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ADVANCING DIGITAL LITERACY, SCIENTIFIC INFRASTRUCTURE, AND LEADERSHIP
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A Policy Brief by CSIS Indonesia

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This research is cofunded by the European Union’s Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 873119.

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Foreword

This policy advice advocates for Indonesia to assert itself as a regional leader in science and technology by implementing specific policies and programmes. The policies and programmes are coherent with UNESCO's Open Science framework, which incentivizes Indonesia to make all of its publicly funded scientific research open access, to invest in a robust and ubiquitous digital infrastructure, and to establish a centralized online repository and publishing system for scientific research. Using the 2023 ASEAN Presidency to announce its position on Open Science and international science cooperation, Indonesia would trigger a political gravity for regional and international science communities, making it an attractive country for highly talented scientists and researchers while creating a basis for the Indonesian population writ large to participate in scientific knowledge production.

Problem

Open Science is mandatory for international science cooperation to achieve the United Nations 2030 Agenda on Sustainable Development and combat global crises. However, misunderstandings of the Open Science paradigm, along with in-built institutional and capital barriers, lead to differentiated and unfulfilled policies and mindset shifts in science and technology policymaking. Science nationalism and science profiteering lead to differentiated implementations of science and technology policy, per nation and region, hindering cooperation towards both the 2030 Agenda and combatting global crises. Thinking within nation-state borders (methodological nationalism) chokes the imagination of policymakers to establish international science cooperation regimes that could foster scientific innovation towards a regional and global common good.

The Indonesian context of Open Science is of particular interest. Boasting the largest number of Open Access Journals in the world and steadily capitalizing on a burgeoning technological economy, Indonesia is ripe for a science and knowledge-sharing renaissance. In the past five years, science and education institutions have been consolidated into one "super-entity", the Indonesian National Research and Innovation Agency (BRIN), stirring the imagination for a publicly funded and centralized open access system for indexing, storing and sharing scientific research, data and results. Further, on the back of the 2022 G20 Presidency, Indonesia holds the 2023 ASEAN Presidency, which provides it with agenda-setting powers towards regional science and technology cooperation. The potential is high for Open Science, and thus the global sustainable development agenda, to find precedence in Indonesia’s policymaking discourse. The reality is the contrary, though—so far.

Interviews conducted with BRIN staff, professors and PhD Candidates of leading Indonesian universities, policy advisers of research institutes, and grassroots organizers illuminate three common challenges to the implementation of Open Science policies and the Open Science mindset: 1) low digital literacy, 2) deficit in open access and open data sharing, and 3) a hesitancy towards regional leadership in international science cooperation. For Indonesia, none of these challenges is insurmountable. However, they require precision and coherence between different policymaking sectors, a utilization of digital infrastructures from private-public partnerships, and a willingness to be a leader in the international arena.
Background

UNESCO’s Open Science

Open Science is a UNESCO-led science paradigm and set of science policies seeking to transform scientific cultures and communities towards open and equitable access to scientific knowledge globally. It recognizes the plurality of epistemic communities and scientific cultures and responds to the demands of digitally-accelerated globalization. Open Science, like other UNESCO-led initiatives, such as Global Citizenship Education, recognizes that global crises do not stop at national borders—they affect all humans—and it is the belief that open, direct, and compassionate international cooperation can mitigate the negative impacts of global crises and orient our national and regional policymaking regimes towards a "global common good". For example, in their 3rd UN Conference on Open Science, the United Nations confirmed that Open Science plays a pivotal role in achieving the 2030 Agenda on Sustainable Development objectives and that international cooperation must be on all levels to move the agenda forward. Where numerous institutions have attempted to negotiate, debate and define Open Science in the last decade, UNESCO, a global standard setter, published its Recommendation on Open Science in Fall 2021, defining the concept, its policies and the paradigm of the global common good from which the policies are to be implemented, per governance regime and local institutions.

Though the definitions within the Open Science framework are clear, and although the UNESCO Recommendation provides the rationale and moral argument for implementing the policies, actual implementation encounters diverse barriers and challenges. Some obstacles and challenges to Open Science implementation are common across world regions and across sectors. However, some are specific to nations, cultures, sectors or local institutions.

Science and Technology Policy in Indonesia

Science and technology policy in Indonesia over the last 18 years has been steered thematically by Indonesia’s National Long-Term Development Plan (RPJPN) (2005-2025) and implemented in four National Medium-Term Development Plans (RPJMN). Since 2011, Indonesia's development plans have been embedded in its Masterplan for Acceleration and Expansion of Indonesia’s Economic Development, which, at its publication, announced goals to increase both industrializations for the domestic market and the R&I sector in order to be globally competitive. Upon his inauguration in 2014, President Joko Widodo overlaid the pre-existing development plans with his own "Nawacita Plan" of nine national development points, which tilted the national priorities towards anti-corruption measures, strengthening institutions for trustworthy governance, and bolstering national civic education and diversity education.

