

# Open Science in Spain: Towards a Coordinated Strategy

To: Spanish Ministry of Science and Innovation

[J.P. Manzano-Patrón](#)<sup>1,2</sup>, [Isabel López-Neira](#)<sup>1</sup>, [Pablo Izquierdo](#)<sup>1,3</sup>

<sup>1</sup> Department of Science Policy, Society of Spanish Researchers in the United Kingdom (SRUK)

<sup>2</sup> Sir Peter Mansfield Imaging Centre, Faculty of Medicine, University of Nottingham

<sup>3</sup> Department of Neuroscience, Physiology and Pharmacology, University College London

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Corresponding address: [sciencepolicy@sruk.org.uk](mailto:sciencepolicy@sruk.org.uk)

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**Executive Summary:** Research is being transformed by transparency, collaboration, public engagement and shareability, which are key elements of the Open Science (OS) movement. Open Access (OA), one of its main areas of action, aims to make all research freely available. Benefits of OA have already triggered a shift toward its implementation at the European and international level, with funders creating new platforms to support an ecosystem of open publications and data. Despite remarkable early contributions by Spain in terms of OS pilot initiatives and specifically OA publication performance, the latter has declined by more than a third since 2016. Moreover, no new indicators have been put forward since, even though openness remains to be deemed a strength. In this policy memo, we examine policy options to support OS in the country, with a focus on OA. These could be structured by a National Strategy for Openness, including actions to ensure OA for all publicly funded research, standardization of procedures, and the re-design of assessment criteria to incorporate reproducibility of outputs, knowledge dissemination and transfer.

## I. The age of open science

Open Science (OS) is the movement and set of principles that promote accessible scientific research through transparency, collaboration, public engagement and shareability (Vicente-Saez and Martinez-Fuentes 2018). Open Access (OA) is among its main areas of action, and hence the focus of our analysis. It aims to make research findings freely available by removing paywalls and distribution barriers for both readers and authors. Such principles do not only apply to peer-reviewed academic articles but also to book chapters and theses, code repositories or raw research data (Suber 2012).

Collaborative research holds more potential for high-impact knowledge creation (Wuchty et al., 2007). Besides improving collaboration and transparency, there is evidence that OS can benefit research and education (Tacke 2010), thus acting as a research

accelerator (Woelfle, Olliaro and Todd 2011). Even under traditional metrics such as citation rates, publicly available papers outperform publications with subscription-based access (Swan 2010), although there is still debate about the implications of OA for research practice and evaluation, including unintended effects on journals' competition and quality (Ali-Khan, Jean and Gold 2018; Allen and Mehler 2019).

The advantages of OA have already triggered a shift in the traditional understanding and praxis of research. European bodies and international funders have started to vigorously promote OA, leading initiatives such as the Plan S (a public-private endeavour that pledges to make all research funded by supporting bodies OA; Coalition S) for scientific publications, the creation of open data portals for public administrations (European Data Portal), the

development of a science cloud (The European Open Science Cloud Initiative) or the recent Open Source Software Strategy (European Commission 2020a) as part of the European Commission (EC)'s Digital Strategy (European Commission 2018). These seed actions may intertwine in a European strategy for openness. In line with this, the EC's report 'Open Innovation, Open Science, Open to the World—a Vision for Europe' (European Commission 2016) set out their intentions to shape the future of science and innovation through new digital tools to make it at once more global and open to citizens.

## II. Current situation of open science in Spain

Much of Spain's efforts toward OS have focused on OA. The country's 2011 National Science, Technology and Innovation Act requires the publication of research outputs generated with public funding under OA (Spanish Government 2011). The country's contribution to the international OA landscape grew since then, ranking in the top ten by OA publications until 2016 (Hook, Hahnel and Calvert 2019). Interest in promoting openness was also reflected in the 2017-2020 State Plan for Scientific and Technical Research and Innovation, a four-year program that set out the country's strategy in the medium term (Spanish Government 2017). The plan's SWOT analysis recognized both institutional repositories and the readiness of research centers and universities for OA as strengths, and identified OS as a key opportunity to improve Spain's research infrastructure and knowledge generation. It also pledged for the publication of research outputs (papers and primary data) in open repositories to be considered in the evaluation of researchers in public funding calls—albeit no specific protocols were indicated. All in all, the plan aimed to increase OA publications from 20% in 2015 to 35% in 2020.

