The 16th National Information Day: Open Science, Open Data, Open Access, Bulgarian Open Science Cloud

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Abstract. This paper gives a comprehensive overview of the current landscape and the ongoing efforts regarding open science at both national and international level, focusing on open access to scientific information, open data, and the Bulgarian Open Science Cloud.

Keywords: Open Access, Access to Knowledge, Open Science, Open Data, Repositories.

1 Introduction

The 16th National Information Day is dedicated to demonstrating successful open access (OA), open data sharing and open science projects and initiatives; strategies for the promotion of OA; advancements in the Bulgarian Portal for Open Science (BPOS) and other national repositories; copyright and licenses under OA; best practices and examples of policies for the development and promotion of open access at both national and institutional level, etc. The event will support academic staff, research project managers, policymakers and staff working in research funding bodies. It will demonstrate the main concepts for the implementation of OA principles and propose a national OA roadmap, key terms, strategies, business models, work plans, copyright and licenses, best practices, examples and policies for OA, open data and open science.

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The development of artificial intelligence (AI) is bringing new issues and challenges to open science. These advances are influencing both our work and the outcomes we produce. Some of them are:

- the transformative power of AI both a **scientific tool** and a **research object**, offering new ways to enhance scientific discovery;
- presence of **concerns about transparency, reproducibility, and accountability** due to AI's "black box" nature;
- ensuring ethical use of AI to uphold open science values - **openness, transparency, reuse, and accountability;**
- embedding ethical safeguards, using high-quality open data, and ensuring **human oversight** and responsible integration of AI.

2 Bulgaria OA Journals, Repositories and Portals

Data for Bulgarian open access repositories in 2025 is shown in Table 1.

Table 1. Open Access Bulgarian repositories in 2025.

Open Access Bulgarian Repositories 2025	Software	Link
New Bulgarian University Repository	EPrints 3.4.3	http://eprints.nbu.bg
Bulgarian Digital Mathematics Library (BulDML) at Institute of Mathematics and Informatics, Bulgarian Academy of Sciences (IMI-BAS)	CultIS	https://buldml.math.bas.bg
Digital repository of Sofia University	DSpace 1.8.2	https://research.uni-sofia.bg
D.A.Tsenov Academy of Economics - Digital Library	DSpace 6.3	http://dlib.uni-svishtov.bg
Academic Research Repository at the Burgas Free University	Dspace 1.8.1	http://research.bfu.bg:4000/home
Central Medical University - MU, Sofia	DSpace 7.4	http://cml4.mu-sofia.bg:4000/home
Medical Academic Repository - Medical University - Varna Prof. Dr. Paraskev Stoyanov	Dspace 6.2	https://repository.mu-varna.bg/
Digital Library of the University Library of Sofia University	CultIS	https://digital.libsu.uni-sofia.bg
Bulgarian Portal for open science (BPOS)	Elasticsearch	https://bpos.bg/
Technical University of Sofia (E-Publications)	Technical University	https://e-university.tu-sofia.bg/e-publ/search.php

Digital Library SU 'St.Kliment Ohridski'	CDS Invenio v0.99.1	https://sudigital.org/lib/
NALIS Repository - The founders of the National Academic Library and Information System Foundation (NALIS Foundation)	DSpace 6.2	http://digilib.nalis.bg/xmlui/
Repository of the University of Chemical Technology and Metal-lurgy	DSpace 7.6	https://rlib.uctm.edu/home
CL-BAS Repository	DSpace 6.2	http://dspace.cl.bas.bg/xmlui/

The total number of indexed OA journals in Bulgaria (DOAJ: Directory of Open Access Journals) is 98. The existing Bulgarian national (open datasets) portals are:

- **Bulgarian Portal for Open Science** (https://bpos.bg/) - BPOS is the national repository for data and publications resulting from research funded wholly or partially by public funds, maintained by the National Center for Information and Documentation (NACID). The repository is multidisciplinary, allowing the upload of publications and research results from all scientific fields.
- **Open Data portal** (https://data.egov.bg/). Access to public open data sets in machine-readable format. It contains data sets from many organizations.
- **National Spatial Data Portal** – Infrastructure for Spatial Information, INSPIRE (https://inspire.egov.bg/) includes data sets, services and maps.
- **National Statistical Institute** (https://www.nsi.bg) – Similar to the open science portal, the NSI provides free and unrestricted access, but for selected data sets in machine-readable data formats in CSV, JSON.

