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**The Democratization of Academic Knowledge Through Open Science: Policies, Practices and Prospects**

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**Ο Εκδημοκρατισμός της Ακαδημαϊκής Γνώσης Μέσω της Ανοικτής Επιστήμης:  
Πολιτικές, Πρακτικές, Προοπτικές**

**The Democratization of Academic Knowledge Through Open Science: Policies,  
Practices and Prospects**

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### **Περίληψη**

Το κίνημα της Ανοικτής Επιστήμης (ΑΕ), θεμελιωμένο στις αρχές της διαφάνειας, της συνεργασίας και της καινοτομίας, έχει αποκτήσει ιδιαίτερη σημασία στη σύγχρονη ακαδημαϊκή κοινότητα. Αναγνωρίζοντας τη σημασία της ΑΕ, εστιάζουμε αφενός στις αρχές και τα πολιτικά εργαλεία που τη διαμορφώνουν σε παγκόσμιο και ευρωπαϊκό επίπεδο και αφετέρου στη θέση των ελληνικών πανεπιστημίων στο εξελισσόμενο αυτό πλαίσιο. Η εξέταση των παγκόσμιων, ευρωπαϊκών και εθνικών πλαισίων καταδεικνύει ότι οι χώρες οι οποίες έχουν αναπτύξει οργανωμένες πολιτικές για την ΑΕ έχουν καταφέρει να μεταβούν από την θεωρία στην πράξη, δημιουργώντας ένα οικοσύστημα που μπορεί να εξελιχθεί η ανοικτότητα. Ωστόσο, η υπάρχουσα βιβλιογραφία υποδεικνύει ότι αυτό δεν ισχύει για την Ελλάδα. Παρά την καθιέρωση ορισμένων πρωτοβουλιών όπως η Ελληνική Πρωτοβουλία για την Ανοικτή Επιστήμη (HOSI), το OpenAIRE και το Ερευνητικό Κέντρο «ΑΘΗΝΑ», η απουσία ενός συνεκτικού πολιτικού πλαισίου φαίνεται να έχει αναστείλει την πρόοδο του κινήματος της ΑΕ. Στο παρόν άρθρο προτείνουμε μια σειρά στρατηγικών για τη συστηματική ενίσχυση της ΑΕ στην ανώτατη εκπαίδευση, οι οποίες περιλαμβάνουν τη διαμόρφωση εθνικής στρατηγικής ΑΕ εντός συγκεκριμένου χρονικού πλαισίου, τη διασφάλιση βιώσιμης κρατικής χρηματοδότησης, την καθιέρωση προγραμμάτων κατάρτισης του ακαδημαϊκού προσωπικού στην ΑΕ και την εφαρμογή δεικτών παρακολούθησης της προόδου καθ' όλη τη διάρκεια της μεταβατικής διαδικασίας.

## **Λέξεις-κλειδιά**

ανοικτότητα, ανοικτή επιστήμη, επιστήμη των πολιτών, πολιτικές ανοικτής επιστήμης, δημοκρατικοποίηση της ακαδημαϊκής γνώσης, Ελληνικό Ανοικτό Πανεπιστήμιο

## **Abstract**

The Open Science (OS) movement, underscored by its core principles of transparency, collaboration and innovation, has been gaining significant prominence in contemporary academic discourse. By acknowledging the importance of OS, we focus on the twofold of firstly the principles and policy tools that frame OS on a global and European levels and secondly, the positioning of Greek universities within this evolving framework. The examination of global, European and national frameworks reveals that countries that have developed regulatory texts and open science-related policy frameworks have effectively transitioned from discourse to practical materialization of OS, creating an ecosystem in which openness can evolve. However, existing literature indicates that this is not the case for Greece. Despite the establishment of certain open science-oriented initiatives such as the Hellenic Open Science Initiative (HOSI), OpenAIRE and ATHENA RC, the absence of a cohesive policy framework appears to have impeded the advancement of the movement. In this article, we propose several strategies for the systemic enhancement of OS in Greek higher education, including the formulation of a national OS strategy within a defined timeline, sustainable governmental funding, the establishment of academic staff training on OS and the implementation of progress monitoring metrics throughout this transformative process.