Indonesian development has been rhetorically focused on promoting innovation, entrepreneurship, and research and development (R&D). Still, until multiple scientific and education institutions merged into the National Research and Innovation Agency (BRIN), R&D did not appear as a priority on the development agenda. According to data from the World Bank, only .28% of Indonesia's GDP was dedicated to R&D in 2020, compared to its closest neighbours, such as Singapore, which dedicated 1.89% of its GDP to R&D or Malaysia 1.04% of its GDP.

There are interesting initiatives for R&D, such as science and technology parks supported by the Asia Development Bank (ADB), which connect universities with private enterprises to foster innovation. There is an ever-expanding ICT sector and platform economy, seen in apps (services) like Gojek, Grab, and
Tokopedia. However, Indonesia's support for science and technology has been too tightly focused on private enterprise and the market economy, preventing the bulk of the population from engaging with science, technology and R&D in meaningful ways.

On the international stage, Indonesia pays lip service to global sustainable development and the SDGs, such as with the green "Bali Clean Energy" advertisements carrying the G20 logo, presented at the T20 conferences in Bali in August 2022. However, the Indonesian government has failed to link public access to scientific knowledge with broader science and sustainability education, awareness and innovation. Open Access and Open Data are on the periphery of discussion, but other tenets of Open Science, such as citizen science, are not acknowledged at all.

**The State of Open Science According to Indonesia’s Science Regime**

A study was conducted by interviewing directors of programmes at BRIN, research and administrative staff of the Centre for Strategic and International Studies (CSIS), professors and PhD candidates at the University of Udayana, and civil society agents from U-Inspire, which is a coalition of young scientists and young professionals working towards disaster risk reduction, science communication and the SDGs. The discussions were facilitated by semi-structured interviews, of which the data is still being analyzed for a larger dissertation project. However, the patterns that emerged are clear. They speak to the state of Open Science in Indonesia, the priorities of Indonesia in terms of science governance and cooperation, and the challenges and barriers to effectively implementing Open Science policies and Open Science mindsets in the region. These particular institutions were chosen for study to diversify the sample: BRIN is the head national research funding instrument in Indonesia; CSIS is a leading research institute which uses scientific research to propose policy advice to the Indonesian government and international partners; Udayana University, in the context of Bali and the recent T20 meetings in 2022, is representative of the academic systems of education and publishing; and U-Inspire is a civil society organization which engages in citizen science and science communication, particularly in the context of technologies and digital inclusion. Together, these organizations represent different branches of the Open Science framework, from policymaking to publishing, from scientific research to citizen science and education.

**Open Access**

Qualitative interviews were used to complement data and statistics from third-party organizations because interviews reveal the lived experience and mindsets of the sample group, which may differ from the laws and structures in place to implement policies. For example, Indonesia boasts the most significant number of Open Access journals in the world; however, the interviews highlighted a lack of access to knowledge-based resources. Research conducted by BRIN and grants awarded by BRIN often do not have provisions for accessing scientific research locked behind paywalls (i.e. closed access). Further, they often do not provide provisions for the researcher to publish Open Access—Article Processing Charges (APCs) come from the pocket of the researcher, whether an early career or senior researcher. This creates a two-fold problem for the scientific community: 1) Indonesian scientists are (financially) barred from the leading scientific research in the natural science and social science communities, putting them behind international discourses; 2) predatory online journals arise to pray upon researchers who need to publish, and they collect APCs while upholding weak evaluation mechanisms.
**Predatory Journals**
The second dilemma for the scientific community is pervasive and not uniquely Indonesian. The marriage of globalization to digitalization has provided more possibilities and ease in some arenas, but it has also accelerated processes. The sentiment is that because communication and output can be instant, it should be instant, and more production is thus expected. Rather than ease, the worker feels more significant pressure to produce faster. A predatory publishing industry preys upon academics and scientists who feel this pressure, extracting capital for the promise of publishing fast with few barriers while sacrificing quality. In Indonesia, there are few regulations to prevent nor punish such predatory online journals, and the industry perpetuates the problem of not having incentives for producing sound science.

**Open Data**
Interviewees highlighted a deficit in open data sharing as a critical inhibitor of scientists' and citizens' participation in scientific research. The state of Indonesia launched its One Data policy in 2020 as part of an Open Government Partnerships initiative. Indonesia's One Data policy is "designed to improve internal government data governance practices by providing a regulatory framework"; however, the One Data policy has met challenges to its implementation. Although it centralizes research data, that data is not always accessible to the public nor to scientific communities. For example, in disaster risk reduction work by U-Inspire, interviewees noted that access to tsunami early warning data was consistently barred from localized citizen scientist collectives. A "lack of credentials", meaning university degrees, was pointed out as a reason for tsunami early warning data not being shared with citizen scientist groups. "Closed" and exclusive access to disaster risk data is an essential example of both state and private enterprise ideologies of ownership, whether for state security or profit, which reduce the participation of the citizenry in scientific endeavours—and thus also in reasoned civic engagement.

