteriology treatise in 1885 and published over 1,000 scientific papers and 25 monographs in microbiology and pathology; he made significant contributions to the study of rabies, leprosy, diphtheria, tuberculosis, and other infectious diseases, discovered more than 50 germs (including babesia), and foresaw new methods of staining bacteria and fungi; his prolific work earned him numerous honorary orders (including the French Legion of Honor).
26
5 **Florica Bagdasar** (1901-1978), neuropsychiatrist, the first woman minister (of Health) in Romania; specialised at Harvard with a Rockefeller fellowship, she dedicated her career to neuropsychiatric and educational care of children, founding the Center for Mental Hygiene in Bucharest (1946) - an interdisciplinary team of psychologists, pedagogues, speech therapists, and kinesiotherapists - and introducing the specialty of "pediatric neuropsychiatry" as professor at the Medical-Pharmaceutical Institute in Bucharest; she was also vice-president of the Romanian Red Cross.
6 **Sarmiza Bîlcescu** (1867-1935), lawyer - the first female lawyer in Romania; she was the first woman to study law and obtain a PhD in law at the Faculty of Law of Paris - the 2nd PhD in law in Europe granted to a woman; in 1891 she was admitted with full honours to the bar association, an unprecedented event in comparison to most European countries at the time.
25
7 **Ion Cantacuzino** (1863-1934), physician, bacteriologist, and academician, founder of the Romanian modern immunology and experimental medicine; he laid the foundations of the public health system, has contributed to Romania becoming the second country in the world after France to introduce the BCG vaccine against TB, and founded the Institute of Serums and Vaccines (1921) which now bears his name.
8 **Henri Coandă** (1886-1972), academician, inventor (holder of over 250 patents), aerodynamics pioneer and builder of an experimental aircraft - "Coandă-1910" (an unconventional sesquiplane aircraft powered by a ducted fan) generally described as the world's first jet; he invented a great number of devices and discovered the "Coandă effect" of fluid dynamics utilized later in many aeronautical inventions.
24
9 **Gogu Constantinescu** (1881-1965), scientist, engineer, and inventor (holder of over 400 patents - some of which with very important military applications), the creator of the "theory of sonics" - a new branch of continuum mechanics describing the transmission of mechanical energy through vibrations; he promoted the use of reinforced concrete and built the first bridge of reinforced concrete with straight crossbars in Romania (1906); in 1926, he was nominated by The Graphic magazine among the 17 titans (including Einstein, Edison, Kelvin, Rutherford, Graham Bell, and Marie Curie) of the scientific world from 1900 to 1925.
10 **Aurora Gruescu** (1914-2005), the world's first female forestry engineer; she made considerable contributions to the field of forestry in Romania, developing the first national afforestation plan that encompassed 100,000 ha and implementing chemical pest control measures in the forested areas surrounding Bucharest.
11 **Horia Hulubei** (1896-1972), nuclear physicist, known for his contributions to the development of X-ray spectroscopy, in neutron physics, and in the study of transuranic elements and nuclear reactions; he established the first laboratory of the structure of matter in Romania; he was Vice-President of the IAEA Council and the founder of the Romanian Institute of Atomic Physics, while the National Institute for Physics and Nuclear Engineering in Măgurele now bears his name.
12 **Sofia Ionescu-Ogrezeanu** (1920-2008), the first female neurosurgeon in the world, performing a life-saving emergency brain surgery on an injured boy during the bombing of Bucharest in WWII (1944), also known for her research work on spinal cord and brain surgery; she was part of the first neurological team of Romania, "The golden team".
13 **Ștefania Mărăcineanu** (1882-1944), physicist, the discoverer and first person to propose the otherwise controversial (at the time) concept of "artificial radioactivity" (having demonstrated in 1924 that lead subjected to centuries of solar radiation had become radioactive, although subsequent research on the matter led to other scientists being granted the Nobel Prize in chemistry in 1935); she worked with Marie Curie studying the element named for Curie's homeland Polonium; in her seminal experiments investigating the connection between radioactivity and rainfall, as well as between rainfall and earthquakes, she discovered and successfully triggered the world's first artificial rain in Romania in 1931 using radioactive salts; she created the first radioactivity laboratory in Romania.
14
15

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a 3-page prologue

14 **Gheorghe Marinescu** (1863-1938), neurologist, founder of the Romanian school of neurology, internationally renowned pioneer of the application of histological, histochemical and histopathological methods in the field of neurology and of anatomo-clinical and electrophysiological methods in neurological research; his work is considered to be a significant contribution to global medicine and have formed the basis of future discoveries; he isolated a hereditary degenerative disease of the nervous system known as the "Marinesco-Sjögren syndrome" and created the world's first documentary film in 1898 titled "Walking Troubles of Organic Hemiplegy", praised by Auguste Lumière at the time.

15 **Hermann J. Oberth** (1894-1989), German physicist, mathematician, and engineer of Romanian origin, one of the fathers of rocketry and astronautics; in 1922 he published "By Rocket into Planetary Space" mathematically demonstrating the ability of a rocket to leave Earth's orbit and that rockets could operate in a vacuum; his later work in rocketry research for the USA led to the development of the Saturn V rocket which carried men to the moon in Apollo 11.

16 **Ştefan Odobleja** (1902-1978), philosopher, writer, and military physician, the father of one of the most influential sciences of the 20th century, cybernetics - as founder of consonant(ist) psychology that laid the theoretical foundations of generalized cybernetics –, and one of the precursors of artificial intelligence; through his consonantist psychology, a new theory of thought, he was the first thinker who considered the phenomenon of closed loop with reverse connection as a universal law, i.e., introducing the concept of feedback in psychology.

17 **George Emil Palade** (1912-2008), American physician and scientist of Romanian origin, universally hailed as the founder of modern cell biology for his discoveries and insights into the structure and function of eukaryotic cells, winner of the Nobel Prize in Physiology and Medicine in 1974 "for discoveries concerning the structural and functional organization of the cell" and of the National Medal of Science, USA in 1986 (along numerous honorary degrees and prizes); he was the first scientist to use the electron microscope to study cell structure (the Nobel committee was also acknowledging that "he added important methodological improvements both to the differential centrifugation and to the electron microscopy") and has discovered the ribosomes of the endoplasmic reticulum (1955) - the site of cellular protein synthesis; dedicated to teaching, "he made the cell biology course for medical students the outstanding course in the basic sciences at the medical school and probably in the country" (Yale); he was founding member of the World Cultural Council (1981), founding editor of the Annual Review of Cell and Developmental Biology (1985), and founder and first Chairman of the Department of Cell Biology at Yale University (1979).

18 **Constantin Ion Parhon** (1874-1969), neuropsychiatrist, endocrinologist, professor, and politician, the father of endocrinology in Romania and one of the founders of the science worldwide, author of the world's first medical treatise on endocrinology (1909, "Traité d'endocrinologie. Les sécrétions internes"); he was the first to discuss the internal secretions of the ovary and demonstrated the existence of vegetative centers in the cerebral cortex, he isolated and described two new endocrine diseases - hyperhydropexic syndrome known as the "parhon syndrome" and hyper-hypophyseal dwarfism; renowned for his encyclopedic knowledge and innovative views, he published over 400 scientific and clinical texts covering a range of medical fields (e.g., neurology, psychiatry, genetics, heredity, in vitro cultures, organogenesis); he established the world's first endocrinology department (at the Faculty of Medicine in Bucharest), he was director of the Institute of Endocrinology which bears his name since 1946, the first director of the National Institute of Geriatrics and Gerontology founded by Ana Aslan - and her mentor, founder of three medical societies in Romania, and member of the endocrinology societies in Paris, Moscow and Prague.

19 **Petrache Poenaru** (1799-1875), educator, literary critic and historian, mathematician, agronomist, engineer, and inventor, the first Romanian to ever hold a patent - he invented the world's first fountain pen in 1827 (registered in France with the no 3208 and the description "plume portable sans fin, qui s'alimente elle-même avec de l'encre"); he had a significant contribution to the organisation of national education, he supported the establishment of primary schools, he developed school textbooks (having published the first geometry and algebra textbooks) contributing to the formation of mathematical terminology in Romanian, and he produced the first free and official rural publication, "The Village Teacher" in 1843; he elaborated one of the first Romanian newspapers; he founded the Agricultural Society and the Schoold of Agriculture (1835), the civil engineering sections of the School of Bridges and Roads (1850), the Philharmonic Society (1833), the Botanical Gardens, and the National Museum of Antiquities in Bucharest; he contributed to the formation of Romanian engineering (by introducing measuring tools and micrometers, unknown to the underdeveloped Romanian engineering at the time).

20 **Alexandru Proca** (1897-1955), Romanian physicist who studied and worked in France, one of the creators of theoretical nuclear physics (considered the most influential Romanian theoretical physicist of all time); he developed the vector meson theory of nuclear forces and the relativistic quantum field equations that bear his name ("Proca's equations") for the massive, vector spin-1 mesons (in 1936) - enabling further Nobel prize-awarded research and acknowledged by Wolfgang Pauli, winner of the Nobel Prize in Physics in 1945, in his Nobel Lecture and other publications; with an outstanding scientific career (including editor of the influential physics journal Les Annales de l'Institut Henri Poincaré) during which he collaborated with numerous European science titans and Nobel Prize winners, his publications continue to be highly referenced in top scientific journals worldwide to this day.