## **Keywords**

openness, open science, citizen science, open science policies, democratization of academic knowledge, Hellenic Open University

## **Introduction**

The concept of Open Science (OS) is gaining prominence within the contemporary academic research landscape, emerging as a key driving force of the democratization of academic knowledge, both as a global policy imperative and as a practice for transforming academic institutions, notably universities. Transparency, scientific collaboration, and innovation constitute its core values and are closely linked to data openness. Namely, the ability of researchers to share, reuse, and comprehensively utilize research data under conditions that ensure documentation, reproducibility, and reusability (Wilkinson et al., 2016). However, as Moore (2022) highlights, the act of sharing resources alone is insufficient; true democratization requires collective governance and a community-oriented culture, ensuring that change is not imposed by the ones in power but is achieved through communal responsibility. Similarly, Leonelli (2023) emphasizes that OS cannot be reduced to the mere sharing of data or resources. For it to function as a genuinely democratic tool, it must be grounded in “judicious connections”, which acknowledge and respect the diversity of scientific traditions and methods. This way, the risk of excluding certain communities or imposing a uniform approach can be avoided, ensuring that openness serves epistemic justice rather than homogenization. In this sense, Mielkov (2023) associates OS with a “democratic academic culture” rooted in autonomy and critical thinking practices.

Expanding upon this notion, OS can be regarded as an integral component of a broader ethos of openness in education (Locke & Weber, 2022), which has been extensively analyzed in existing literature (Cronin, 2017). This approach contextualizes openness as part of a larger pedagogical culture (Manousou et al., 2025), fostering collaboration, participation, and critical thinking. In a different yet converging domain, OS extends this philosophy from the classroom into the research context, emphasizing data management and the institutional practices that accompany it. This transition signifies a substantial reorientation, which can be interpreted as a form of democratizing academic knowledge: shifting from equitable access to learning resources toward the development of institutional and research policies that ensure data and knowledge generated within universities remain

available, transparent, and (re)usable for the collective benefit of the academic community.

Within this framework, the present paper focuses on OS through two distinct yet complementary perspectives: firstly, the principles and policy tools that frame OS on an international and European level; and secondly, the positioning of Greek universities within this evolving framework. The aim of this article is to highlight how international directives are translated into national policies and practices, while also identifying the challenges as well as the opportunities that may arise in this endeavor to enhance quality, reliability, and transparency in research outputs.

### **The Building Blocks and Convergences of Open Science**

OS today represents a key horizon for the revitalization of higher education and research, not solely because of its premise of broader access to scientific knowledge, but also because it reconceptualizes science within its social context. Three building blocks lie at its foundation: open access to publications, open data, and open methodologies.

The concept of open access ensures that the outcomes of scientific work are largely accessible, thereby multiplying the dissemination and impact of research (Budapest Open Access Initiative, 2002). Platforms such as Zenodo and arXiv, for instance, enable researchers to make preprints and articles freely accessible to the global academic community, thus strengthening collaboration and accelerating the distribution of academic knowledge.

Open data constitutes the second cornerstone -the “fuel” of scientific inquiry. It refers to research datasets made openly available for assessment, replication, and use for further research, in line with the FAIR principles (Findable, Accessible, Interoperable, Reusable) (Wilkinson et al., 2016). Initiatives such as the European Open Science Cloud (EOSC) or OpenAIRE establish ecosystems in which data are deposited, curated, and rendered reusable, providing direct value not only in terms of the academic community but also regarding the broader industry and societal contexts, thereby contributing to the accelerated advancement of knowledge.

The third component is Open Educational Practices (OEP)-ranging from open protocols to citizen science- which constitute the ways in which academic

information becomes accessible, while simultaneously reinforcing the reliability and social accountability of science (Vicente-Saez & Martinez-Fuentes, 2018). These practices include pedagogical methodologies that employ openness to foster collaborative, participatory, and critical learning. The concept expands into an educational culture that promotes co-production of knowledge, co-creation, and the cultivation of democratic skills (Cronin, 2017). Citizen science projects, for example, engage non-specialists in data collection and analysis, such as in global environmental monitoring networks (Zooniverse, Galaxy Zoo). This not only increases the volume of available data but also strengthens the relationship between science and society.