**Digital Literacy**
Lastly, from the interviews conducted on the intersection between Open Science and digitalization in Indonesia, the digital literacy deficit was highlighted as the number one problem across sectors of the Indonesian science and technology ecosystem. Digital literacy trains citizens and scientists in their earliest education to use digital technologies effectively, filter information, to recognize digital technologies as tools, not only as entertainment machines. The proliferation of ICTs in Indonesia is strongly market driven, without complementary policies for regulating nor guiding the use of technologies. However, low digital literacy prevents the population from using devices like smartphones for much more than entertainment or propping up the gig economy. The recommendation is thus for the Indonesian state to invest in digital literacy education as part of a digital citizenship education initiative.

**Unlocking Indonesia’s Innovation Potential through Open Science**
BRIN is now the amalgamation of numerous scientific and educational institutions in Indonesia. Whereas some public discourses debate the politicization of BRIN’s consolidation, the "super-entity" does provide Indonesia with a unique opportunity to be a power player in Open Science and, thus, in scientific innovation in Southeast Asia.
First, Indonesian scientific and citizen science communities need a centralized data and results repository for all publicly funded research. Similar to Mexico’s Repositorio Nacional, the repository would centralize all publicly funded scientific publications, datasets, theses, and presentations in an index that uses metadata to organize and simplify access to cutting-edge national research. It would then be able to deal with private enterprises about uploading privately funded scientific research and datasets to the repository. The rationale is the same rationale that some government agencies use to restrict data access—national security—and the same rationale that private enterprises use to limit access—protecting innovation. This would fulfil Indonesia's One Data policy, which centralizes open data in a repository but remains too disorganized to be widely effective. By centralizing and opening access to scientific data and results, more members of society can contribute to cutting-edge national research. BRIN would then have the leverage and appeal to invite scientists from other countries, including ASEAN neighbours, to contribute to the national repository and to grant access to the datasets and publications therein. In one fell swoop, Indonesia would become the science hub of the Asia Pacific.

The next level would be for the Indonesian state to endow BRIN with publishing and quality control powers. BRIN could develop a publishing branch that provides open-access publishing opportunities to all scientific research institutes, public and private. The in-house state publisher would ensure high-quality publications in field-specific online journals while curtailing the practices of online journal predation and alleviating the cost burdens from the scientific research community. All publications published via the national publisher would be placed in the national repository alongside relevant datasets, accessible to the greater Indonesian, regional and global scientific communities. For such a model, Indonesia could look to its partners in Europe and the Open Research Europe platform, which centralizes and publishes scientific research and datasets for beneficiaries of the European Commission's publicly funded Horizon research programmes.

A fulfilled global Open Science framework would see the creation of an "Open Research Global" in which all publicly funded research, from all UN member nations would find a home in a centralized online platform of field-specific journals, indexed with datasets, and open access for all to participate in cutting-edge science. However, a first and necessary step is to create national and regional full-package science publishing and indexing systems, like BRIN could host. By housing data and publications on regional servers, the risk of "data nationalism" is mitigated. When data is centralized in one nation's repositories, access to that data depends on international cooperation and trust. If that trust breaks down, national, digital borders may be enforced (i.e. China’s "Great Firewall"), and access to scientific data may be blocked. Therefore, even an "Open Research Global" needs to house international scientific knowledge on multiple servers in multiple world regions to ensure data fluidity and to mitigate protectionist measures by any one nation, which may attempt to use exclusive access to scientific knowledge as geopolitical leverage.

Servers and online platforms necessitate a robust, international digital infrastructure, which international trade regimes can organize through private-public partnerships with multinational ICT companies. International science cooperation networks can push for international digital infrastructure by institutionalizing the aforementioned policies. These policies fulfill Article 27 of the UN Universal Declaration on Human Rights, which states that access to science and its products is a human right. When science, the public sphere, and political discourses increasingly occur online, Article 27 necessitates that access to the internet is also a human right. This demand is legitimated through Open Science—the future is science is on the internet; the future of science is global.
The Policy Advice

1) Invest heavily in digital literacy and science education. This imbues the population with a critical logic for thinking of technology as a tool, being critical about filtering knowledge, and believing in scientific knowledge as a globally shared enterprise. Insert the digital literacy and science education curriculum into primary, secondary and higher education curricula. Resources for effective digital literacy and science education are available as open educational resources from UNESCO.

2) Expand BRIN further—make it a publisher and index for all publicly funded scientific research. BRIN's online platform will centralize and open research data and results to the public sphere of academics, policy advisers and citizen scientists, synergizing different scientific sectors, establishing a clear "cutting-edge" for Indonesian scientific research, and making Indonesia a more attractive location for the international scientific community. This would place Indonesia as the leader of the Asia-Pacific in science and technology. Mexico's Repositorio Nacional is a model for a centralized, online national repository and index. At the same time, the European Union's Open Research Europe platform is a model for a centralized, regional publishing and indexing system, which adheres to the tenets of Open Science.

3) Use the 2023 ASEAN Presidency to lead the Asia-Pacific region into science and technology cooperation. In coherence and congruence with the above policy mandates, Indonesia must rhetorically assert itself as a science and technology leader and then invite ASEAN to manifest that position through international science cooperation networks. The first steps to this show of leadership are to announce science and access to the internet as a human right and to establish key private-public partnerships to ensure a robust and ubiquitous digital infrastructure across Indonesia and Southeast Asia.