21 **Emil Racoviță** (1868-1947), biologist, zoologist, speleologist, and Antarctic explorer, the co-founder of biospeleology (cave/ subterranean biology); together with Grigore Antipa, he is regarded as one of the foremost promoters of natural sciences in Romania; he was the first Romanian to have gone on a scientific research expedition to the Antarctic (1897-1899) - where he made the first daily meteorological recordings and measurements in Antarctica, every hour, for a whole year, collected information on oceanic currents and terrestrial magnetism, and gathered 1,600 botanical and zoological specimens - being the first researcher to collect such samples from areas beyond the Antarctic Circle; he explored over 1,400 caves in France, Spain, Algeria, Italy, and Slovenia (two caves in Romania and Moldova bear his name); he founded the world's first speleological institute in Cluj-Napoca (1920).

22 **Raluca Rîpan** (1894-1975), chemist and inventor, the first Romanian woman to earn a doctorate in chemistry (1922), first woman rector of a Romanian university (1955, University of Cluj), and first woman to be inducted in the Romanian Academy (1948, being president of the Cluj branch between 1957 and 1975); she founded the Institute of Chemistry in Cluj-Napoca (1951, and headed the institute until 1970 - which now bears her name); she patented many chemical processes with industrial applications and wrote various treatises in the field of analytical chemistry; she discovered and studied new classes of complex combinations used in the determination of metals, as well as new methods of assay for thallium, lead, tellurium, selenic acid, and selenocyanates.

23 **Anghel I. Saligny** (1854-1925), academician, construction engineer, and minister, considered to be one of the pioneers of world technology in the designing and construction of bridges and silos with metal structure and reinforced concrete, one of the founders of Romanian engineering, most famous for designing the Feteşti-Cernavodă railway bridge (1895) over the Danube - the longest bridge in Europe at that time; he built the first silos in the world made of reinforced concrete, which are preserved today in Constanța, Brăila, and Galați.

24 **Maria Teohari** (1885-1975), mathematician and astronomer, the first woman astronomer of Romania (and one of the very few in the world at the time), regarded as the 'unofficial professor' of Romanian astronomers in the 20th century, she conducted the first solar activity observations at the Astronomical Observatory of Bucharest; she published several specialized papers on various celestial phenomena, including planets, sunspots, and protrusions of Halley's comet; she authored a series of textbooks and taught astronomy and mathematics aiming to cultivate a greater interest in these sciences among high school students in Bucharest.

25 **Nicolae Vasilescu-Karpen** (1870-1964), engineer, physicist, and inventor, minister (of Commerce and Industry), telegraphy and telephony pioneer and builder of the Karpen Pile (patented in 1922 and built in 1950, the remarkable device called the "uniform-temperature thermoelectric pile" continues to operate flawlessly, defying expectations that it would have ceased functioning decades ago; however, there are controversies surrounding its operation, which unfortunately persist due to limited research and inadequate funding at the Dimitrie Leonida National Technical Museum, where it is housed for private display); one of the founders of modern engineering education in Romania, he established the first doctoral programme in engineering and was the first director and rector of the Polytechnic School of Bucharest (1920-1940); he conducted extensive research and published numerous treatises in the fields of elasticity, aerodynamics, thermodynamics, electrostatics, physical chemistry, electrochemistry, and electromagnetism.

26 **Aurel Vlaicu** (1882-1913), engineer, inventor, one of the pioneers of world aviation and early pilot, he performed the first flights on Romanian territory with his aircrafts "Vlaicu 1909" (a glider, performing a test flight on a field in 1909) and "Vlaicu I" (a powered airplane, performing the first official flight on June 17, 1910); in 1912, he competed with his improved "Vlaicu II" against 44 other aviators in the International Flight Week in Aspern-Vienna, where he won two first prizes - in tight turns and projectile throwing at a target from a height of 300 m - and a second prize in spot landing (ranking alongside world-renowned French aviator Roland Garros); many streets, a Bucharest Metro train station, an airport, a university, an air force school, and schools and high schools in 18 cities across Romania bear his name.

27 **Traian Vuia** (1872-1950), inventor and one of the pioneers of world aviation, he designed, built, and tested the first tractor monoplane (a high-wing monoplane powered by an adapted carbonic acid gas engine) - performing the world's first self-propelled flight with a heavier-than-air aircraft in March 18, 1906 (despite initial rejection of the project in 1903 by the Academy of Sciences in Paris, considering that "the problem of flight with a machine which weighs more than air can not be solved and it is only a dream"); he further built and tested two more upgraded versions, inspiring further aviation experiments worldwide; between 1918 and 1922 he built and tested two types of helicopters with rotating wings, a rudder, and a horizontal stabilizer; by his experiments, his legacy to world aviation include the monoplane configuration of aircraft, the first wing with variable incidence in flight, the principle of a single tractor propeller, the first airplane with folding wings; he also invented the internal combustion steam generator with catalytic combustion and the high-intensity furnace combustion generator, which laid the foundations for the technology later used in thermal power plants that employ complex high-pressure cycles; many streets, an airport, and high schools in nine cities across Romania bear his name.

28 **Elisa Leonida Zamfirescu** (1887-1973), chemical engineer - the first woman engineer in Romania and Europe and one of the first in the world (graduating in 1912 after being the first female student of the Royal Technical Academy in Berlin), the first woman member of the General Association of Engineers of Romania; she worked at the Geological Institute of Romania for 42 years (from 1920 until her retirement at the age of 75), where she coordinated various laboratories and conducted extensive research and field studies on Romania's mineral resources analysing drinking and mineral waters, petroleum and natural gas, coal, solid bitumen, and construction materials, having signed over 85,000 analysis reports and published numerous treatises.

A different narrative, once again driven by people steadfastly pursuing results, reveals the enduring journey of institutional learning and systemic capacity building spanning the last two decades, providing the very foundation for the transformative shift toward open science.

Since 2003, UEFISCDI (the Agency) designed and organised three generations of systemic foresight exercises for the **science & innovation** research agenda of Romania - a meaningful learning process which had shaped the 2007-2013, 2014-2020 and 2021-2027 policy cycles; the dialogue further extended to cover the **future of higher education**, then of **public and e-administration**, **science-enabled integrated territorial development**, and, more recently, **sustainable development**. These efforts have forged the Agency's profile as the **'governmental foresight hub'** in Romania with a **systems approach to policy making**.

The European Structural and Investment Funds facilitated these - and other - impactful systemic interventions, while the Agency's core approach has consistently revolved around ensuring the sinergy of our development projects and sowing strategic, timely 'seeds' that would incrementally mature into policy intervention 'highways' over time, all while consolidating our capacities and expertise.

The journey starting from the (2003) inception dialogue on the future of science & innovation led to sophisticated **foresight frameworks and tools** (including real-time Delphi consultations - our 'elphi' methodology), **forward-looking, community-oriented dialogue frameworks** (our 'Bucharest Dialogues' and 'crazy futures' brands), an **AI-fuelled radar of weak signals and tech trends**, a robust **entrepreneurial discovery mechanism** (shaping the Smart Specialisation agenda of Romania), **citizen science frameworks**, complex **evidence-based decision-making mechanisms** (including methodologies and tools for Big Data Smart Analytics, such as blended semantic-network analysis), and an **integrative approach to research and technological infrastructures**, their services and integrated management.

and many other relevant ingredients to be discovered at forhe.ro, bit.ly/47l0lxS, and the Institutional Projects section in uefiscdi.gov.ro.

A total of **24 ESIF and national systemic projects** and **over 60 European and international cooperation projects** (the Agency consistently ranks among the top institutions in Romania for accessing research funds in the EC's funding schemes) have ensured - and continue to - a **consistent track**, **impact**, **international visibility** and the **consolidation of policy-knowledge** strengthened by the partnership with the UNESCO Chair on Science and Innovation Policies at SNSPA, as evidenced by publications in top peer-reviewed journals and partnerships with international publishers (see uefiscdi.gov.ro/Publicatii-1).

This open-ended portfolio of projects and commitment has always been centered on a growing national community with international links; there, we have nurtured research practice skills, futures literacy, and strategic capacities. We 'never stop there', and we have built innovative platforms of European relevance: the **European Research and Technology Infrastructure System (EERTIS platform)** with over 1,500 RIs from the region (15,000 pieces of equipment, providing 4,500 services), and the **Brainmap online community** of over 56,000 researchers, innovators, technicians, and entrepreneurs in 2023. ***After two decades of passion, collaboration, trust in us, and focus on performance and reliability.***


NATIONAL
CONTEXT
INTERNATIONAL

NATIONAL CONTEXT

In Romania, open access to scientific publications, a part of open science, has received limited support through the National Strategy for Research, Development, and Innovation (SNCDI 2014-2020) and the National Plan for RDI (PNCDI III 2015-2020). The Strategy mentions ensuring and supporting open access to research results as one of the priorities, by providing access to scientific research from the main streams for all research organizations and encouraging the publication of research results funded by public funds, following 'gold open access' standards.