Nevertheless, Openness transcends the realm of research. Within higher education, the debate initially centered around Open Educational Resources (OER) -learning content, teaching materials, and scholarly resources made openly available under licenses allowing adaptation and reuse. Initiatives such as MIT OpenCourseWare or OER Commons provide courses, textbooks, and multimedia resources to millions of users worldwide. Their value lies in making knowledge accessible by reducing cost and availability barriers, thereby broadening participation in learning (UNESCO, 2019).

In this respect, OS constitutes the most advanced stage of this paradigm: openness is no longer restricted to teaching practices but extends to the very mechanisms of knowledge production. Knowledge is increasingly conceived as a collective, accessible good produced in collaborative networks, through practices aligned with the principles of access, transparency, social accountability, and innovation (Tait, 2018).

The evolution of OS -from the initial concept of Open Access to open data, open educational practices, and open educational resources- reflects the larger expansion of a concept with multiple meanings and expectations. The term “open” has conventionally been used to signal that a resource is free of cost, that it can be used in any way, that anyone can contribute to processes of production and dissemination, that outputs are accessible, and that new resources can be derived from existing ones (Pomerantz & Peek, 2016). This generates a “virtuous circle”; the use of open resources produces new open resources, thus exponentially enhancing

accessibility, transparency, and the concept of reuse within the domain of academic knowledge. At its core, the concept of openness is not merely about cost-free availability (*gratis*), but freedom of use and reuse (*libre*) -a principle that lies at the heart of scientific progress and social innovation. However, as the notion of openness expands into novel domains, challenges of conceptual clarity emerge, the excessive or ambiguous usage of the term risks misinterpretation. Consequently, the key challenge lies not only in the expansion of open practices but also in grounding them in clear, well-documented, and institutionally embedded frameworks, ensuring that OS becomes a genuine driver of credibility, quality, and social impact in Academia.

### **The Institutional Establishment of Open Science: International, European, and National Frameworks**

OS has emerged as a pivotal strategic priority for the international academic community as well as for European institutions. Its institutional establishment has been developed through regulatory texts and policy frameworks that laid the foundations at both international and European levels. On the global scale, two landmark initiatives provided the initial groundwork.

The Budapest Open Access Initiative (2002) was the first international declaration to explicitly define open access as both a right and a perspective for the future of science. It underscored that the free availability of scientific publications online constitutes an “unprecedented public good,” capable of accelerating progress and enhancing global equity in knowledge dissemination. The initiative highlighted the principle that knowledge generated with public funding cannot remain locked behind costly subscriptions but must instead be freely available beyond economic or legal restrictions.

A year later, the Berlin Declaration on Open Access (Berlin Declaration, 2003) extended the scope of Budapest by introducing the idea that all products of scientific activity-data, multimedia, software- should be openly accessible and freely reusable. The Berlin Declaration acted as a political catalyst, mobilizing universities, research centers, and funding agencies to gradually adopt institutional open access policies. Over time, it became a reference point for embedding openness into European

strategies and beyond. Collectively, these two declarations established the foundations for contemporary debates on openness, framing access not merely as a technical matter but as a question of scientific democracy.

On this basis, the UNESCO Recommendation on Open Science (2021) provided a universal policy framework, linking diverse national and regional initiatives to a shared international horizon for the advancement of strategies and institutions that promote openness. The Recommendation emphasizes not only access but also societal engagement in the production and use of knowledge (citizen science), this way positioning OS as a driving force for democratization and social innovation.

At the regional level, the European Union has translated these directions into concrete policies and infrastructures. The European Commission has integrated OS as a core principle of research funding. The *European Research Area (ERA)* and the establishment of the European Open Science Cloud (EOSC) in 2022 constituted pivotal steps in building a pan-European infrastructure envisioned as the central hub for accessing, sharing, and reusing research data. EOSC embodies the vision of a research ecosystem in which scientists can access high-quality data, tools, and services, thus fostering interdisciplinary collaboration.

