OSI POLICY PERSPECTIVES

CONSIDERING EVIDENCE-BASED OPEN ACCESS POLICIES

OSI POLICY PERSPECTIVE 6
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ABOUT OSI POLICY PERSPECTIVES

The OSI Policy Perspectives series offers broad, common ground perspectives on key issues in scholarly communication. Each report summarizes the current state of a particular issue and what we know about it, and also attempts to articulate the perspectives and lessons of experience from all stakeholder groups in scholarly communication on this issue (particularly but not exclusively as expressed in OSI conversations) and identify what common ground might exist for building broadly acceptable policy.

OSI is not a democratic body that speaks with one voice on any particular issue. Trying to reconcile the views, intentions, and motivations of all the different actors, communities and groups in the scholarly communication space—which are very rarely entirely aligned—is challenging. We acknowledge, therefore, that these reports may be (and in fact, probably are) an imperfect reflection of the many perspectives and ideas in this group. The fact that these reports sometimes need to be published in a rush, in response to policy commenting deadlines and other pressures only makes this imperfection more likely.

We also acknowledge, however, that OSI often considers a wider range of perspectives than established policymaking bodies in scholarly communication, and that our relative strength is showcasing this range of perspectives and noting how they differ, and importantly, how they share common ground. To this end, we hope it is valuable to produce these reports, however imperfect, and share them with the scholarly communication community and beyond.

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AUTHOR CONFLICT STATEMENT: The lead author of this report, Glenn Hampson, is the Executive Director of the Science Communication Institute and program director and principal investigator for OSI, which receives funding from foundations, UNESCO, commercial publishers, and individual participants by way of conference fees. Funders, however, have no privileged input into OSI policy deliberations apart from being equal members of the OSI community. OSI has many voices contributing to documents such as this, and endeavors to maintain an inclusive and balanced perspective on scholarly communication issues. Jason Steinhauer is a Global Fellow at The Wilson Center, Senior Fellow at the Foreign Policy Research Institute, bestselling author, and Executive Director of the History Communication Institute.

DISCLAIMER: In this report, the authors have attempted to accurately represent the perspective and ideas of the broad open solutions community, and in particular UNESCO and OSI participants, alumni and observers. However, it is possible that this attempt is incomplete and/or inaccurate. Any responsibility for errors, omissions and/or misrepresentations rests solely with the lead author. Also, the findings and recommendations expressed herein also do not necessarily reflect the opinions of all co-authors, contributors, individual OSI participants, alumni, or observers, or any of the institutions, trustees, officers, or staff affiliated with these individuals.

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CONSIDERING EVIDENCE-BASED
OPEN ACCESS POLICIES

ACRONYMS & DEFINITIONS

AAAS: American Association for the Advancement of Science

Arcadia: UK-based nonprofit charity

APC: Article Publishing Charge

arXiv: Preprint repository used primary by physics and astronomy

BOAI: Budapest Open Access Initiative

CC-BY: A Creative Commons content license that "allows re-users to distribute, remix, adapt, and build upon the material in any medium or format, so long as attribution is given to the creator"

CC-BY-NC-ND: A Creative Commons license that specifies the same use and reuse terms as the CC-BY license, but does not allow modified content to be distributed without permission, and also prohibits commercial reuse

CERN: The European Organization for Nuclear Research

CODATA: Committee on Data of the International Science Council

CONSORT: Consolidated Standards of Reporting Trials

DARTS: A description of the open spectrum invented by OSI participants, wherein the five attributes of an information artifact's openness are its discoverability, accessibility, reusability, transparency, and sustainability

DataSpace: The leading data sharing and discovery tool for HIV vaccine research, run by the Fred Hutchinson Cancer Research Center

DataSphere: A not-for-profit international data repository network

DORA: Declaration on Research Assessment

FAIR: Findable, Accessible, Interoperable, Reusable

Gates: The Bill & Melinda Gates Foundation

GenBank: An open access, annotated collection of all publicly available nucleotide sequences and their protein translations, produced and maintained by the US NCBI (National Center for Biotechnology Information)

HINARI: Health Internetwork Access to Research Initiative

Leiden Manifesto: suggests ten principles for the appropriate use of metrics in research evaluation

Lindau Guidelines: A proclamation for an open, cooperative science community where data and knowledge are freely shared

Mellon: The Andrew W. Mellon Foundation

National Academies (also NAS and NASEM): The US National Academies for Sciences, Engineering, and Medicine

Nelson Memo: The August 2022 OSTP memo authored by OSTP acting director Alondra Nelson

NIH: The US National Institutes of Health

NSF: The US National Science Foundation

OA: Open access

OASPA: Open Access Scholarly Publishers Association

OER: Open Educational Resources

Open access: Very widely defined. The base attribute is an information artifact which is free to read. Additional attributes (depending on the definition) can include free to reuse with permission, immediately accessible upon publication, and more.