Although there have been no concrete national policies regulating open access to research results, it is important to mention the effort to open doctoral research results for the development of the open science ecosystem in Romania - one of the few such national initiatives in Europe. Starting in February 2020, open access to doctoral research results through the publication of doctoral theses is ensured in accordance with Article 168 paragraph (9) of Law No. 1/2011 on national education, with subsequent amendments and supplements[7].

Another national initiative to support the adoption of open science policies is the Open Government Partnership and the adoption of the National Action Plan in this regard in November 2018, which includes a section dedicated to open access to research results and envisions the adoption of a national strategy through the implementation of pilot programs, research foundation, and public consultations.

In June 2022, the Romanian Parliament approved Law No. 179/2022 on open data and the reuse of information from the public sector. The provisions of Article 13 (1) of the law are as follows:

- Public entities ensure open access to data resulting from research that has/ is benefiting from public funding.
- Policies regarding open access adhere to the principle of 'open by default' and are compatible with the FAIR principles: findable, accessible, interoperable, and reusable.
- Ensuring open access to data is done in accordance with the principle 'as open as possible, but as closed as necessary,' taking into account intellectual property rights, personal data protection, confidentiality, security, and legitimate commercial interests.
- The provisions regarding open access apply to entities conducting research activities and entities financing research activities with public funds for the data resulting from funded activities.

In addition to paragraph (2), Article 13 of the law states that "data derived from research are reusable for commercial and non-commercial purposes in accordance with Chapter III (reuse conditions) and Chapter IV (nondiscrimination and fair trade) to the extent that they are publicly funded, and researchers, entities conducting research activities, or entities funding research activities have already made them available to the public through an institutional or thematic database. In this context, legitimate commercial interests, knowledge transfer activities, and pre-existing intellectual property rights under the law are taken into account."

Another national instrument to support open science is the Institutional Development Fund[8], which has a dedicated action (starting in 2022) within domain 6: Developing institutional capacity for research in state universities. State higher education institutions can apply for funding for specific institutional development projects to create the necessary capacity for implementing open science practices.

Objective 1.2, 'Ensuring the transition to open science and facilitating the path to excellence in scientific research,' of the National Strategy for Research, Innovation, and Smart Specialization 2022-2027[9], provides:

Open Access to Publications:

- Mandatory publication in open-access journals from the main stream of knowledge or on open-access platforms (e.g., Open Research Europe), with the assurance of covering necessary costs. Negotiations for transformative agreements with publishers will be conducted to establish nationally equitable costs for access to international publications and open scientific publishing.
- Support for Romanian journals indexed in the Web of Science with an impact factor or an absolute influence score above their field average, and the adoption of best practices for open access publishing (such as obtaining DOAJ SEAL accreditation).
- Promotion and support of existing initiatives and new ones that support open science, particularly for long-term storage of open-access publications, for integration into disciplinary databases and/or EOSC (European Open Science Cloud).
- Grant opportunities for open-access publishing in journals indexed in the Journal Citation Reports with an impact factor or an absolute influence score above their field average.
- Maintaining a strategic interest in ensuring access to specialist scientific literature from the mainstream of knowledge, including through synergy funding mechanisms.

Open Access to Research Data following the European principle 'as open as possible, but as closed as necessary' for research projects that produce scientific data and in accordance with the responsible research data management principle.

- Mandatory development of data management plans, respecting FAIR principles and open data, within research-development-innovation projects funded by public funds. Research infrastructures will also be supported in developing and implementing data management plans associated with experiments.
- Ensuring the eligibility of costs associated with the management of research data resulting from publicly funded research.
- Grant opportunities for preparing data that underlie scientific research results for open publication/deposition.
- Promotion and support of existing initiatives and new ones that support open science, especially for the long-term storage of research data, for integration into disciplinary databases and/or EOSC.

Establishment and Implementation of a National Mechanism for Supporting the Transition to Open Science:

This mechanism, under the supervision of the Open Science Council of the MCID (Ministry of Research, Innovation, and Digitalization), will:

- Provide support for defining and implementing specific open science policies and coordinating the development and implementation of recommendations from the Strategic Document on the Framework for Open Science Development in Romania.
- Offer support for the development of specific open science capabilities.
- Ensure the coordination of the network of experts within research organizations.
- Ensure the coordination of the development of open science management capacity within research organizations.

Citizen Participation: In addition to encouraging citizen participation in defining the strategic research agenda, projects that encourage citizen participation in various stages of the research process, such as data collection, will be supported. Pilot initiatives will be explored for involving citizens as end beneficiaries in expert evaluations at various stages of relevant projects.

An important action in 2021 was the establishment of the national initiative for open science cloud - RO-NOSCI[10] in the context of the "NI4OS Europe"[11] project. RO-NOSCI is a national coalition of organizations, coordinated by UEFISCDI, the National Institute for Research and Development in Informatics, and the National Institute for Research and Development for Physics and Nuclear Engineering "Horia Hulubei", with the aim of: establishing the national cloud for open science within the EOSC ecosystem's development; optimizing and coordinating activities related to integrating national infrastructures and services into EOSC; facilitating academic and research community access to EOSC resources; promoting and implementing open science policies at the national level.

The national portal[12] dedicated to open science was developed by UEFISCDI (part of the SIPOCA 592 project), and its purpose is to connect and actively engage the academic and RDI community in the dynamics of open science. It also provides educational resources related to open science in Romania (such as scanning the international and national open science dynamics, providing a set of tools to facilitate capacity development, and connecting the portal with other national initiatives, among others).

Promoting open science at the national level, supporting dedicated actions, and connecting with major European initiatives are largely ensured through the Open Science Knowledge Hub Romania (OSKH) within UEFISCDI. OSKH is a partner or member of the most significant international communities and initiatives dedicated to open science, including OpenAIRE, Research Data Alliance (RDA), EOSC Association, and various European projects[13] and organizations[14] focused on open science. UEFISCDI - OSKH represents Romania in the Policy Support Facility Challenge - Mutual Learning Exercise (MLE) "Citizen Science Initiatives - Policy and Practice"[15] organized by DG Research & Innovation, European Commission. The objective of this European-level mutual learning exercise is to facilitate the exchange of information, experiences, lessons learned, and to identify best practices, policies, and programs related to various approaches at the local, regional, and national levels to support citizen science. Through OSKH, UEFISCDI contributes to the development of the national strategic framework for open science, aligning the national context with international recommendations and initiatives.

In these efforts, OSKH collaborates with the UNESCO Chair on Science and Innovation Policies at SNSPA, which has established the Open Science Lab to support the development of policies, capacity building, and the implementation of open science on specific research topics.

At present, Europe is in the midst of a transition towards open science, supported by various initiatives, policies, and decisions concentrated on ensuring, among other things:

1. Free access to scientific publications and research data funded by public funds, including ensuring research data management in accordance with FAIR principles.
2. Transparency in the costs of open access publishing.
3. The acquisition of specific skills and competencies related to open science by researchers and academic and research institution staff.
4. The development and implementation of incentives and rewards for adopting open science practices.
5. Adaptation of research evaluation processes to the new context of open science, including the introduction of new generation metrics in the research and researcher career evaluation system.
6. The development of infrastructures for open science and their integration into the European Open Science Cloud (EOSC), which provides a secure virtual environment for accessing, sharing, and reusing research results across borders and scientific disciplines.
7. Engaging citizens in science through "citizen science."

The European Union's new framework program - Horizon Europe 2021-2027 - strengthens obligations regarding open access to scientific publications and research data funded by public funds. Beneficiaries must ensure free access to scientific publications, at the latest upon publication, through archiving in a trusted digital repository.

The provisions regarding research data management in the Horizon Europe 2021-2027 framework program are as follows: data must be "FAIR" and open by default, with exceptions considered (national security, personal data, confidential data, data related to legitimate commercial interests). It is mandatory to create and continuously update a data management plan. Beneficiaries must archive data in a trusted digital repository and associate data with scientific publications, ensuring immediate open access to data by applying open licenses and adhering to the principle of "as open as possible, as closed as necessary."