3 The Main Open Science Activity in Bulgaria – 2024 - 2025

National Priorities within the OS Initiative

- provide the necessary trusted infrastructure for long-term storage, sharing and access to scientific publications and other research results from publicly funded research;
- foster new skills and competences;
- raise awareness on open science and ensure the active involvement of researchers, universities and research organizations;
- create a national open science program to consolidate objectives and solutions.

National Policy and Infrastructure

Bulgaria has adopted a National Plan for the adoption and implementation of open science policies in January 2021. The general aim of the plan is to provide the research community and general public with access to scientific publications and research data in an open and non-discriminatory way at the earliest stage possible and ensure the

possibility for the use and re-use of said information. The plan provides for the adaptation of national policies, initiatives and research infrastructures, as well as the creation of conditions for inclusion and interoperability with the European Open Science Cloud.

In recent years, open access has emerged as a pillar in the transformation of academic communication, fostering transparency, equity, and visibility of scientific knowledge. In June 2022, the Bulgarian Ministry of Education and Science entered into a strategic three-year agreement with Elsevier, aiming to facilitate access to scientific literature and incentivize OA publishing. As part of the agreement, corresponding authors affiliated with eligible Bulgarian institutions may publish a limited number of articles in Elsevier's hybrid journals without incurring Article Processing Charges (APCs). The annual publication quotas under this framework are as follows:

- 2022–2023: 100 OA articles
- 2023–2024: 180 OA articles
- 2024–2025: 260 OA articles

The data reveals both promising growth and significant underutilization. While the increase in 2024 points to improving institutional readiness, the relatively low uptake in 2022 and 2023 raises questions about internal communication, awareness, and administrative barriers. The dominance of a few institutions, particularly BAS, also indicates the need for broader capacity building and support for smaller or regionally-based universities.

This uneven distribution suggests that national-level policy interventions, including targeted training and institutional support mechanisms, may be necessary to ensure equitable access and full utilization of the OA publishing benefits across the higher education and research sector.

As part of its commitment to advancing the objectives outlined in the National Plan, the Ministry of Education and Science is developing the National program for open and responsible science. This initiative is designed to embed the principles and practices of open and responsible science into the standard research culture across the Republic of Bulgaria. The overarching aim is to improve access to scientific results, enhance the transparency of research activities, and promote a more open, collaborative, and impactful scientific environment.

The Program supports the creation and maintenance of a sustainable infrastructure for storing and accessing scientific data. It fosters the development of essential skills and competencies among researchers, and encourages robust national and international collaboration. A core objective is to ensure that the Program evolves into a sustainable process aligned with the long-term strategic development of Bulgaria’s educational and research systems. This vision is intended to help Bulgarian researchers, universities, and research organizations accelerate the adoption of open access policies, thereby increasing the visibility of their work and elevating the international standing of Bulgarian science.

By promoting open and responsible science, the Program also facilitates effective interdisciplinary and cross-sectoral cooperation, which is vital in addressing pressing global challenges. The overarching goal is to support the implementation of open science principles within scientific organizations and higher education institutions, in

alignment with European and global standards, ultimately enhancing the visibility, accessibility, and impact of scientific research.

The Program is structured around five main pillars:

- Pilot Introduction of open access publishing, implemented through the National Publishing House for Education and Science "Az-buki". This pillar promotes the adoption of open access publishing models, enhancing the visibility and dissemination of scientific work.
- Development and enhancement of open science infrastructure, which includes the creation and sustainable management of repositories, platforms, and tools that enable data sharing, long-term preservation, and interoperability in line with European and international standards.
- Training and education, which aims at raising awareness and building skills among researchers, educators, and students, this pillar supports training programs, workshops, and the integration of open science principles into academic curricula.
- Integrating policies, providing advisory and methodological support for the implementation of European and national policies for open and responsible science, as well as fostering international partnerships and participating in joint initiatives.
- Promoting and engaging, focusing on organizing and holding forums (e.g., schools, workshops, information days, conferences), creating educational materials to raise public awareness, and introducing incentives to encourage the implementation of open and responsible science.

The Program's activities include, but are not limited to:

- development and implementation of institutional open science policies;
- support for the creation of internal regulations, action plans, and guidelines;
- establishment of open science coordinators or dedicated teams within institutions;
- introduction of monitoring and evaluation measures for open science adoption;
- creation of a sustainable digital infrastructure for open science;
- modernization and development of e-infrastructures;
- upgrade of available and development of new institutional repositories;
- integration of local repositories into national and European infrastructures such as the European Open Science Cloud (EOSC);
- provision of storage capacity and tools for the long-term preservation of research results;
- definition and implementation of data standards;
- development and application of metadata standards and documentation practices;
- establishment of interoperability with global scientific databases and repositories;
- capacity building;
- provision of training for researchers, administrators, and IT professionals on open science practices, FAIR principles, and data management;
- creation of educational resources and guidance materials;

- promotion of incentives for open and responsible science;
- promotion of incentives for publishing in open access formats;
- encouragement of recognition of open science achievements in academic evaluations and career development;
- support for citizen science participation;
- promotion of the broader societal and scientific benefits of open and responsible research.