ORFG: The Open Research Funders Group

OSF: Open Science Framework

OSI: Open Scholarship Initiative

OSTP: US White House Office of Science and Technology Policy

Plan A: OSI's 2020 policy proposal for what a new global open access policy might look like

Plan S: The EU-based plan creating a one-size-fits-all solution for global scholarly publishing. Although nominally intended to apply to EU-based researchers, the plan has become the de facto global standard since publishers have modified their business plans and offerings to align with the plan.

PLOS: A leading nonprofit publisher of open articles in science, technology, and medicine and other scientific literature

PubMedCentral: The central information repository for published research used by the US government

Research4Life: A global nonprofit initiative that provides institutions in low-and middle-income countries with online access to academic and professional peer-reviewed content

RDA: Research Data Alliance

Sage Bionetworks: A nonprofit data sharing network that supports research collaborations by overseeing data coordination, visualization, and analytics across distributed teams.

SciELO: South America's leading cooperative electronic publishing network for open access journals, and a global pioneer in open access development

SDSS: The Sloan Digital Sky Survey

SPARC: Scholarly Publishing and Academic Resource Coalition

UNESCO: United Nations Educational, Scientific and Cultural Organisation

Vivli: A leading global platform for sharing clinical trials data

CONSIDERING EVIDENCE-BASED OPEN ACCESS POLICIES

According to the world's most influential open access policies, only certain types of information outputs are genuinely open. In practice, however, there are actually many types of open access outcomes and solutions. A more flexible, evidence-based approach to creating open access policy will better meet researchers' requirements and also reduce the unintended consequences of our current policies.

EXECUTIVE SUMMARY

The most influential open access policies in the world today are founded on the belief from the early 2000s that only specific types of information outputs are truly open. In this ideology, all other types of outputs (such as free to read but still copyrighted) are unacceptable, particularly for academic journals.

After seven years of global, multi-stakeholder engagement and research—during which our understanding of the global information landscape has evolved a thousand-fold from the early 2000s—the Open Scholarship Initiative (OSI), in collaboration with the United Nations Educational, Scientific, and Cultural Organization (UNESCO), has reached the opposite conclusion: that openness has many definitions and outcomes, and that many different open solutions are working well in modern research communication. In fact, some of today's most robust and promising open solutions would not even be considered open by the ideology of the early 2000s.

As policymakers around the globe move forward with the challenge of making research more accessible, it is crucial that these efforts be based on solid, democratic, fact-based foundations. Particularly, policymakers should pay close attention to what researchers need, what information sharing solutions are already working in the research world (including solutions that do not fit common definitions of open), and the negative unintended consequences of our current open policies.

ABOUT OSI

The Open Scholarship Initiative (OSI) is a diverse, inclusive, global network of high-level experts and stakeholder representatives working together in partnership with UNESCO to develop broadly accepted, comprehensive, sustainable solutions to the future of open scholarship that work for everyone everywhere. This document reflects the input of the individuals listed here as well as contributions from other OSI participants who are not listed. The findings and recommendations expressed do not necessarily reflect the opinions of these individuals, OSI participants, OSI participant institutions, or the agencies, trustees, officers, or staff of these institutions.

OSI is managed by the Science Communication Institute (SCI), a US-based 501c3 nonprofit charity. OSI serves as part of the Network for Open Access to Scientific Information and Research (NOASIR) for the United Nations Educational, Scientific and Cultural Organization (UNESCO). For more information about OSI, please visit osiglobal.org.

UNESCO has long argued that equity should be a pillar of this next-generation open policy framework. OSI has proposed that doing something with open should be a second pillar, treating open as a tool to help research succeed rather than as an end in itself. OSI's 2022 research communication surveys indicate that the majority of researchers agree with this perspective and methodology.

Reconsidering our open policies does not necessarily mean abandoning Plan S, the Nelson Memo, the UNESCO open science policy, or major transformative agreements. In any case, these policies are all evolving gradually in response to feedback and market pressures. Rather, it suggests that in the future, we should also develop broad, inclusive, flexible, evidence-based policies as part of a tapestry of open options and approaches. Doing so will benefit researchers and societies worldwide, improve global equity in research and research communication, allow the world capitalize on the full potential of open research, and help prevent research from fracturing along regional and ideological lines.