Additionally, Recommendation (EU) 790/2018[16] on access to and preservation of scientific information mentions that member states should establish and implement clear policies regarding the skills and competencies of researchers and staff from academic institutions concerning scientific information. Member states should ensure that, through the application of these policies, the necessary education and training are provided for the transition to open science

The European Commission defined the expertise, skills, and specific competencies required for implementing open science practices in its July 2017 report[17]. These encompass various areas:

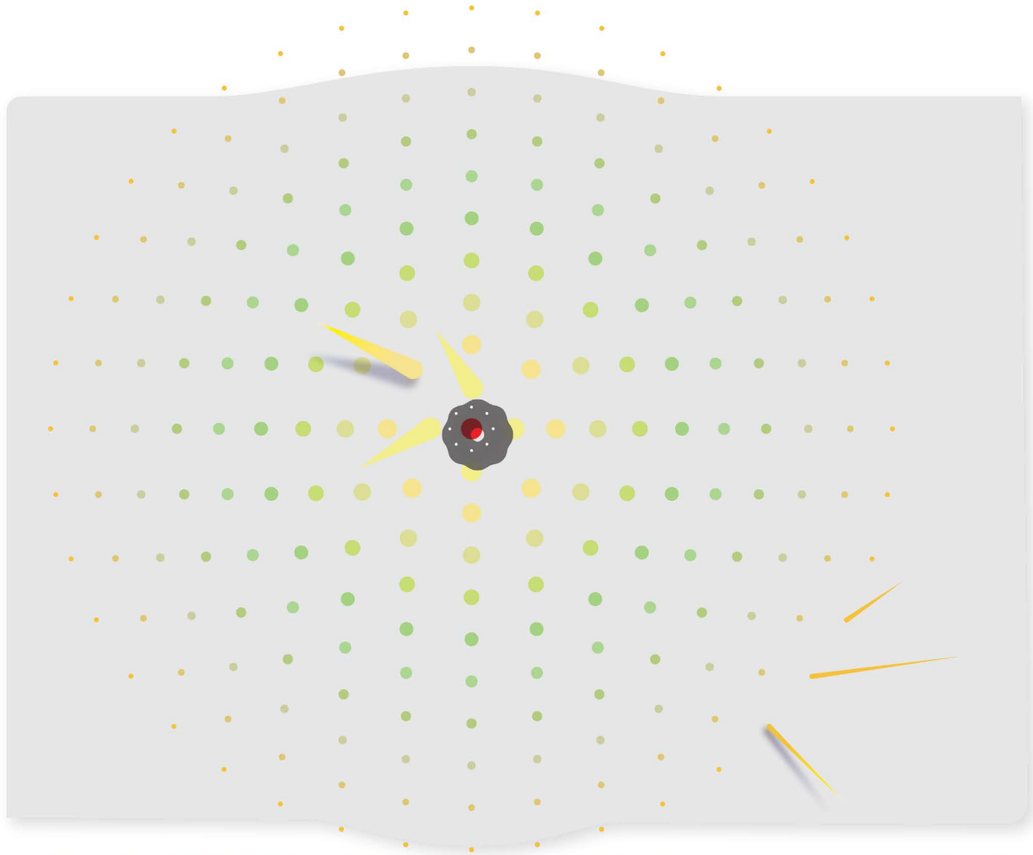
- Open Access Publishing.
- Data Management and Open Data.
- Skills and expertise for working within and beyond one's academic and disciplinary community.
- Competencies for conducting research professionally, including research management skills, legal expertise, research integrity, and ethics.
- Skills and expertise specific to "citizen science," where researchers interact with the general public to enhance the impact of science and research.

These skills are necessary at different levels of the research system, including researchers, technicians, and support and administrative staff, depending on their roles in an open science research environment.

In the report "Digital skills for FAIR and open science"[18] developed by the EOSC Executive Board Skills and Training Working Group in February 2021, digital competencies for FAIR and open science are considered fundamental for EOSC. Building a network of qualified EOSC professionals is crucial for fostering a culture of research results sharing and enabling individuals and institutions to develop and maintain the required skills and capabilities.

The Conclusions of the Competitiveness Council regarding research assessment and open science implementation[19], adopted on June 10, 2022, pertain to the reform of research assessment systems in Europe, the development of capabilities for research publishing and communication, as well as the promotion of multilingualism in European research publications.

Additionally, noteworthy are initiatives by the Organisation for Economic Co-operation and Development (OECD), particularly the Council Recommendation on Access to and Sharing of Research Data from Public Funding (2006, revised in January 2021)[20]. These initiatives address various challenges related to data governance and systems for recognizing and rewarding data authors. As highlighted by the OECD, global collaboration and research data sharing have reached unprecedented levels in response to the current global emergency generated by COVID-19. The complete genome of COVID-19 was published just a month after the first patient was admitted to a Wuhan hospital, with open access publication in The Lancet[21]. This contrasts with the delay of five months in the case of the 2002-2003 SARS outbreak, mainly due to early information disruption. However, trust in (at least some) data remains relatively low at present, and unresolved issues include the implementation of specific standards, interoperability, data quality, and interpretation..



VISION

Supporting a systemic transformation towards open science
is necessary and aligns with European policies stemming from digitalisation and technological changes that have influenced the conduct and organization of scientific research, as well as the participatory role of society in knowledge production.

By 2030, the research culture will undergo a transformative process towards openness, reusability, and replicability of research results, enhancing transparency, quality, and the efficiency of research. This transformation will enrich knowledge, accelerate innovation, and provide solutions to major societal challenges.

In 2030:

Open access to scientific publications resulting from research funded by national public funds becomes a common practice applied by researchers.

The scientific publishing system becomes more efficient and dynamic, benefiting from a transparent and equitable framework for the costs of open access publishing and access to international publications.

Research data management in accordance with FAIR principles is a standard for publicly funded research, and open data access is ensured while respecting the principle "as open as possible, as closed as necessary".

Digital infrastructures, services, and repositories for open science are developed to enable free access, visibility, sharing, reuse, and long-term preservation of research results in digital format.

The evaluation of researchers' careers, research projects, and research institutions adapts to consider open science practices. The adoption of open science practices is not only encouraged and assessed but also professionally recognized and rewarded.

Citizens have access to scientific results and participate in various stages of the research process, such as data collection (citizen science), strengthening the relevance of research in addressing societal challenges and society's trust in science and innovation.

8 STRATEGIC OBJECTIVES

The White Book aims to comprehensively address the needs of the institutional stakeholders regarding the implications of open science[22]. It is anchored in the main European and global recommendations and practices - reflecting the major trends to be addressed - and in the national context, it defines 8 directions (strategic intervention objectives), and proposes subsequent actions for achieving the *open science vision* for Romania - and for implementing the provisions of the European Commission's recommendations[23], UNESCO's Recommendation on Open Science[24], and the Conclusions of the Competitiveness Council on Research Assessment and Implementation of Open Science from June 10, 2022[25].

The strategic objectives are discussed in dedicated briefs that describe the current state and propose nationally-oriented strategic actions.

This leaflet includes the sets of proposed strategic actions, while the detailed information on the national and European/ international context can be found at www.open-science.ro.

Objective 1. Ensuring Open Access to Scientific Publications Resulting from Publicly Funded Research

Ensuring open access to all scientific publications resulting from publicly funded research, as soon as possible, preferably upon publication, starting with the new research funding cycle, with the aim of aligning with the best international practices by 2030.

Objective 2. Managing Research Data and Ensuring Open Data Access

Research data management should become a standard scientific practice during the research process when generating, collecting, or reusing data. Data management and responsible data handling should be based on a data management plan, ensuring compliance with FAIR principles, and open access should be provided while respecting the "as open as possible, as closed as necessary" principle.

Objective 3. Ensuring Transparency, Equity in the Costs of Open Publication, and Access to International Publications

To ensure an efficient and dynamic open scientific publishing system, a transparent framework for publication costs and conditions is needed. The recommendation describes the necessary steps for ensuring transparency and avoiding double funding regarding open scientific publishing and access to scientific databases. Double funding concerns hybrid journals that charge fees both for open publication and subscriptions, thus doubling the costs for accessing scientific publications. Currently, this practice of hybrid open publication is discouraged at the European level.

Objective 4. Development of Infrastructures and Services for Open Science

In the transition to an open science system, it is vital to promote and support the development of dedicated initiatives, digital repositories, and services to support open access and the FAIR storage of research results (publications and research data) and integrate them into the European Open Science Cloud (EOSC) and/ or trusted discipline-specific databases/ platforms.

Objective 5. Ensuring Open Science Governance

In order to align with the recommendations and policies of the European Union and to facilitate and ensure the national transition to open science, it is necessary to develop institutional capacity through the establishment and implementation of an institutional support mechanism in accordance with the provisions of the SNCISI 2022-2027.

Objective 6. Developing the Capabilities Required for Open Science Implementation

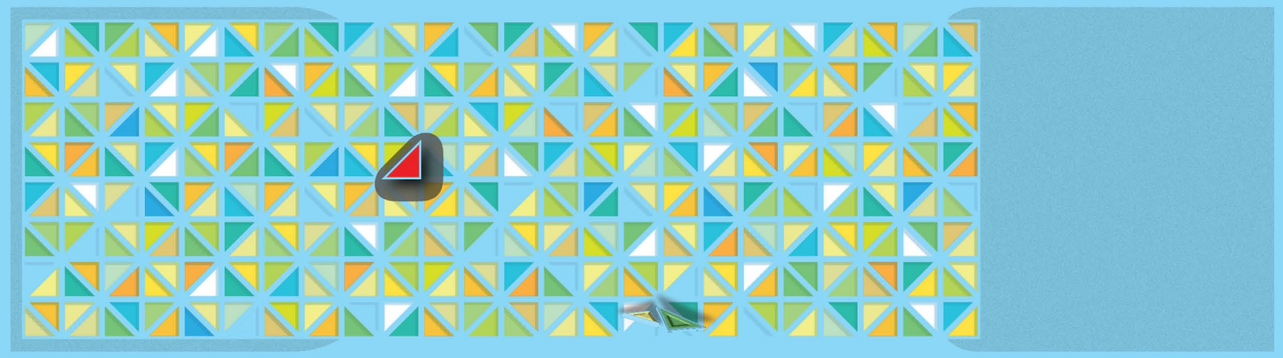
By developing specific capabilities for open science, the aim is to acquire skills and competencies, especially by researchers and staff from academic and research institutions, as well as other actors involved in "open science," to support an efficient national transition in line with the recommendations and policies of the European Union and international best practices in open science.