Through the aforementioned efforts, the National Program for open and responsible research aims to foster a more inclusive, transparent, and globally connected scientific ecosystem in Bulgaria.

Open Data and Cloud Computing National Initiative in Bulgaria

This environment requires diverse expertise to achieve its potential, but also opens distinct possibilities, especially in high performance data analytics and artificial intelligence, as well as traditional high performance computing (HPC) applications.

The Bulgarian Portal for Open Science

The Bulgarian Portal for Open Science, developed and maintained by NACID, continued to grow steadily over the past year, marking its fifth year since its official launch.

Among the most recent developments, a significant regulatory document concerning the operation of the Portal was published in the State Gazette, Issue 20, on 11 March 2025. This document, titled Regulation on the Procedure for Publishing and Storing Data and Publications in the Bulgarian Portal for Open Science, was issued by the Minister of Education and Science pursuant to Article 78, Paragraph 4 of the Act on the Promotion of Research and Innovation. The Regulation sets out the procedures for publishing and storing data and publications resulting from scientific research funded wholly or partially by public funds from higher education institutions and research organizations in the BPOS. It outlines the principles governing publication and storage, describes the types of resources to be included, and details the overall organization of the publication process within the Portal. The other novelty is the introduction of the new Rule of Procedure of the National Science Fund, where the agreement for funding must to be accompanied by a Data Management Plan (including open research data where appropriated) proposed by the Beneficiary of the grant.

In terms of usability, BPOS has seen a notable improvement. Over the past 12 months, the number of available documents has increased by over 38%, largely thanks to the automated integration with the newly established repository of Sofia University "St. Kliment Ohridski". As of May 17, 2025, the Portal hosts over 87 000 documents. These are categorized by access rights as follows: open access – 77 815, metadata-only access – 7 412, restricted access – 1 787, and embargoed access – 24.

Regarding document types, as seen in Fig. 1, scientific articles constitute the majority (over 76% of the Portal's content), followed by dissertations (13%), conference proceedings (6%), and other types (5%). The high number of dissertations is largely due to the established automated link between BPOS and the Register of Academic Staff

and Defended Dissertations in the Republic of Bulgaria, also maintained by NACID. However, the number of datasets and data papers remains extremely low.

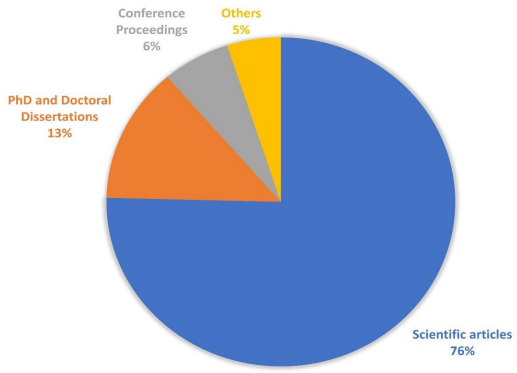

Fig. 1. Distribution of Publication Types in the Bulgarian Portal for Open Science. Data are current as of May 17, 2025.

As for individual registrations, the total number of registered users has reached 5 443 (see Fig. 2). These are distributed as follows: 4 951 scientists, 288 moderators, and 204 organizational administrators. In nearly all cases, the registered users across all three categories are scientists from Bulgarian universities or research institutions. This indicates that interest in the Portal among the Bulgarian scientific community remains steady.

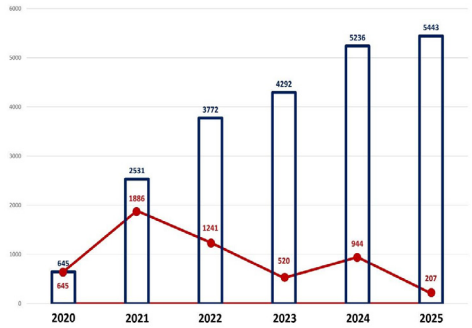

Fig. 2. Registered Individual Users by Year (2020 – 2025). The chart displays both the number of new users each year (line graph) and the total number of users per year (bar chart). Data for 2025 are current as of May 17, 2025.