Since Horizon 2020, and more firmly under Horizon Europe (2021–2027), open access to scientific publications has been mandated, while particular emphasis has also been placed on the dissemination of open research data according to the FAIR principles (Findable, Accessible, Interoperable, Reusable) (Wilkinson et al., 2016). These principles, first published in 2016, have since emerged as the global benchmark for data management and dissemination, underpinning international strategies for openness.

A significant milestone in this trajectory was the enactment of Directive 2019/1024 (European Parliament & Council of the European Union, 2019) on Open Data and the Reuse of Public Sector Information (Open Data Directive), which expanded the regulatory framework to include research data generated through public funding. This Directive further established obligations for Member States, with particular emphasis on the provision of “high-value datasets” that must be both freely accessible and reusable. In addition to that, the Directive (European Parliament & Council of the European Union, 2019) enshrined the principle of “as open as

possible, as closed as necessary,” thereby acknowledging the need to balance transparency with privacy, confidentiality, and national security.

Another recent and significant initiative is the ROSiE project (Responsible Open Science in Europe, 2022–2024), financed by the European Commission (2024a), which aimed to map OS policies across Europe and develop guidelines for responsible practices. ROSiE conceptualized openness as an ecosystem that must be governed by ethical, legal, and social principles. Its emphasis is articulated through the following triptych:

1. Research integrity and ethics, ensuring that the open sharing of data and methods does not compromise confidentiality or intellectual property.
2. Cultural and social implications, recognizing that OS is not value-neutral but embedded within frameworks of social needs and norms.
3. Policy and institutional frameworks, providing universities and European organizations with specific recommendations for designing sustainable and responsible openness strategies.

In this way, ROSiE complements technological and policy-oriented initiatives such as EOSC and the FAIR principles, emphasizing that OS is not merely a technical or institutional issue but also a discourse of values and social accountability.

### **International and European Strategies for the Materialization of Open Science**

The institutional consolidation of OS is grounded in regulatory frameworks established both internationally (Budapest Open Access Initiative, 2002; Max Planck Society, 2003; UNESCO Recommendation, 2021) and on a European level (e.g., Directive 2019/1024, ROSiE project). Its genuine potential, however, emerges through the ways in which states and universities translate these principles into national strategies, institutional tools, and academic policies.

On an international level, countries such as the United States and Canada have adopted mandatory open access policies for publicly funded publications, thereby strengthening the dissemination of knowledge and access to research data (Piwowar et al., 2018). Similarly, in Australia, the National Research Infrastructure Strategy supports interoperable data infrastructures and open repositories (Australian Government, 2021).

In Europe, we observe diverse yet converging implementation models. The Netherlands -perennially ranked among the leaders -having adopted early on the principle of *open by default* for research data- has established the National Programme Open Science (NPOS) and, more recently, Open Science NL, with a roadmap toward 2030 that focuses on open publications, FAIR data, and research assessment reform (NPOS, 2017; Open Science NL, 2023). In the United Kingdom, the UKRI Open Access Policy, first introduced in 2021, mandates open access for all publicly funded research (UKRI, 2023). In France, the *Second National Plan for Open Science (2021–2024)* introduces explicit obligations for repositories and FAIR data (MESRI, 2021), while in Germany the National Research Data Infrastructure (NFDI) creates thematic consortia for data management (DFG, 2020). In Spain, the National Strategy for Open Science 2023–2027 (ENCA) coordinates university policies on a national level (Gobierno de España, 2023); in Portugal, RCAAP establishes a unified network of repositories (Correia & Teixeira, 2020); while in Italy, the *Piano Nazionale per la Scienza Aperta (PNSA)* sets rules for open data and new forms of assessment (ANVUR, 2022). Finally, Finland has incorporated OS into its national higher education framework, complete with specific timelines and evaluation indicators (Federation of Finnish Learned Societies, 2025).