Objective 7. Adapting the Research Evaluation and Rewarding Process to the New Context of Open Science

For open science to become a reality, it is necessary to change how research is evaluated and rewarded. In this regard, the evaluation system for research (researchers, projects, and research organizations) needs to be revised and updated to reward the implementation of open science practices, such as early sharing of research results, open collaboration, open access to research findings, and involvement of societal actors wherever possible. Moreover, such a process must be accompanied by a transformation of the evaluation system to recognize a broader range of research outcomes and activities.

Objective 8. Involving Citizens in Science ("Citizen Science")

In order to open up science to society and enhance citizens' trust in science and the relevance of research in addressing societal challenges, citizens' involvement in various stages of the scientific research process ("citizen science") within research projects funded through national research funding programs needs to be supported and encouraged.



O1. Ensuring Open Access to Scientific Publications Resulting from Publicly Funded Research

1.1. Ensuring open access to all scientific publications resulting from publicly funded research as soon as possible, preferably upon publication, starting with the new research funding cycle. Regardless of the publication channel (scientific journal, digital infrastructure, multimedia channel, or any new/ experimental mean of academic communication), open access to publications should be granted within a maximum of 6 months from the publication date (up to 12 months for social sciences and humanities), following the provisions of European Commission Recommendation 790/2018[26].

Open access publication can be achieved through the following methods:

- Immediate open access publication or "gold" open access (most commonly through authors paying an open access publication fee - Article Processing Charges - APCs, costs covered by the research funding organization based on the funding project contracts for publicly funded research);
- Immediate open access publication without costs or "diamond/ platinum" open access;
- Self-archiving[27] or "green" open access, where research results are deposited by the author in a digital repository, before, simultaneously, or after publication (in case of an embargo period, no later than six or twelve months from publication, for social sciences and humanities).

Authors of publications or institutions should retain sufficient intellectual property rights to ensure open access, leading to wider dissemination, exploitation, and reuse of research results.

1.2. Open access publication in hybrid journals[28] should only be accepted within the transition process to open access for a clearly defined period, as part of transformative agreements with publishers[29].

1.3. Regardless of the chosen publication route, applying the Creative Commons Attribution International Public License[30] is necessary, preferably CC BY, or an equivalent license that allows the reuse of scientific information resulting from publicly funded research, in compliance with copyright legislation and without infringing upon it. For monographs and other types of books, the license may exclude commercial use and derivative works (e.g., CC BY-NC, CC BY-ND).

1.4. Publication metadata must be openly accessible under the Creative Commons Public Domain Dedication (CC0) or equivalent and in line with FAIR principles to be machine-actionable.

1.5. Regardless of the chosen publication route ("green," "gold," "diamond/ platinum"), depositing scientific publications in a trusted open-access digital repository that ensures long-term preservation is strongly encouraged[31]. A digital repository is an online archive where researchers can deposit digital research results and offer open access to them.

1.6. Utilize unique and persistent identifiers (e.g., DOI - Digital Object Identifier for scientific publications and ORCID for researchers) in ensuring open access to scientific publications.

1.7. Include open access requirements for scientific publications as a condition for project approval (a project evaluation criterion), part of the funding contract, including monitoring compliance with these requirements[32].

1.8. Maintain the eligibility of article processing charges (APCs) in accordance with Government Decision No. 134 of February 16, 2011, which approves the methodological norms for establishing expense categories for research and development activities and innovation stimulus financed from the state budget (Art. 7)[33].

1.9. Understand the challenges and opportunities associated with ensuring open access to scientific publications and patents.

1.10. Define and align the institutional policies and strategies of universities, research organizations, and libraries regarding the dissemination of scientific publications and open access to them.

1.11. Support Romanian journals in adopting best practices for open access publishing (such as obtaining DOAJ SEAL accreditation).

1.12. Maintain the strategic interest in ensuring access to specialized scientific literature in the mainstream of knowledge, including through synergy funding mechanisms, in line with the achievement of transformative negotiations (per strategic objective 3).

O2. Research Data Management and Open Research Data

2.1. The introduction of the mandatory development and continuous updating of data management plans, in compliance with FAIR principles and open access to data, starting with the new funding cycle, for all research projects that generate, collect, or reuse publicly funded data, and monitoring compliance with these requirements. It is recommended that the data management plan be openly accessible, except when legitimate reasons exist for keeping it confidential. If made public, it is recommended to apply the CC BY license to allow broad reuse.

2.2. Ensuring open access to stored data as soon as possible and within the deadlines set in the plan - through a digital repository[34] and applying the most recent available version (preferably) of the "Creative Commons Attribution International Public License" (CC BY or CC0) or an equivalent license. According to the provisions of Article 13 (1) of Law 179/2022 on open data and the reuse of information from the public sector, "open access policies respect the 'open by default' principle and are compatible with FAIR principles: findable, accessible, interoperable, and reusable, in accordance with the Marrakech Agreement establishing the World Trade Organization, ratified by Romania through Law no. 133/1994". "Ensuring open access to data is done in accordance with the principle of 'as open as possible, but as closed as necessary,' taking into account intellectual property rights, personal data protection, privacy, security, and legitimate commercial interests." This means that, as an exception, beneficiaries can or must keep certain data closed for justified reasons (explicitly stated in the data management plan).

2.3. Metadata related to stored data should be openly accessible under the "Creative Common Public Domain Dedication (CC0)" license or an equivalent, following FAIR principles (especially to make them "machine-actionable").

2.4. Research data should adhere to FAIR principles and be easily identifiable through persistent and unique identifiers - PID (most commonly using DOI - Digital Object Identifier) and should be linkable to other datasets and publications through appropriate mechanisms[35].

2.5. Costs associated with the management of research data should be eligible in the funding contracts for publicly funded research projects.

2.6. It is recommended to manage and provide open access to other research outcomes besides research data, such as software[36], models, algorithms, workflows, protocols, simulations, electronic lab notes, in compliance with FAIR principles and open access (as far as possible).

O3. Ensuring Transparency and Equity of the APC and of Access Costs

3.1. Ensuring transparency of publishing costs through the participation and contribution of research organizations in Romania to initiatives such as OpenAPC and consortia aimed at supporting open access publishing, such as cOAlition S, the Sponsoring Consortium for Open Access Publishing in Particle Physics (SCOAP)[37], Fair Open Access Alliance (FOAA)[38], or Open Library of Humanities (OLH)[39]. Libraries, foundations, companies, and funding organizations can be members[40].

3.2. Initiating and conducting transformative negotiations/ agreements by the national coalition that ensures access to scientific literature and other relevant organizations (libraries, research funding organizations, etc.) with publishers for establishing fair and transparent costs for open access publishing and access to international publications (to obtain the best possible conditions - reduced open access publishing fees, transparency in costs, practices regarding access to scientific publications, including their use and reuse), based on the models promoted by cOAlition S through Plan S and other international practices and recommendations.

Transformative negotiations should be set for a well-defined period, being a temporary transition stage toward the long-term support and assurance of publishing in open access journals and platforms.

3.3. Supporting non-commercial publishing models and collaborative publishing models without article processing charges or monograph processing charges (the "Diamond Open Access" and "Platinum Open Access" publishing models), following international recommendations and initiatives - the UNESCO Recommendation on Open Science[41], the Council's Conclusions on Research Assessment and the Implementation of Open Science[42], and the Action Plan for Diamond Open Access[43].

O4. Development of Infrastructures and Services for Open Science

4.1. Promoting and supporting existing initiatives (digital repositories, services, open-source solutions[44]) and new ones that underpin open science (enabling access, archiving, sharing, and reuse of scientific information), especially for long-term digital storage of open access publications and research data, with the aim of integration into discipline-specific databases and/ or the European Open Science Cloud (EOSC).

By infrastructure, we mean the structures and services necessary for the functioning of open science, including services, protocols, standards, and software that the academic ecosystem needs to fulfill its functions throughout the research lifecycle[45]. A digital repository is an online archive where researchers can deposit digital research outputs and provide open access to them[46].

4.2. Increasing international cooperation in open science to reduce digital, technological, and knowledge divides and promote collaboration between disciplines and countries (supporting membership in international infrastructure networks, initiatives, consortia), with a priority focus on EOSC, in line with the goals of RO-NOSCI.

4.3. Supporting collaborative platforms that facilitate communication and collaboration in science (adding new features to existing ones and continuously adapting them to the European context and requirements, such as incorporating elements related to open science and research evaluation, as well as developing other new solutions/ features to support citizen science).

O5. Ensuring Open Science Governance

5.1. Establishment of the Open Science Council.

5.2. Clarification of the role, representation, and operationalization of the National Reference Point for Romania, in accordance with Recommendation (EU) No. 790/2018 on access to and preservation of scientific information[47].

5.3. Establishment and implementation of a functional national institutional mechanism under the supervision of the Open Science Council to support the transition to open science through:

5.3.1. Serving as an observer of the transition by mapping resources and initiatives for open science and formulating strategic recommendations for aligning national policies with international ones.

5.3.2. Creating a network of experts within research organizations by designating a focal point for open science activities in each of these organizations to support the national mechanism/structure under its coordination, with the aim of facilitating the transition to open science.