Bulgarian Digital Mathematics Library (BulDML)

In accordance with the goals and objectives of the National Programme "Stimulation of publication activity in international scientific journals and open access to scientific information", where the Institute of Mathematics and Informatics at the Bulgarian Academy of Sciences (IMI-BAS) holds a leading position within BAS, in 2024 and 2025 the institutional repository for open access to scientific production of IMI-BAS – Bulgarian Digital Mathematics Library (BulDML) has undergone a complete transformation and new release on the basis of the CultIS platform (https://cultis.math.bas.bg/bg), a software environment of the Department of Mathematical linguistics. From the autumn of 2024, the new platform is publicly available at https://buldml.math.bas.bg and provides full-text digital open access to all key journals and collections published by or in collaboration with IMI-BAS – Serdica Mathematical Journal, Serdica Journal of Computing, Mathematica Balkanica, Pliska Studia Mathematica, Bulletin de l'Institut de Mathématiques, Fractional Calculus and Applied Analysis, KIN Journal, INIS series, BIOMATH, Biomath Communications, Digital Presentation and Preservation of Cultural and Scientific Heritage, Conference Proceedings, Science Series "Innovative STEM Education", Mathematics and Education in Mathematics, Ph.D. and DSc. theses, preprints, publications of IMI-BAS researchers for the period 2021-2024 with open access in Q1, Q2, Q3, Q4 or SJR. A volume of 5426 publications has been achieved, 4220 of which have been indexed and referenced in BPOS, placing IMI-BAS in sixth place among the largest providers of open access scientific content. Thanks to this, the percentage of open access to IMI-BAS scientific output for 2023 provided through the BulDML institutional repository is over 30% of the total scientific output. Work is ongoing to add new publications to the repository and the BPOS.

Digital Library of the University Library of Sofia University

In 2025 a specialized software system for intelligent digital management and presentation of large data sets and knowledge was developed through CultIS and put into operation for the needs of the University Library of Sofia University (https://digital.libsu.uni-sofia.bg/bg). The system based on CultIS was developed and implemented by a team from the Institute of Mathematics and Informatics, Bulgarian Academy of Sciences. The system provides digital access to more than 24,000 digital objects from the library's book collection and provides browsing, searching services (including full-text searching of the objects' content). Integration with the University Library's main library system, ALEPH, has been implemented, enabling automatic retrieval of metadata and greatly facilitating the object entry process. The platform is integrated with the Bulgarian Open Science Portal, where Sofia University is among the organizations providing the most content (more than 12000 documents). The digital library has reached the maximum level of technological readiness TRL9 with the implementation, deployment and actual use of the application (public access from 10.03.2025). The digital library is fully compliant with the current accessibility standards (Web Content Accessibility Guidelines - WCAG 2.0, level AA) and EU best practices for accessible web content. Current W3C (World Wide Web Consortium) recommendations and security requirements for digital libraries are covered. The performance

tests performed confirm normal system performance even when the normal traffic is significantly exceeded.

Training and Support

The team behind the Bulgarian Portal for Open Science works to support researchers and institutions by offering guidance not only on using the Portal's features but also on broader open science practices. Assistance is available via phone and email, and the website's sections on news, events, documents, and tools are regularly updated. The team is also committed to participating in national events related to open science, such as conferences, workshops, and training sessions, helping to promote and strengthen the open science culture in Bulgaria.

Capacity Building and Institutional Reforms

In 2024, a joint venture between Sofia University "St Kliment Ohridski" and NGO Links, the aptly named "ORBIT: Open Research Bulgarian IncubaTor", began its 1-year long trial implementation. The project is funded by the REINFORCING Project of the EU (CERN Data Centre and Invenio, n.d.). The overarching aim of ORBIT is to strengthen and expand the application of open and responsible research and innovation (ORRI) practices throughout the Sofia University community, delivering a wider and longer-term impact on fostering ORRI in Bulgaria. The main achievements of ORBIT are:

- **Assessment of the open science perceptions across different stakeholders (researchers, citizens, policy makers/administration).**

ORBIT examined the attitudes of key participants in the process, identifying their views on barriers and incentives, and suggests future steps for better understanding and implementation of open research. The study addressed two major challenges: lack of information on stakeholder attitudes in Bulgaria and insufficient awareness about the benefits of open research for a wider audience. One of the notable findings is that "Researchers show a high level of awareness (92.6%) about open research, mainly through experiences with open-access publications, open data, and educational resources. However, only a small fraction fully embraces the broader UNESCO definition of open research and its comprehensive elements. Responsible research is less of a local priority compared to open research."