The unifying theme across these cases is clear: where national strategies, funded infrastructures, and institutional mandates are present, universities can successfully transition from rhetoric to practical application. The comparative analysis across all the above cases reveals three recurring patterns: firstly, the universality of mandates advocating for open publications; secondly, the investment in infrastructures and roles (repositories, FAIR data, data stewards); and thirdly, the reformation of assessment systems to acknowledge the value of openness. These conditions offer valuable lessons for Greek universities.

### **The Reality of Open Science in Greece**

The unique case of Greece constitutes an example of a context where international and European directives intersect with institutional requirements but also with long-standing gaps in practice. OS in Greece is shaped by a heterogeneous array of

policies, digital initiatives, and university practices that remain fragmented and often contrasting.

On one hand, significant steps have been taken in the digital transformation of public administration. On the other hand, open data maturity indicators reveal stagnation and even regression. According to the Open Data Maturity Report 2024, Greece records an overall score of 56%, which is significantly lower than the European average of 83%. More specifically, the country showcases deficiencies in metadata quality (49% compared to 79% in the EU) as well as in impact measurement (45% compared to 81%) (European Commission, 2024b).

This difficulty is also reflected in the findings of iMED Lab (2023), which indicates that Greece was downgraded in 2022 from the “follower” to the “beginner” category in the Open Data Maturity Index. This development further reinforces the view that progress in digital services has not been accompanied by a corresponding institutional and operational openness culture.

The picture is further reinforced by the international Open Data Inventory (ODIN) 2024, which positions Greece at the 115th place worldwide with a total score of 51. This highlights significant deficiencies in the availability and reuse of critical datasets, particularly in areas related to social policy and the environment (Open Data Watch, 2024).

On a national level, the National Documentation Centre (EKT) has played a pivotal role in coordinating OS initiatives, especially through the establishment of the Hellenic Open Science Initiative (HOSI). However, these initiatives often fail to disseminate evenly across the academic landscape. A prime example of this is the Hellenic Open University, which advocates open access through its Library’s thematic catalogues and outreach endeavors. Yet, its focus lies on open access alone, thus excluding the adoption of strategies for open data, reproducibility, or citizen science. This illustrates that a holistic culture of OS has yet to be comprehensively developed. The significance of these findings is twofold: while Greece is formally committed to European and international frameworks, it struggles to translate them into sustainable university policies and foster a culture of openness. This discrepancy between theory and practice constitutes the core challenge for the future advancement of OS in Greece.

### **Specific Policy Directions for the Integration of Open Science in Greek Universities**

The global discourse surrounding Open Universities as key exponents of openness, as outlined by Tait (2018), demonstrates that the initial innovation advantage these institutions possessed in the early decades of their operation has since decreased due to the digital revolution and overall changes in higher education. The key takeaway from this finding is that innovation, as a dynamic attribute, requires constant renewal, systematic integration, and strategic leadership to ensure the long-term sustainability not only of Open Universities but of higher education institutions at large. This issue is particularly significant within the Greek context, as universities in Greece -including the Hellenic Open University- face the challenge of establishing OS as an institutional and organizational imperative.

At the national level, the establishment of the Hellenic Open Science Initiative (HOSI) in 2022 constitutes a critical advancement, as it aligns Greece with the European Open Science Cloud (EOSC) and establishment a formal framework for cooperation among universities, research centers, and policy bodies (OpenAIRE, ATHENA RC). However, the integration of these initiatives within academia is neither uniform nor guaranteed. Researchers and academic units often act individually, using private platforms for data sharing or publishing, leading to fragmentation and unequal access (ZBW MediaTalk, 2022).

At the same time, the digital transition is accompanied by substantial barriers. Recent studies (Gkrimpizi et al., 2023) highlight that Greek universities encounter difficulties across six critical domains: technological infrastructure, human resources, organizational culture, financial capacity, regulatory frameworks, and leadership. The absence of a comprehensive strategic plan renders the transformation process fragmented, confirming Tait's observation that innovation necessitates long-term investment and stable institutional framework to be effective.