5.3.3. Coordinating the development of open science management capacity within research organizations.

5.3.4. Coordinating the implementation of actions included in Objective 2 of the National Strategy for Research, Innovation, and Smart Specialization 2022-2027 and the recommendations of the Strategy Paper on the framework for developing open science in Romania.

5.3.5. Providing support to the academic and research community by developing guides and blueprints on open science.

5.3.6. Assisting the academic and research community in building capabilities and defining and implementing open science-specific policies by facilitating access to information about current practices, methods, and technologies for various key stakeholders at the national level (including organizing national and international dissemination, information, consultation, and mutual learning events).

O6. Developing the Capabilities Required for Open Science Implementation

6.1. Mapping the competencies for emerging professions required for the implementation of open science and creating a competency framework aligned with specific disciplines for researchers and staff in academic and research institutions, as well as for other relevant stakeholders in the private and public sectors and civil society.

6.2. Developing/ adapting national policies on the skills and competencies of researchers and staff in academic and research institutions related to scientific information and open science, as well as for other relevant stakeholders in the private and public sectors and civil society, ensuring that these policies provide education and training as part of the higher education and training system.

6.3. Developing/ updating university curriculum and postgraduate training programs to include dedicated open science programs, such as research management programs that provide education and training on open access to scientific results, research data management, and the use of open science-related resources (infrastructure and services).

6.4. Developing advanced programs for new professional profiles in the field of data processing technologies, training expert computer scientists in data-intensive workflows, including specialists, technicians, engineers, and data administrators.

6.5. Building capabilities at all levels of actors involved in the research and innovation system[48] regarding open access, data management planning, data curation, long-term data preservation, implementation of FAIR principles, integration of infrastructures, services, and digital repositories for open science into EOSC, citizen involvement in science ("citizen science"), licenses, understanding and using new metrics in evaluation, what open science means, and why the adoption of open science principles is essential for research activities. This should be achieved through professional networking, experience sharing, and best practices among national and international actors and experts, as well as through activities such as workshops, mutual learning, dissemination, training, and capacity building.

6.6. Developing digital learning resources, tools, and solutions dedicated to open science and, when applicable, integrating them into EOSC (e.g., MOOCs[49], seminars, interactive online sessions, etc.).

O7. Adapting the Research Evaluation and Rewarding Process to the New Context of Open Science

7.1. Reviewing current research evaluation processes (researchers, projects, and research organizations) to identify the extent to which they take into account and incentivise open science practices and identifying possible measures required for this purpose.

7.2. Developing existing or new evaluation practices, methods, tools, and criteria, in collaboration with research communities (through co-creation exercises and pilot projects), to recognize and reward open science practices, as well as a broader range of research outcomes and activities. This includes updating and complementing the indicators and criteria used in research evaluation processes to include those that stimulate and reward the adoption of open science practices, such as early sharing of research results and data, open collaboration, open access to research results, and engagement with relevant societal stakeholders (where relevant and feasible). It also involves the dissemination of research results to the general public and dedicated indicators that allow for the recognition and reward of a greater diversity of research outcomes and activities.

7.3. Monitoring and periodically reviewing the implemented evaluation processes to draw conclusions about their efficiency and effectiveness.

7.4. Maintaining continuous and transparent communication of information regarding the evaluation process, methodologies, tools, and criteria, and involving all relevant stakeholders in their review. Public research and research funding organizations have the duty to make information about the methods, tools, and criteria used in the evaluation of researchers, projects, and research organizations publicly available and easily accessible.

7.5. Implementing supportive actions, such as creating working groups to facilitate the dialogue and consultation process with members of the scientific communities and other relevant societal stakeholders on topics related to the review and update of research evaluation processes for recognizing and rewarding open science practices, as well as a broader range of research outcomes and activities. This also includes organizing dedicated events for this purpose.

7.6. Implementing supportive actions, such as creating guidelines aimed at research organizations and others, to guide them in the process of reviewing and updating evaluation processes and implementing recognition and reward systems for open science practices.

8.1. Supporting projects that encourage citizen participation in various stages of the research process, such as data collection.

8.2. Piloting forms of citizen involvement, from the perspective of end beneficiaries, in completing expert evaluations at various stages of relevant projects in this regard.

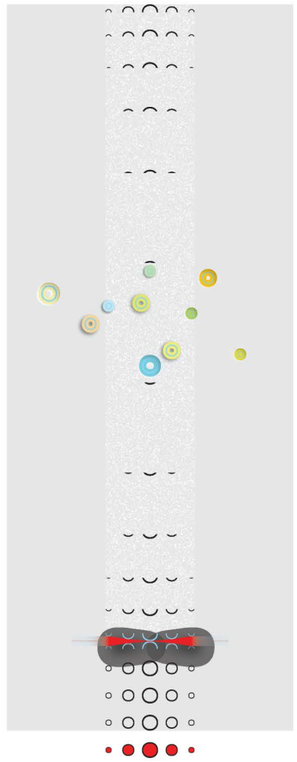
8.3. Developing innovative methodologies and tools to facilitate citizen involvement in science (mobile applications, devices, web solutions, etc.).

8.4. Supporting the development of specific "citizen science" capabilities/ skills of researchers and staff in academic and research organisation through capacity-building activities (workshops, information sessions, etc.).

8.5. Considering "citizen science" practice in the rethinking of the rewards and evaluations of researchers, projects, and research organizations (the potential social impact and citizen involvement should become selection and evaluation criteria for projects - White Paper on Citizen Science for Europe - European Commission[50]).

8.6. Developing a national network dedicated to "citizen science" within the RDI community in Romania, following the models existing at the European level (e.g., Citizen Science Network Austria, Spanish Observatory of Citizen Science, Bürger schaffen Wissen - citizens create knowledge in Germany, Swedish Citizen Science Network[51]).

8.7. Promoting and piloting "citizen science" exercises in schools, high schools, and higher education institutions, adapted to various target groups, aligned with the Sustainable Development Goals[52].



TARGETS for achieving the Vision

[2030] 100% of scientific publications resulting from publicly funded projects are open access.

[2027] 70% of research data is FAIR, and, wherever possible, open.

[2030] Specific digital infrastructures, services, and repositories are adapted to open science and, where possible, integrated into the European Open Science Cloud (EOSC).

[2026] National curricula are adapted to the European framework for data stewards' training.

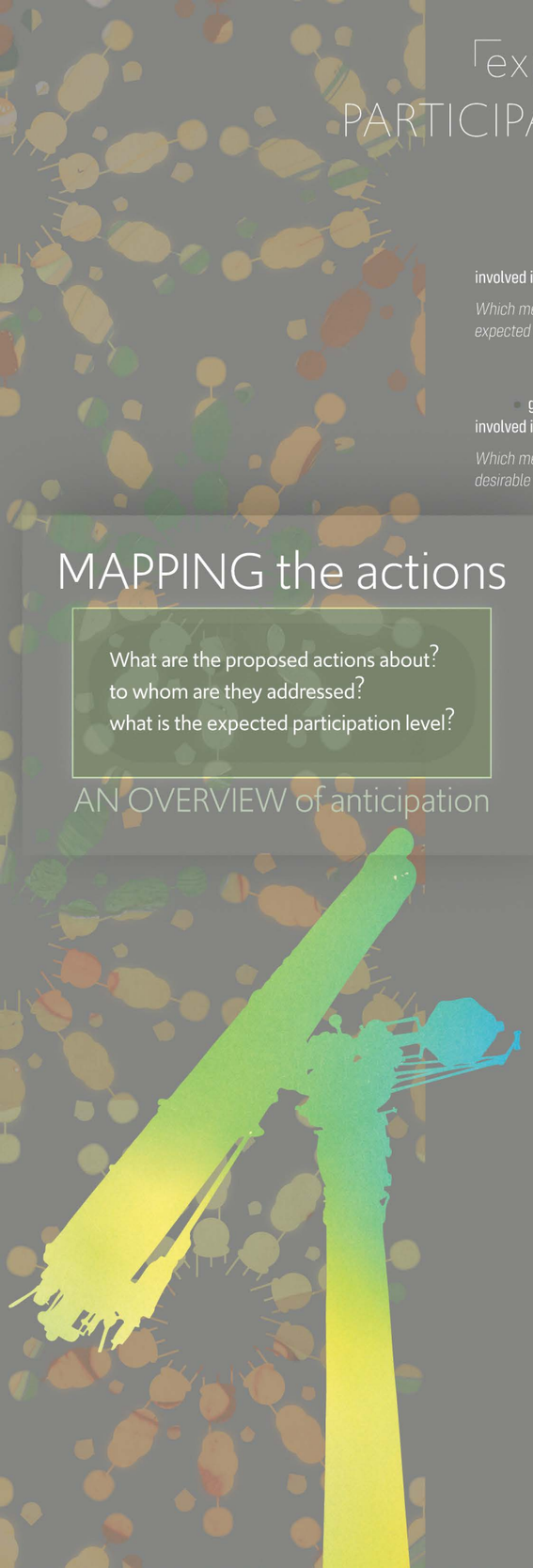
[2030] 80% of researchers and staff in academic and research institutions have the necessary skills for implementing open science practices.