INTRODUCTION

The Open Scholarship Initiative (OSI) is an international group of leaders and experts in scholarly communication. Approximately 450 individuals have participated in group discussions since 2015, representing over 250 research institutions from 32 countries and 18 stakeholder groups. UNESCO, non-profit foundations such as Sloan, commercial publishers and publishing industry groups, scholarly societies, universities, scholarly communication experts, and participants themselves (by way of conference fees) have supported OSI's work.[1]

OSI has served as an open policy observatory, facilitating direct communication between high-level leaders in scholarly communication, and synthesizing policy recommendations for UNESCO's consideration based on our group's extensive knowledge. Our policy recommendations have always been more a collection of perspectives than a consensus opinion, given that we represent so many diverse global regions and differing points of view. For example, when we issued a generally negative critique of Plan S in 2019 due to how it would widen the gap between high and low income countries by replacing paywalls with "playwalls" (i.e., by eliminating subscription access to published research and replacing it with a system where researchers are charged for publishing their findings), roughly a third of OSI participants still supported Plan S with minor or major modifications, while another third did not (Hampson 2019).

On social media…[this community's] differences of opinion frequently manifest as a battle between good and evil, between those who support rapid reform for the greater good and those who support a status quo characterized by entrenched dysfunction and profiteering. In reality, though, we are all working toward the same goal: A future where we can do more with research because more research is open and accessible.

These honest differences of opinion exist not only within OSI but within the broader scholarly communication community as well, where some are cheering the current state of open access policies like Plan S, others are urging a more thoughtful and restrained approach, and still others are resigned to the fact that rapid change is happening and are just trying their best to adapt. On social media, these differences of opinion frequently manifest as a battle between good and evil, between those who support rapid reform for the greater good and those who support a status quo characterized by entrenched dysfunction and profiteering.

1. OSI has received funding from and worked directly with UNESCO as part of the agency's Network for Open Access to Scientific Information and Research (NOASIR). OSI is a unique voice in this group, focused solely on delivering evidence-based assessments of open solutions, rather than advocating for particular open ideologies or outcomes.

In reality, though, we are all working toward the same goal: A future where we can do more with research because more research is open and accessible. There are some who want to act now, and others who are committed to finding solutions that truly work for researchers everywhere, not just in the United States and the European Union. Our commitment to working for more inclusiveness and equity is what best defines OSI's work. Generally speaking, this challenge has appealed to scholarly communication analysts (many of the world's leading scholarly communication experts have contributed to OSI's work) but has frustrated those on the far right and far left. Open access (OA) critics have not engaged much with OSI over the years, fearing reputational damage to their careers and institutions by speaking negatively about OA reform ideas and policies, while those who are morally outraged by publisher profits have not engaged much with OSI because OA reforms are, in their mind, a social justice issue with a clear cause and clear solution. For these OA supporters, debate equals appeasement.

We believe the observations and recommendations in this report have withstood scrutiny and can serve as the foundation for a new generation of open research policies that are more effective and sustainable... [Many of our current policies], particularly those of global significance, are not based on evidence and vetted through democratic policymaking processes, as we would expect for sound public policy. A weak foundation is only part of the problem; failing to understand the needs and perspectives of researchers is also a major flaw.

To-date, OSI's authors have published six policy perspectives (including this one) that detail the group's findings and recommendations. Our first policy perspective, published in March 2019, analyzed the pros and cons of Plan S and suggested that the organizers (cOAlition S) modify their plan to prevent the kinds of unintended consequences we're currently witnessing with regard to growing inequity between researchers with large publishing budgets and those without. The second policy report from OSI, which was published in April 2020, examined the common ground for policymaking in this space. OSI argued, based on our internal discussions, conference proceedings, and original research, that there are numerous areas of common ground in this community, and that working together on these areas was the most rational approach to policymaking. OSI's third report, published in June 2020, served as an introduction to OSI's participation in UNESCO's open science policy initiative. In this document, OSI provided UNESCO with extensive research on how open science is variously defined and what global open science policies should look like (OSI later participated in UNESCO's regional consultative meetings and served as an official observer during the final passage of this policy). The fourth policy perspective from OSI, published in February 2021, investigated the technical and policy overlap between all open solutions, including open access, open data, open code, open government, open educational resources, open science, and open methods. This original research led us to the conclusion that the most effective framework for inclusive open solutions policies will be built on a foundation of achieving common goals, such as working together to cure cancer by creating open policies and resources that enable more information of all types to flow between cancer researchers, as opposed to thinking of open as a way to collect information in text, data, or code format. OSI's fifth report, published concurrently with this report, summarizes the results of its 2022 researcher surveys.