Crucial work has been done by the Spanish Foundation for Science and Technology (FECYT; Anglada i de Ferrer et al. 2014) and the Conference of Rectors of Spanish Universities (CRUE; Mora Mas et al. 2019), outlining paths to success and piloting key initiatives. However, growth of OA publications has declined since 2016 according to data from OpenAIRE (Rico-Castro and Bonora 2020), even though overall publications have plateaued (Knoema). Reasons are not clear and merit further research. Furthermore, while openness is still deemed a strength of the research production system,

the most recent Strategy for Science, Technology and Innovation (2021-2027; Spanish Government 2020) presents no new OS indicators or updates of the ones from 2016. The failure to meet objectives and lack of wider OS strategies motivated this policy memo.

## III. Policy options

OS is reshaping research culture and filling in some of the existing gaps regarding publication formats, access and reproducibility of research outputs (Friesike et al. 2015). As discussed, Spain needs to set out a wider and clear OS strategy and take decisive, coordinated actions that build upon and improve existing structures to bring itself back to the forefront of OS. Based on our recent report "Por un país innovador" ("For an innovative country"; Society of Spanish Researchers in the UK 2020), we hereby suggest a number of policy options that would help in such endeavour within each of the following aspects of OS.

### *i. A national strategy for openness*

In line with other EU countries like France (French Government 2018) or Netherlands (DANS 2019), Spain could benefit from rolling out a National Plan or Strategy for Openness as a framework for the implementation of successive options. Such a plan would take into consideration current EU best practices and adapt them to the structure and needs of the country's research system. Through such a national strategy, Spain could:

#### *(1.A) Adhere to the Plan S*

This route is currently endorsed by all organizations that form the Science Europe consortium, including the EC, the European Research Council (ERC), the World Health Organization (WHO) and private trusts like Wellcome in the UK. The move allows researchers to retain copyright of their publications and not only improves visibility but also fights the current rise of "predatory journals," fraudulent publications that charge high fees to publish but provide no peer-review or quality checks (Spanish Government 2018). Implementation could be financed by block grants like in the UK (UK Research and Innovation). However, it would result in additional costs for research institutions and would fail to substantially change the publication system—rather than modifying the publishers' business model.

*(1.B) Negotiate new licenses with publishers*

Doing so could relieve some of the financial burden on the research system. While the approach has been successful in countries like Germany and Norway (Else 2019), it is worth noting that research policy in Spain is not managed centrally and the lack of a single interlocutor could hinder negotiating efforts (Martínez-Galindo et al. 2019). Thus, forming a negotiating consortium—representing stakeholders at the national, province and university level—would be advised. Like in the Plan S, subscription fees could be replaced by publishing fees, thus still impacting research budgets, harming especially researchers from emerging economies and non-funded or early-career researchers (Martínez-Galindo et al. 2019).

*(1.C) Implement use of its public national aggregator 'RECOLECTA' ('collect' in Spanish)*

RECOLECTA compiles content across OA repositories and seeks to strengthen institutional repositories, a fundamental pillar of the OA policy as outlined by FECYT (Anglada i de Ferrer et al. 2014). Such repositories grant access to data and metadata from all publicly funded research projects.

Any OA plan should incorporate the replication and evaluation of research results among its objectives. To this end, the public deposit of any research output including protocols, laboratory notes or code could be encouraged by using standardized open electronic formats. In particular, the deposit of negative results (i.e., findings that do not support the initial hypothesis that led up to them) could tackle the 'file drawer' problem (Salkind 2010) and help advance research, e.g. providing insights to avoid researchers repeatedly working towards wrong hypotheses or using inadequate procedures to test them. This can be done through new complementary assessment metrics (*see 3.C*).

*ii. Interoperability and shareability*

As tools and techniques develop, there is a risk of divergence in standards and procedures, which would hinder interoperability of software and digital frameworks and, as a consequence, the very reproducibility of research. To avoid that, it is essential to establish standardized criteria and protocols in order to:

*(2.A) Promote the use of open-platform permanent identifiers*

Open-platform identifiers will help to guarantee the interoperability of systems, such as ORCID (for researchers' profiles), DOI (for research articles and data), or FundRef (for funding information). A significant step would be accepting ORCID profiles as an open-platform, universal substitute of normalized CVs in national funding calls.

*(2.B) Promote the design and adoption of standard operating procedures (SOPs)*

SOPs will provide more thorough information of performed protocols (Stark 2018; Nature 2018). In recent years, it has become common for publishers to request disclosure of replicate numbers and exact statistics on the results shown as well as asking authors to make raw data and codes available. The development of guidelines and checklists can also offer a solution to current issues reporting metadata, particularly in some fields (Leipzig et al. 2016; Obels et al. 2020). To achieve this, Spain could seek agreements with both international organizations for standardization (e.g. ISO) and publishers, and adopt guidelines based on findability, accessibility, interoperability and reusability (FAIR) principles (Wilkinson et al. 2016).