[2026] A more diverse range of open science-specific research activities and results are recognized and rewarded in research evaluation.

MAPPING the actions

What are the proposed actions about?
to whom are they addressed?
what is the expected participation level?

AN OVERVIEW of anticipation



expected PARTICIPATION level

- getting **actively** involved in the transformation
  Which means the action is expected (from)
- getting **proactively** involved in the transformation
  Which means a push is desirable (from)
- **aligning** with the transformation
  Which means reform constraints (on)

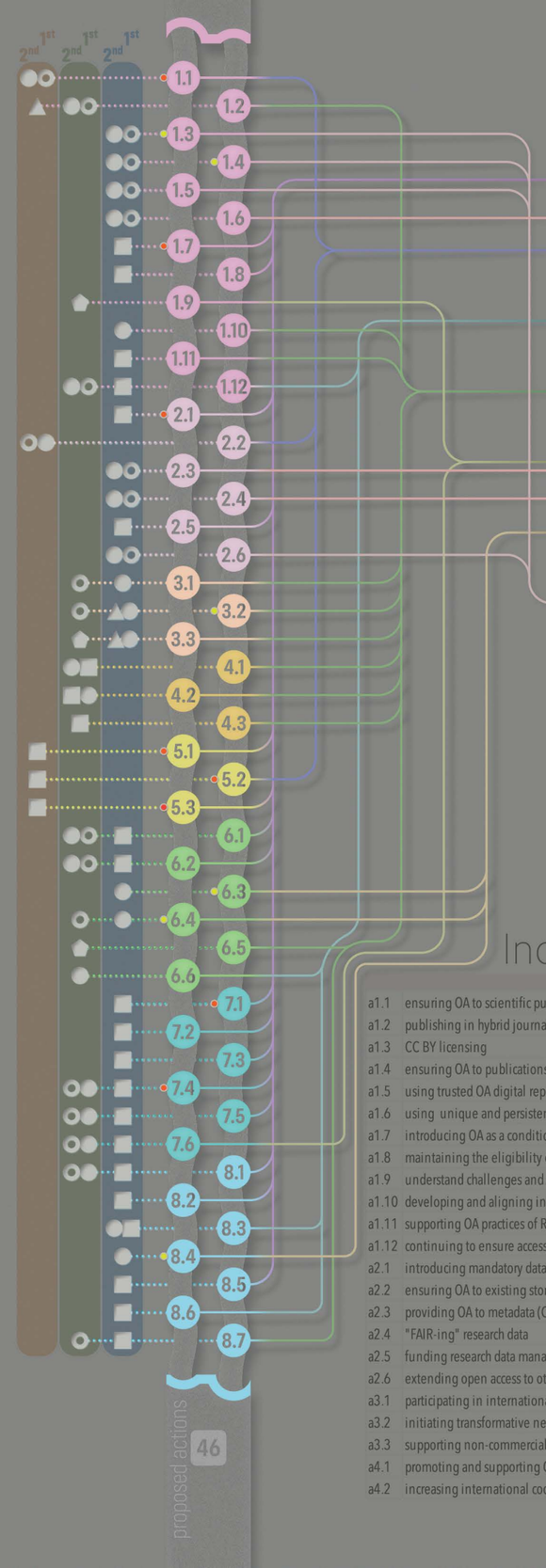
immediate action responsibility of the state 8
safeguarding/ support responsibility of the state 6

targeted ACTORS

- research organisations
- state
- researchers
- publishers & platforms
- *community
  of the OS national ecosystem

TOPICS of the proposed actions

1 Objective	a1.1	OA	a1.2	hybrid journals
	a1.3	licensing	a1.4	publications metadata
	a1.5	digital repositories	a1.6	identifiers
	a1.7	OA as a condition for funding	a1.8	article processing charges
	a1.9	challenges and opportunities	a1.10	institutional policies for OA
	a1.11	OA practices of journals	a1.12	access to scientific literature
2	a2.1	data management plans	a2.2	existing stored data
	a2.3	metadata	a2.4	FAIR research data
	a2.5	research data management	a2.6	other research products
3	a3.1	international initiatives	a3.2	transformative agreements
	a3.3	publishing models		
4	a4.1	OS initiatives	a4.3	collaborative platforms
	a4.2	international cooperation	a5.2	National Reference Point
5	a5.1	Open Science Council		
	a5.3	national framework		
6	a6.1	competency framework	a6.4	advanced educational programmes
	a6.2	upskilling policies	a6.5	OS capacities
	a6.3	OS educational programmes	a6.6	digital learning resources & tools
7	a7.1	research evaluation	a7.4	communicating
	a7.2	new evaluation practices	a7.5	supportive actions - dialogue
	a7.3	monitoring and revising evaluation	a7.6	supportive actions - guidelines
8	a8.1	citizen participation	a8.5	citizen science in research evaluation
	a8.2	citizen involvement in evaluations	a8.7	citizen science exercises in education
	a8.3	innovative methodologies & tools		
	a8.4	citizen science-related skills		
	a8.6	national network for citizen science		



POLICY LEARNING AREA

Governance & policy/ funding design-proposed actions are about ensuring transformative coherence.

Enforcing legal provisions, including EC recommendations, is a question of systemic consistency.

Strengthening key resources is about the consolidation/ provision (by the state but also by others) of key resources for the actors in the system to continue the transformation.

Institutional change and capacities also encompasses community transactions and the resolution of systemic tensions.

Knowledge consolidation is about further substantiating and directing the transformation.

Skills consolidation refers to the skills required for a meaningful transition to open science.

Research practice/ conduct is about shaping the way in which research is conducted and concluded.

Work technicalities is about operational accuracy, i.e., actions that provide more detailed reference points for achieving the transfromation.

Index of shortened proposed actions

a1.1	ensuring OA to scientific publications	a4.3	supporting collaborative platforms for science
a1.2	publishing in hybrid journals - transformative agreements	a5.1	establishment of the Open Science Council
a1.3	CC BY licensing	a5.2	operationalise the National Reference Point for Romania
a1.4	ensuring OA to publications metadata	a5.3	designing and implementing a national framework for the transition to OS
a1.5	using trusted OA digital repositories	a6.1	creating a competency framework for OS-related emerging professions
a1.6	using unique and persistent identifiers	a6.2	developing/ adapting upskilling policies for OS
a1.7	introducing OA as a condition for public funding of research	a6.3	including OS educational programmes in higher education
a1.8	maintaining the eligibility of article processing charges	a6.4	designing advanced educational programmes for new professions
a1.9	understand challenges and opportunities of OA	a6.5	building relevant OS capacities of organisations
a1.10	developing and aligning institutional policies for OA	a6.6	developing digital learning resources, tools, and solutions for OS
a1.11	supporting OA practices of Romanian journals	a7.1	reviewing current research evaluation processes to incentivize OS
a1.12	continuing to ensure access to scientific literature	a7.2	co-creating and piloting new evaluation practices to reward OS
a2.1	introducing mandatory data management plans	a7.3	monitoring and revising the evaluation processes
a2.2	ensuring OA to existing stored data	a7.4	communicating on the evaluation processes
a2.3	providing OA to metadata (CC0)	a7.5	supportive actions - dialogue for the review of evaluation processes
a2.4	"FAIR-ing" research data	a7.6	supportive actions - guidelines for the review of evaluation processes
a2.5	funding research data management	a8.1	supporting projects that encourage citizen participation
a2.6	extending open access to other research products	a8.2	piloting forms of citizen involvement in evaluations
a3.1	participating in international initiatives for OA publishing	a8.3	developing innovative methodologies and tools for citizen science
a3.2	initiating transformative negotiations/ agreements	a8.4	developing citizen science-related skills of researchers
a3.3	supporting non-commercial and collaborative publishing models	a8.5	including citizen science-criteria in research evaluation processes
a4.1	promoting and supporting OS initiatives	a8.6	developing a national network for citizen science
a4.2	increasing international cooperation in OS	a8.7	piloting citizen science exercises in ISCED 1-6 education institutions

1 Findability, Accessibility, Interoperability, and Reuse of digital assets: https://www.go-fair.org/fair-principles/

2 European Commission (2016). Open Innovation, Open Science, Open to the World – A Vision for Europe: https://op.europa.eu/ro/publication-detail/-/publication/3213b335-1cbc-11e6-ba9a-01aa75ed71a1

3 In the context of open access initiatives, we refer to the natural sciences, social sciences, and humanities, as well as STEM (Science, Technology, Engineering, and Mathematics) and SSH (Social Sciences and Humanities) disciplines together. See also ERAC SWG Open Science and Innovation (2020), SWG OSI Opinion on future Open Science and Open Innovation priorities in the European Research Area (2020-2030), General Secretariat of the Council, European Research Area and Innovation Committee, ERAC 1203/20, Brussels, 1 April 2020.