- **Design and implementation of an innovative mentoring programme, tailored specifically for PhD students.**

The mentoring programme of ORBIT focused on increasing the capacity in ORRI in Sofia University St Kliment Ohridski and more generally on generating a positive contribution to the Bulgarian researchers' engagement in ORRI. It offers a dedicated programme for early-stage researchers which was delivered in 3 stages – winter school (intensive stage), 3-months long mentorship programme (support and development stage) and presentation of the achievements at the ORBIT final conference (dissemination stage).

The mentoring programme succeeded in attracting 22 PhD students from different faculties of Sofia University to work on different subjects of open science – citizen science, science communication, open data, and intellectual rights.

- **Training of experienced researchers.**

The capacity-building activities in the ORBIT project also aimed to enhance the knowledge and ORRI-specific skills among experienced researchers from different academic institutions. Two workshops were delivered in February and April 2025 with contributions from several European experts. The main topics covered included open metrics and open access, FAIR data, misconceptions and prejudices about the essence of open science and the role of science communication and citizen science in this process.

The overall effects of ORBIT's activities were the strengthening of open science activities, which are not as popular in Bulgaria – specifically, open data and open educational materials. Jointly with the Science Directorate of the Ministry of Education and Science, ORBIT also launched the first National award for open science. Many European countries and institutions have introduced awards in the last 5 years, using them as an effective tool to promote the integration of open and responsible research and innovation practices.

In addition, Sofia University launched a project exploring the possibilities of integrating open science into research assessment. AURA: Advancing Sofia University St Kliment Ohridski's Research Assessment obtained funding from Coalition for Advancing Research Assessment (CoARA). The project explores the attitudes of academics and researchers from Sofia University towards expanding research assessment and incorporating the open research dimension into it. Utilizing a co-creation process, the project will explore how the research-active staff at Sofia University St Kliment Ohridski perceive the integration of open research practices into current research evaluation procedures and career advancement systems. The outcomes of the project will also greatly contribute to the ongoing policy discussions, particularly those led by the Ministry of Education and Science.

Both ORBIT and AURA have successfully involved a diverse range of stakeholders, effectively strengthening Bulgaria's open science landscape. This fruitful engagement has fostered an improved understanding, awareness and skill development around open science principles. In the long term, these outcomes are expected to lead to more concrete and practical initiatives at both the institutional and national levels.

Outreach and Dissemination

In the frame of OpenAIRE (OpenAIRE Science, n.d.), we support researchers and research organizations in the transition to open science practices through tailored services, training opportunities and expert consultations. Our work includes assisting in the development and implementation of open science policies aligned with EU and global standards, ensuring interoperability between systems and the European Open Science Cloud (EOSC), and advising on open access publishing of data, software, and research. We also monitor policy impact and organize national dialogues—such as meetings between OpenAIRE and Bulgarian researchers—to address open science challenges and progress. On October 29, 2024, the Bulgarian Ministry of Education and

Science will host an international online event in collaboration with OpenAIRE, aimed at sharing best practices in open science. Experts from Belgium, Portugal, and Ireland will present how their countries promote openness and accessibility of scientific information. The event was initiated by the national coordinator for Bulgaria in OpenAIRE.

Task Forces

- Participation in the European Open Science Cloud Steering Board (Ministry of Education and Science);
- • Participation in the EOSC Association (Sofia University St Kliment Ohridski);
- • Participation in the OpenAIRE AMKE (IMI-BAS);
- • Participation in Skills4EOSC (IICT-BAS).

4 Conclusions

This traditional overview of the advancement of open science in Bulgaria highlighted key novel developments in 2024-2025. There was a noticeable progress in the legislation, the volume of deposited open access publications in BPOS, and some welcome institutional initiatives contributing to the capacity building and skills' landscape. The launch of the first national award for open science is another welcome development.

Besides these successes, a number of issues are still hindering the wider adoption of open science as an underlying research principle as stipulated by the national law on scientific research. On a national level, this is the much-needed national center which would support open research, liaising also with the research infrastructures from the National Research Infrastructure Roadmap. At the institutional level, a mixed picture is still observed, but generally, open science remains poorly integrated into institutional policies. Some academic libraries are actively vested in providing support for the researchers, but this is still not a common practice. In this climate, the motivations of individual researchers and their level of engagement with open science are very diverse. Those that are well-integrated in EU collaborative projects are active in applying open science practices; however, there is still a general delay in the development of capabilities in general.

Finding mechanisms to increase the institutional involvement in open and responsible research and innovations would be a productive way forward but it still needs some enabling support on the national policy making level.

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