This sixth OSI policy perspective is, in a sense, the culmination of our five previous OSI reports, bringing together their observations and recommendations. In this document, we will reiterate that APCs are harmful and that ideologically-based policies limit the potential of open (OSI Policy Perspective 1); that common ground is abundant and should be our primary policy focus (Policy Perspective 2); that open science policies are an obvious vector for change, but these policies must be grounded in

evidence and make sense to researchers (Policy Perspective 3); and that developing broad, flexible, long-term, goal-oriented strategies is essential (Policy Perspectives 4 and 5). In building our case, we will also summarize the key recommendations of OSI participants since 2015 and note how the results of our global surveys of researchers in 2022 support these recommendations.

We believe the observations and recommendations in this report have withstood scrutiny and can serve as the foundation for a new generation of open research policies that are more effective and sustainable than current policies. This claim may appear overly confident. After all, current open access policymaking efforts are continuing unabated, and countries have an abundance of existing policies to choose from without considering new policy frameworks from OSI. As we will discuss in the introduction of this report, however, many of these policies, particularly those of global significance, are not based on evidence or vetted through democratic policymaking processes, as we would expect for sound public policy. A weak foundation is only part of the problem; failing to understand the needs and perspectives of researchers is also a major flaw.

The recommendations in this report describe a range of global open access policies that can be used as templates by researchers, institutions and countries around the world. If you have any questions or would like to provide feedback on this report, please email OSI program director Glenn Hampson at ghampson@nationalscience.org by August 31, 2023.

HOW WE GOT HERE

Walt Whitman, the American bard of democracy, noted 150 years ago that democracy isn't just about voting. It's also about respecting different points of view in all walks of life.

"Did you, too, O friend, suppose Democracy was only for elections, for politics, and for a party name? I say Democracy is only of use there that it may pass on and come to its flower and fruit in manners, in the highest forms of interaction between men and their beliefs – in Religion, Literature, Colleges and Schools – Democracy in all public and private life." (Walt Whitman, in Democratic Vistas, 1871)

Representative democracy was a nascent and revolutionary form of government in Whitman's time. Today, about two-thirds of the world's countries are democratic. In most of these countries, when it comes to making public policy, democratic principles are the ideal: Experts convene to study an issue, they invite broad and representative public comment to inform their deliberations, and they draft thoughtful recommendations for policymakers and elected politicians to consider. Some policies get codified into law; other policies are amended or disappear entirely over time.

The reality, of course, is that policymakers aren't robots. Rather, they are individuals who enter the arena of public policy with their own opinions, biases, and motivations. In addition, policymakers are not independent of political leaders. Even though one of the most important characteristics of the modern administrative state is that public servants strive to be impartial and objective, politicians sometimes task administrators with "color by number" policymaking rather than building policy from the ground up, using supplied "facts," or implementing predetermined partisan solutions. Even when expert policymaking processes are adhered to, political judgment frequently trumps expert recommendations, and interest groups focus more on demonizing opposing viewpoints and misrepresenting facts than on finding common ground and workable solutions.

In the US, this is the history of much high-profile public policymaking, from manifest destiny to slavery, women's suffrage, civil rights, and immigration. In the area of science, public policy smear and disinformation campaigns have taken place over issues like DDT, tobacco, acid rain, the earth's ozone layer,

clean air and water, climate change, and COVID vaccines (Oreskes 2011). Anti-democratic dynamics in policymaking tax our time and patience, harden our positions, deepen our distrust in facts and government, and delay solutions to important problems. They can even lead us to adopting the wrong policies altogether.

...some people view the open access regulations we have created today as a significant accomplishment, while others see them as a complete failure. Is there a path forward toward open access policymaking that is more democratic?

What does any of this have to do with open access? Open access is a term that has gained much attention in research communication circles over the last twenty years. Generally speaking, it means making information easier to find and share, including but not limited to research information. Countries around the world have focused on open solutions reforms (including but not limited to open access, open data, open educational resources, and more; see Hampson 2021) as being essential to the future of research. The reason for this is not entirely clear, although effective advocacy and constant publicity about publisher profit margins has elevated open access into a sort of cause celebre, with OA advocates being heroic Robin Hoods stealing from the rich and giving to the poor. Our passions appear to have inflamed OA reform ideas into being proxies for reforming the future of research. There is no actual international effort for this kind of work, of course (see Box 1), so open access policies, and to a lesser degree open science and open data policies, have become global research reform policies writ large, soaking up policymakers' attention and creating changes that affect a broad swath of research and research communication practices well beyond just making information more open. In this open solutions race, open access policymakers have so far created the most policies with the most wide-ranging impacts on research.