4 Frontiers Communications in Frontiers Announcements, Open Science and Peer Review (2018). "Scientific Excellence at Scale: Open Access journals have a clear citation advantage over subscription journals".https://blog.frontiersin.org/2018/07/11/scientific-excellence-at-scale-open-access-journals-have-a-clear-citation-advantage-over-subscription-journals/

5 European Commission (2016). Open Innovation, Open Science, Open to the World – A Vision for Europe. https://op.europa.eu/ro/publication-detail/-/publication/3213b335-1cbc-11e6-ba9a-01aa75ed71a1

6 See https://open-access.network/en/information/open-access-primers/arguments-and-reservations

7 REI platform: https://rei.gov.ro/teze-doctorat

8 Institutional Development Fund: https://uefiscdi.gov.ro/fondul-de-dezvoltare-institutionala-fdi

9 National Strategy for Research, Innovation, and Smart Specialization 2022-2027: https://www.research.gov.ro/uploads/comunicate/2022/strategia-na-ional-de-cercetare-inovare-i-specializare-inteligent-2022-2027.pdf

10 RO-NOSCI: https://uefiscdi.gov.ro/ro-nosci

11 NI4OS Europe - National Initiatives for Open Science in Europe project: https://ni4os.eu; https://uefiscdi.gov.ro/national-initiatives-for-open-science-ni4os

12 The National Portal for OS: https://www.open-science.ro

13 FAIR-IMPACT - Expanding FAIR solutions across EOSC project: https://fair-impact.eu; https://uefiscdi.gov.ro/fair-impact; OPUS - Open Universal Science project: https://opusproject.eu; https://uefiscdi.gov.ro/opus; GraspOS - Next Generation Research Assessment to Promote Open Science project: https://www.open-science.ro/proiecte; SECURE - The Sustainable Careers for Researcher Empowerment project: https://www.open-science.ro/proiecte

14 Science Europe (https://www.scienceeurope.org/) and CoNOSC - Council for National Open Science Coordination (https://conosc.org/#page-content)

15 Mutual Learning Exercise on Citizen Science Initiatives-Policy and Practice: https://ec.europa.eu/research-and-innovation/en/statistics/policy-support-facility/psf-challenge/mutual-learning-exercise-citizen-science-initiatives-policy-and-practice

16 European Commission (2018). Commission Recommendation (EU) 2018/790 of 25 April 2018 on access to and preservation of scientific information. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018H0790&from=EN

17 European Commission (2017). Providing researchers with the skills and competencies they need to practise Open Science: https://storage.fnr.lu/index.php/s/a9WySvOkwtlQoYr#pdfviewer

18 European Commission (2021). Digital skills for FAIR and Open Science: https://op.europa.eu/en/publication-detail/-/publication/af7f7807-6ce1-11eb-aeb5-01aa75ed71a1

19 Council of the European Union (2022). Council conclusions on Research assessment and implementation of Open Science: https://www.consilium.europa.eu/media/56958/st10126-en22.pdf

20 OECD Council Recommendation, 2006, rev. 2021: https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0347

21 Lu R, Zhao X, Li J, Niu P, Yang B, Wu H, et al. Genomic characterisation and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding. Lancet: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)30251-8/fulltext

22 Instituții de finanțare, decidenți, cercetători, instituții și organizații de cercetare, universități, biblioteci, reviste științifice.

23 European Commission (2018). Commission Recommendation (EU) 2018/790 of 25 April 2018 on access to and preservation of scientific information: This recommendation focuses on access to and preservation of scientific information: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018H0790&from=EN;
Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions (2012). A Reinforced European Research Area Partnership for Excellence and Growth: https://www.research.gov.ro/uploads/politici-cd/politici-europene/era-communication_en_jul-2012.pdf. This communication prioritizes optimizing the circulation, transfer, and open access to scientific knowledge, especially research results financed from public funds, whether through EU-funded projects or nationally funded ones;
Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the regions (2012). Towards better access to scientific information: Boosting the benefits of public investments in research: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2012:0401:FIN:EN:PDF. This communication emphasizes the optimal circulation and transfer of scientific knowledge and ensuring better access to it.
Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions (2015): A Digital Single Market Strategy for Europe: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52015DC0192: This communication highlights the importance of science and research in accelerating innovation, particularly by supporting "data-driven science".

24 UNESCO (2021). UNESCO Recommendation on Open Science. https://unesdoc.unesco.org/ark:/48223/pf0000379949

25 Council of the European Union (2022). Council conclusions on Research assessment and implementation of Open Science: https://www.consilium.europa.eu/media/56958/st10126-en22.pdf

26 European Commission (2018). Commission Recommendation (EU) 2018/790 of 25 April 2018 on access to and preservation of scientific information: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018H0790&from=EN

27 Self-archiving enables immediate access to publications and will be done either at the time of publication or as soon as possible through archiving in an open access digital repository validated by the Directory of Open Access Repositories - OpenDOAR (https://v2.sherpa.ac.uk/opendoar/) and/ or Registry of Open Access Repositories - ROAR (http://roar.eprints.org/).

28 At the European level, publishing in a hybrid "open access" model, where journals charge both for OA publication and subscriptions, is discouraged. This practice doubles the costs for accessing research results.

29 Rationale for the Revisions Made to the Plan S Principles: https://www.coalition-s.org/rationale-for-the-revisions/

30 Creative Commons Attribution International Public Licence. https://creativecommons.org/licenses/by/4.0/

31 cOAlition S strongly encourages researchers to deposit their scientific publications in a repository, regardless of the chosen "open access" compliance route. UNESCO also recommends that scientific publications be disseminated by publishers on open-access publishing platforms and/or deposited and made immediately accessible at the time of publication in open-access online repositories. Furthermore, within the Horizon Europe program, immediate open access is provided to publications deposited through a trusted digital repository.

32 European Commission (2018). Commission Recommendation (EU) 2018/790 of 25 April 2018 on access to and preservation of scientific information: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018H0790&from=EN and Plan S: https://www.coalition-s.org/

33 The Government of Romania (2011). Government Decision No. 134 of February 16, 2011, for the approval of the Methodological Norms regarding the establishment of expense categories for research and development activities and innovation stimulation, funded from the state budget (Art. 7): https://uefiscdi.gov.ro/resource-82663

34 To identify a trusted open-access digital repository, it is recommended to check the registry of research data repositories with open access, such as Re3data (https://www.re3data.org/) and OpenDOAR (https://v2.sherpa.ac.uk/opendoar/), and/ or the general-purpose repository for multidisciplinary research outputs, including data and software, Zenodo (https://zenodo.org/).

35 European Commission (2018). Commission Recommendation (EU) 2018/790 of 25 April 2018 on access to and preservation of scientific information: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018H0790&from=EN

36 Regarding software, except for the CC0 (Public Domain Dedication) license, Creative Commons licenses are not suitable (although they can be used for software documentation). Instead, it is recommended to use dedicated licenses, such as those listed as free by the Free Software Foundation and open source by the Open Source Initiative. For more details, refer to the Horizon Europe Programme Guide: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/programme-guide_horizon_en.pdf.

37 SCOAP: https://www.scoap3.org

38 FOAA: https://www.fairopenaccess.org

39 OLH: https://www.openlibhums.org

40 Laura Bickel, Nicole Clasen and Ralf Flohr (2019). Open Access Days: Business models and their financial impacts for open access transformation: https://www.zbw-mediatalk.eu/2019/11/2019-open-access-days-business-models-and-their-financial-impacts-for-open-access-transformation/

41 UNESCO (2021). UNESCO Recommendation on Open Science: https://unesdoc.unesco.org/ark:/48223/pf0000379949

42 Council of the European Union (2022). Council conclusions on Research assessment and implementation of Open Science: https://www.consilium.europa.eu/media/56958/st10126-en22.pdf

43 The Action Plan for Diamond Open Access: https://www.scienceeurope.org/our-resources/action-plan-for-diamond-open-access/

44 See open-source software such as Islandora: https://www.islandora.ca, Invenio https://inveniosoftware.org/

45 SPARC EUROPE (2020). Scoping the Open Science Infrastructure Landscape in Europe: https://zenodo.org/record/4153809#.YuE2-3ZBw2w

46 European Commission (2021). EU Grants AGA - Annotated Model Grant Agreement. EU Funding Programmes 2021-2027: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/common/guidance/aga_en.pdf

47 European Commission (2018). Commission Recommendation (EU) 2018/790 of 25 April 2018 on access to and preservation of scientific information: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018H0790&from=EN

48 Researchers and personnel from research organizations, universities, libraries, and funding institutions.

49 Massive Open Online Courses (MOOCs) - free online courses accessible to anyone with internet access: https://www.mooc.org/

50 European Commission (2015). White Paper on Citizen Science for Europe: https://ec.europa.eu/futurium/en/system/files/ged/socientize_white_paper_on_citizen_science.pdf

51 The Austrian model has the following objectives: to create networks of stakeholders involved in "citizen science" in Austria and beyond, to develop "citizen science" as a research method, to ensure the quality of such projects (both in terms of research and collaboration), and to disseminate information about "citizen science": https://www.citizen-science.at; Spanish Observatory of Citizen Science: https://ciencia-ciudadana.es/; Bürger schaffen Wissen: https://www.buergerschaffenwissen.de; Swedish Citizen Science Network: https://medborgarforskning.se.

52 Declaration on Citizen Science: Our world - our goals: Citizen Science for the Sustainable Development Goals (2020): https://survey.naturkundemuseum-berlin.de/sites/default/files/uploads/Citizen Science SDG Declaration.pdf

ENDNOTES

-a policy document about open science

ROMANIA