Nevertheless, the Greek landscape is not solely a source of challenges but also one of opportunities. Organizations such as the GFOSS – Open Technologies Alliance and HOSI itself foster dynamic networks of collaboration, thus cultivating a culture of openness and promoting the use of Free and Open-Source Software (FOSS). Additionally, the growing international pressure for compliance with European

directives, exemplified by the 2019/1024 Directive on high-value datasets, functions as a significant motive for institutional change. This suggests that Greece has the framework to transform OS into a strategic pillar of university development, if provided leadership is enhanced, permanent support structures are established, and measurable evaluation metrics are adopted.

In this regard, it is essential to highlight both the benefits and the challenges of OS to develop a realistic strategy for Greek universities. International scholarship (Fecher & Friesike, 2014; Vicente-Saez & Martinez-Fuentes, 2018) emphasizes that OS can act as a catalyst for improving the quality and reliability of research by enhancing transparency, enabling reproducibility of results, and expanding the dissemination of scientific knowledge beyond the confines of academic communities. At the same time, it creates new channels of collaboration between scientists, citizens, and policymakers, and this way reinforces the social dimension of research.

However, the implementation of OS is accompanied by significant challenges. A lack of infrastructures, unequal access to resources, and varying rates of institutional adoption generate digital inequalities, particularly among countries with different research capacities (UNESCO, 2021). Moreover, researchers are often burdened with additional requirements for data management, without sufficient institutional and financial support (European Commission, 2016). Finally, the commercial exploitation of open data by private entities raises concerns regarding equitable use.

These issues hold relevance particularly for the case of Greek universities. On the one hand, OS presents prospects for the internationalization of research, the enhancement of transparency, and increased visibility in European networks. On the other hand, chronic shortage of funding and technological infrastructures, as well as the absence of comprehensive strategic planning, risk exacerbating fragmentation and inequality. Through this dual prism of opportunities and challenges, it becomes evident that systematic planning is required on both government and institutional levels.

Within this framework, several policy directions, based on related examples in other countries (e.g., the Netherlands, Finland, Sweden), emerge as crucial:

- the establishment of a national strategy for OS within a specific timeline

- the creation of support offices in every university for data management and compliance with European directives
- the enhancement of academic staff training on openness
- the use of progress monitoring indicators, and
- the establishment of sustainable funding for associated initiatives.

The Dutch paradigm illustrates how the establishment of an ambitious strategy (NPOS) with a timeline for full open access, mandatory data sharing, and the provision of incentives and rewards for OS is vital. Similarly, Finland actively maintains coordinating bodies (AVOTT) and monitors progress through specific metrics, while Sweden, through collective schemes such as the Bibsam Consortium, has generated substantial changes in practice, despite the absence of binding legal frameworks.

In this context, the Hellenic Open University, by virtue of its institutional mission and unique profile, can assume a leading role in the institutional consolidation of OS in Greece. As the singular public institution of remote higher education, it can serve as a model for adopting advanced practices in openness, leveraging international networks of cooperation through HOSI and the institutional framework provided by the National Documentation Centre (EKT). In doing so, HOU possesses the potential to establish a coherent culture of openness that transcends the fragmented initiatives of the past, this way contributing to the long-term integration of OS within the Greek university ecosystem.

Beyond the technical and institutional dimensions, OS embodies a profound social significance: the democratization of knowledge. International scholarship discourse recognizes that openness in research is not only about access but also about participation, transparency, and the equitable dissemination of scientific work (Holbrook, 2019; Vicente-Saez & Martinez-Fuentes, 2018). In the same way, UNESCO (2021) underscores that the right of all citizens to participate in scientific progress constitutes a cornerstone of global policy in OS. This connection is increasingly interpreted as the democratization of knowledge (Mielkov, 2023), a fact that positions universities as institutions of social equality, transcending their role as centers of research production.

For the case of Greece, the need to advance OS is rendered even more pressing. In the nation where democracy originated, OS is intrinsically linked to the capacity of universities to serve a collective ideal: knowledge as a common good and a cornerstone of social cohesion. Should this ideal remain unactualized, Greek universities risk what Tait (2018) warned us about -the loss of their competitive edge due to a failure to innovate. Conversely, through organized strategies and the systemic integration of OS, we can ensure that the “democracy of knowledge” evolves into the foundation of sustainable and innovative university development in the 21st century.

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