Unfortunately, the evidence our policymakers have been relying on is inadequate, and the seriousness of our deliberations has not been commensurate with the significance of the policies in question. Our debates have instead been swirling in an anti-democratic eddy for decades, during which time we have not carefully listened to all parties involved—despite what in many cases are genuine efforts to listen and learn—and have instead allowed the policymaking process to be guided more by the opinions of interest groups and biases of policymakers than by objective facts and evidence. This pattern is, maybe unsurprisingly, consistent with the policymaking biases we have seen for many other high-profile science-related issues over the years. As a result, some people view the open access regulations we have created today as a significant and noble accomplishment while others see them as a complete failure unworthy of science. Is there a path toward open access policymaking that is more democratic and evidence-based? And if so, is it even possible to backtrack and think about new policy frameworks?

AGREEING ON DEFINITIONS

A first step might be to agree what open access even means. As mentioned above, this term generally means making information easier to find and share. At its core, this means free to read. But the exact definition involves lots of caveats, depending on who is doing the defining. Some say information is only open access if it is free to read plus licensed in a way that permits unlimited reuse with attribution (a CC-BY license). Others say free plus CC-BY is not sufficient, and that additional conditions are also necessary, like zero embargo (no delay between publishing and accessibility). Still others pile on even more conditions like metadata, repository requirements, and data sharing. The same caveats are true for open data, open code, open educational resources, and more, where different kinds of information have different kinds of open definitions, conventions, options and outcomes.

In this report, we will use the terms open and open access interchangeably (along with the term open solutions, which is a blanket term describing all open approaches). This overlap is intentional. The world outside the confines of scholarly communication experts has conflated these terms and used

BOX 1: GLOBAL PUBLIC POLICY DEVELOPMENT IN RESEARCH COMMUNICATION

In democratic socieites, our ideal is for policymaking bodies to operate within their own spheres of influence and expertise. We neither want nor expect our local health department to design electrical codes, or the US to design immigration laws for France. We also expect strong communication in the policymaking process between those who design policies and those who will be affected. If there is too much disconnect between policy makers and the governed, we end up with unreasonable, unjust, ineffective, and unsustainable laws. Ultimately, of course, public policy is going to be influenced by external factors like bias and politics. But to the extent possible, democratic societies always aspire to the ideal that policymaking is driven by expertise and evidence, and works for the greater good; it should not be ideological driven, or inflict harm on society (although, of course, much of it has throughout history).

When it comes to developing research communication policy, who is the expert? No one really. There are enormous scholarly societies like the American Association for the Advancement of Science and American Geophysical Union who have participated in high level conversations on research communication topics for decades. Similarly, research institutions like the Howard Hughes Medical Institute, the Los Alamos National Laboratory, Max Planck Institute and Cold Spring Harbor Laboratory all have decades of experience thinking and publishing insights about these issues. Government agencies around the world have also been deeply engaged, from the US National Institutes of Health, National Science Foundation, and National Academies of Science, Engineering and Medicine, to China's Association for Science and Technology, Brazil's São Paulo Research Foundation, India's Ministry of Science and Technology, UK Research & Innovation, Horizon Europe, the Autralian Research Council, and many more. All have hosted and participated in conferences about issues in research communication for years. Publishers have also participated and helped fund these conversations, along with universities, llibraries, philanthropies, and interest groups. The collective expertise of these groups regarding research communication policy is deep, but it is also disbursed throughout the world.

When it comes to creating global research policy, then, which single agency has the standing and expertise to do so? Here again, the answer is no one. There is no single voice that speaks for all research everywhere. The needs, perspectives, priorities, practices, and unique knowledge are far too widely disbursed. Added to this, creating a single policy for all research everywhere is akin to developing a single policy for all sports—saying that henceforth, all athletic contests shall involve a ball weighing 450 grams on a field measuring 50 by 100 meters. This kind of policy might be okay for soccer, but the impact on basketball would be interesting and the impact on swimming would be nonsensical. Even if we do hear from all voices and then attempt to create a single policy that averages out everyone's ideas and concerns, the resulting policy still wouldn't necessarily make sense in this case.