*iii. Dissemination and knowledge transfer*

OS can contribute to curb the current 'publish or perish' culture by boosting resources available to researchers. Improving research evaluation criteria would be key in solving the reproducibility crisis (Baker 2016). Pressure to publish is a direct consequence of the current evaluation system, where research is ranked mostly by publication track-record. This system not only fails to assess the quality of individual articles (relying on journal impact factors (JIF) that are not indicative of it (Brembs, Button and Munafò 2013)), but also neglects the value of key aspects of the research practice, like re-checking procedures, re-testing hypotheses and outputs, or the transfer and dissemination of new findings to society. Reliance on JIF as a blanket criterion is particularly damaging in countries with high competition for funding and jobs, such as Spain (Casadevall and Fang 2014). Specifically, employers and funding agencies could adhere to the San Francisco Declaration on Research Assessment (DORA; Moher et al. 2018). Criteria must be specified *a priori* in transparent and verifiable quantitative

metrics, adapted to each research field (Hicks et al. 2015; Wouters et al. 2019). Besides this, it is important to design and develop *ad-hoc* performance indicators to promote:

### *(3.A) Reproducibility*

Encouraging funding bodies and reviewers to acknowledge attempts by researchers to verify their own work as well as to replicate the work done by others. Of note, the importance of reproducibility has been acknowledged by journals and funders (e.g., Organization for Human Brain Mapping), and some argue that high-impact journals are accountable for the replicability of the research they publish (e.g., Royal Society).

### *(3.B) Dissemination and public engagement*

Recent years have seen an increase in the funding frameworks that require and assess plans for communication and dissemination of research outputs, including EU-wide Horizon 2020 and now Horizon Europe. In this line, such activities should be reinforced at the national level in recruitment, promotion and funding calls.

### *(3.C) Transference and direct application of research after publication*

Indicators such as the ratios of patent applications or patent citations to intramural R&D expenditure (or others specified at European Commission 2020b) can be used for improved quantification. New policies and funding calls directed at arising opportunities and strategic sectors for Spain (e.g., renewable energy, e-health, or cybersecurity) can motivate the development of new research-based companies and spin-offs, in line with the EC's new objectives (European Commission 2019).

These additional elements could be introduced in all funding, hiring and promotion opportunities in Spain, by re-designing the assessment criteria of public

research calls as well as evaluation of research performance. In Spain, researchers are periodically evaluated on their outputs. To date, the assessment of their contribution to dissemination and knowledge transfer ("sexenios de transferencia"), rolled out in 2018, has used vaguely defined criteria and failed to acknowledge efforts towards reproducibility. Spain could benefit from more tailored indicators, as proposed, to increase the weight of these activities in existing assessments.

## **IV. Recommendation**

While OS is an established trend for science globally, clear strategies need to be implemented at a national level to ensure the adaptation of research systems to the principles of transparency, collaboration, public engagement and shareability as outlined. We recommend Spain's Ministry of Science and Innovation to take an incremental approach, setting out a National Strategy to then take coordinated actions across the aspects of OS that have been presented.

While all the above-discussed options would promote OS and should ideally be adopted, we recommend the Government to prioritise the following to tackle the current challenges in the Spanish OS landscape, given the possibility of an almost immediate implementation: supporting the public national aggregators as a key resource for OA (1.C) and adopting existing tools (e.g. permanent identifiers) (2.A). Expanding OA publishing as outlined in options 1.A and 1.B should be a key priority in upcoming national strategies for OS, although shortcomings need to be addressed. Finally, for actions that need to be developed from scratch (e.g. 2.B, 3.A and 3.C), we encourage doing so in coordination with Europe to help interoperability and consolidate reproducibility and standardization as key assets for the design and implementation of such actions.

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**J.P. Manzano-Patrón** is currently doing a PhD in Computational Neuroscience & AI at the University of Nottingham and is a member of the Science Policy committee at the Society of Spanish Researchers in the UK (SRUK). He is actively involved in Open Science and the dissemination of scientific knowledge initiatives, such as in the Brainhack community.

**Isabel López-Neira** holds an M.S. in Science, Technology and Society from University College London (UCL). She has explored questions of fairness linked to technology and innovation while researching at UCL's Department of Science, Technology, Engineering and Public Policy (STePP). Isabel is a member of the Science Policy committee at SRUK.

**Pablo Izquierdo** is a 4th year graduate student in the Wellcome Trust Neuroscience program at University College London. He holds a B.S. in Biochemistry from Universidad Autónoma de Madrid and a M.S. in Neuroscience from University College London. He works as a science communicator and serves as Director of Science Policy at SRUK.

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