At the international level, certain agencies have been given the authority by the international community to develop global policies covering a range of issues, from human rights (UN OHCHR) to international monetary policy (IMF), economic development (IBRD), copyright (WIPO), health (WHO) and climate change (IPCC). UNESCO is the only international agency vested with the authority to develop science policy. Although it doesn't have a team of dedicated science policy experts on staff, or a large team of scientists (which arguably makes it an unusual candidate for this job*) UNESCO does have a mandate to be "a laboratory of ideas," and attempt to offer "a broad range of expertise in the fields of Education, the Sciences and Culture" (see unesco.org). In service to its mission, UNESCO does amazing work, attempting to assemble international teams of individuals and organizations to research and consult on various policies.

It was with such commitment and vigor that UNESCO attempted in 2019 and 2020 to hear from the entire global research communication community and then craft a policy that fairly and accurately reflected the needs and perspectives of researchers from around the globe with regard to open science reforms. Some have hailed this effort as an historic success; others (including OSI) have noted that the final policy misses the broader point that one-size-fits-all approaches can't work in research. In terms of effort, however, UNESCO's final product—the UNESCO Recommendation on Open Science (see UNESCO 2021)—stands far above Plan S and the Nelson Memo in terms of commitment to our democratic public policy ideals, since both of these major policies involved no consultations of note with researchers or research communication groups. What's doubly unfortunate is that even though both of these policies were ostensibly designed to only affect a subset of researchers within the borders of the EU and US, their impact is becoming global (Plan S, having a three-year head start on the Nelson Memo, is having the most impact at the moment). Plan S in particular, with its focus on the expensive APC method of paying for research publishing, is exacerbating existing global inequities in research due to a mismatch between the needs and resources of EU researchers and the needs and resources of the Global South (e.g., see Mwangi 2021 for a discussion of resource constraints in Kenya).

Is there another way to reform global research communication policy? More inclusive, evidence based policies would be a good start, particularly to the degree that researchers themselves can be more involved in policy discussions and development. See the policy options discussion section later in this report for more detail.

*Contrast this with the World Bank (IBRD), for example, which is tasked with global economic investment and development but is staffed by thousands of economists and development specialists from 189 countries around the world and has field offices in 130 locations to keep close to projects and devel-opment issues. Similarly, WIPO has hundreds of patent attorneys, WHO's team of 8000 professionals includes many of the world's leading public health experts, including doctors, epidemiologists, scientists and managers, and the IPCC consists of the world's top climate experts and support staff.

them interchangeably, so much so that trying to make a distinction between them is now more confusing than helpful. At least in the policymaking world, OA and open now mean the same thing.

UNDERSTANDING HISTORY

...it's clear that [different philosophies about the nature of open]...have historical roots. Over time, these roots sprouted different branches of open, each with their own definitions, perspectives, tools, and goals...for different audiences.

Over the past 20 years, many valiant open access scholars have tried to organize the different ways in which "openness" is described.[2] Their efforts have ventured beyond just defining open, and have instead focused on trying to understand why we speak with so many different languages when it comes to our open goals and methods. These scholars have invented a multitude of plausible explanations, all correct to some degree, including noting that many different philosophical motivational, epistemological and economic motivations exist for open. But how did all these differences arise in the first place? The economic explanation may be correct one to adopt (Mirowski 2018), but there's also a simpler explanation. As it turns out, the concept and practice of openness has been evolving along at least half-dozen distinct historical paths over a very long time, in some cases for centuries already. Over the years, these histories have led to the formation of entirely different branches of open, each with its own completely and legitimately different ideas about what open research looks like and how it should grow in the future.

The first historical branch of openness comes from within research itself. The need to share ideas and discoveries has always been a bedrock principle of scientific investigation (Poskett 2022). Over time, researchers have been adept at inventing the solutions they need (and that work) to communicate more openly and effectively with each other, including forming new scientific societies; attending conferences; creating new journals; creating a multitude of data catalogues and indexes; creating new standards; creating binding guidelines on the social and ethical need to share research data (see Box 2, for example); and creating highly successful data sharing and research collaboration partnerships and networks, particularly in the life sciences, high energy physics, astronomy, and genetics.

A closely-related second branch of OA evolution centers around publishing practices. Research and the dissemination of research findings have always been closely tied.[3] Widespread use of the printing press started around the late 1500s and was a transformative event in human history that fundamentally changed our expectations for how knowledge could and should be shared (see Johns 1998), particularly for the practice of systematized research, which was just beginning to take root. By the mid-1800s, publications established explicitly to share ideas and discoveries were proliferating—over 1300 journals now existed. It was crucial for scientists to be aware of what knowledge already existed in their field, but even then, doing so was becoming increasingly difficult. This need for more openness and increased awareness gradually led to standards and systems for what constituted clear and rapid sharing of knowledge, claims to discovery, proper citation methods and more (Csiszar 2018). These standards and systems have continued to evolve today in response to the ever increasing growth of research, in response to the ever changing needs of researchers, libraries, funders and governments, and in response to the huge market opportunities available for creating the best new systems.

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2. Notable thinkers include Benedikt Fecher and Sascha Friesike (Fecher 2013), Jeroen Bosman and Bianca Kramer (Bosman & Kramer 2017), Samuel Moore (Moore 2017), Philip Mirowski (Mirowski 2018), Jon Tennant (Tennant 2019), and Rebecca Willen (Willen 2020). See OSI Policy Perspective 3 (Hampson 2020) for a more detailed overview of the philosophical underpinnings of open science.

3. Vint Cerf (co-inventor of the Internet) and Keith Yamamoto (UC San Fransisco Vice Chancellor for Science and Policy) both highlighted this point in their opening and closing remarks to OSI's 2017 conference (see OSI 2017). For Cerf, increasing the reproducibility of published research is of paramount importance for the future of research, which requires increasing access, which in turn requires a much more serious focus on digital preservation—from hardware and operating systems to software and formats. Without this preservation and access, there can be no modern scientific record. For Yamamoto, the act of publishing cannot be separated from research. "If you don't publish your experiment, it is exactly like not doing it."

BOX 2: A VERY ABBREVIATED HISTORY OF HOW WE SHARE HEALTH AND MEDICAL RESEARCH

Organized information sharing in health and medicine has existed in every society around the world and every epoch of history long before open access policies, computers or the Internet. Public health efforts have been a major driver of this need, typically focusing on priorities like malnutrition, infection, and sanitation. This vital knowldge was documented, taught, preserved, shared and improved upon across regions and genarations (see Tulchinsky 2014 for a brief but rich overview). Over time, as the world became more connected through travel and trade, formal international health collaboration resources and organizations began to emerge. In 1892, for example, the International Sanitary Convention was formed to help control cholera. Following World War II, the newly-established United Nations created the World Health Organization, which began sharing information on malaria, tuberculosis, venereal diseases, maternal and child health, sanitary engineering, and nutrition (McCarthy 2002). By the 1960s and into modern times, information sharing across health and medicine was commonplace, highly valued and strongly encouraged (Fienberg 1985). This is a comically short recap of history; our point here is only to highlight, in this box, that information sharing in these fields is nothing new.

The rules and conventions governing how health and medical information is shared, as well as the conduct of medical research itself, largely evolved in an ethical vacuum until the mid-20th Century (there were codes like the Hipocratic Oath, but these were often incomplete or horribly biased). The first major modern rule on research ethics was the 1949 Nuremburg Code, written to ensure that Nazi crimes committed during the Holocaust would not occur again within the medical profession. The Nuremberg Code established that the informed and voluntary consent of research subjects was essential to any research trial; that proposed research must benefit society; that any proposed research study must safeguard the well-being of its subjects; and that the risks of any study must be calculated and justified. Most importantly, the Nuremberg Code imbued medical research with a responsibility to human dignity and human rights. This responsibility was expanded fifteen years later in the 1964 Declaration of Helsinki, issued by the World Medical Association, which not only reaffirmed the Nuremburg Code's ideals, but also established that underrepresented peoples should be given access to studies and study results. Fifteen years after Helsinki, the Belmont Report of 1979 (issued by the US National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research) introduced the importance of using justice and fairness as guiding principles in medical ethics. The report also espoused that when research is supported by public funds, those who take the risk (i.e., the tax-paying public) must experience the advantages, not just those who can afford to access the data.

Many detailed polices governing how and why to share medical research have since been constructed on these ethical frameworks. In 1982, 1993, and 2002 the Council for International Organizations of Medical Sciences (CIOMS) issued a series of guidelines for clinical trials research, followed by similar guidelines from several other organizations during the 1990s and early 2000s (such as CONSORT for clinical trials data). Numerous medical privacy laws have also emerged, along with sophisticated policies and safeguards at the clinic and hospital level. Over the past 20 years in particular, governments and life sciences funders around the world have increasingly merged these old and new information sharing requirements—pushed for the most part by increasingly complex array of funding and regulatory requirements, and recalling that information sharing has always been done (it's mostly just the tools that are new)—with the ethical guidelines and imperatives for sharing data envisioned by Helsinki and Belmont. These resulting new guidelines are robust and expansive, establishing that researchers have a responsibility to protect not only patients and society, but research itself. Modern guidelines include strict compliance with complex clinical research protocols (often hundreds of pages long), clear transparency, proven lack of conflict, proven benefit, demonstrated replicability, advanced scientific and statistical rigor, robust data sharing plans, and more—every attribute of high quality and socially responsible research. Layers of regulatory review and approval by government and/or funding agencies are involved, plus alignment with patient privacy protection laws like HIPPA and GDPR, and oversight by and accountability to institutional review boards, scientific advisory boards, data safety monitoring boards, community advisory boards, and more. And in this midst, a seeming infinte array of research collaboration programs and data sharing networks have evolved, all successfully abiding by their own sharing rules and requirements that supplement this new ethical sharing framework.

Until very recently, none of this history has had anything whatsoever to do with open access, open data or open science. Rather, history has simply unfolded organically over time with input from researchers in order to meet the ethical obligations of research and ensure that research is done right.

A philosophical offshoot of this second branch, technically distinct enough to be considered a third branch, is the growth of computer technology and the Internet starting around the mid-1980s. Once again, as with the advent of printing, these developments fundamentally changed our expectations about access to information, and paved the way for more open developments in research and society, such as the launch of GenBank in 1992 by the US Los Alamos National Laboratory, the world's first public access repository of nucleotide sequences; creation of the world's first preprint server, arXiv, in 1991 (originally for physics and astronomy research); publishing of the world's first OA journals

(through SciELO in 1997); formation of the Open Source Initiative in 1998 to help govern computer code; the world's first OA megajournal (PLOS in 2000); and development of the first open educational resources (by the Hewlett Foundation in 2001). Today, it's impossible to underestimate the influence that technology and the Internet have had on all things communication, from rapid download speeds to social media to the proliferation of publishing platforms. These developments continue to raise our expectations and increase the potential for what communication can become, not just in research but across society.

Over time, the slow and steady march of the scientific method—valuing evidence, openness, transparency, accountability, and replicability—and its success at unlocking true knowledge has influenced everything from philosophy to politics, law and industry, which in turn has created more "norming" of this approach, particularly in the West.

The fourth distinct branch in the evolution of open knowledge has centered around social development. Over time, the slow and steady march of the scientific method—valuing evidence, openness, transparency, accountability, and replicability—and its success at unlocking true knowledge has influenced everything from philosophy to politics, law and industry, which in turn has created more "norming" of this approach, particularly in the West.[4] For example, not long after the start of the Scientific Revolution in Europe, when natural philosophers such as Copernicus and Galileo successfully challenged prevailing explanations for how the world worked (as defined by Aristotle and the Catholic Church), social philosophers such as Locke, Hobbes and Rousseau (among others) were inspired to start questioning the world's social order. This work led directly to revolutionary new political concepts, including France's Declaration of the Rights of Man, and the US Constitution (both passed in 1789), which employed the Scientific Revolution's spark that even man and society were tied to the natural world through natural rights.

In parallel with this growing appreciation of and our need for the scientific method, science and technology became driving forces of global development in the 1800s, with breakthroughs in physics, medicine and biology igniting massive change throughout the world. The public's thirst for knowledge and enthusiasm for learning more about the natural world became a global phenomenon that continued into the first decades of the 1900s. By the aftermath of World War II, Karl Popper's "Open Society and It's Enemies" made the case that the open knowledge ethos of science needed to spread beyond science and into the fabric of societies—that it was important now more than ever to construct societies where truth is widespread and easily accessible, lest we backslide again into a world ruled by totalitarianism and fascism.

Popper's work is generally acknowledged as the formal intellectual beginning of the open society movement. Today, many open advocacy groups travel along an offshoot of this branch, characterizing the need for open science as a social justice issue. The massive technological influence of the Internet has both influenced and enabled this ongoing work and development, raising our expectations for what technology can do for open knowledge and open society, and enabling this change, which in turn has lead to higher expectations and even more change.

A fifth historical branch of open has been accountability. Before the mid-1950s, accountability in research was largely internal, focused on ensuring that research was accurate, and that systems for reporting and writing about research were broadly accepted. In the post-WWII era, as government spending on research increased dramatically, the need for greater public accountability in research also developed, both financially and in terms of public access to what we were spending money on and why. Systems of accountability have now evolved to sophisticated heights, from grant evaluation pro-

4. Several excellent books on the history of science communication touch on this theme, including David Wootton's "The Invention of Science" (Wootton 2019), Adrian Johns' "The Nature of the Book" (Johns 1998) and James Poskett's "Horizons" (Poskett 2022).

cedures to modern research impact evaluation procedures and freedom of information laws, all from different government agencies and with different objectives. For example, the world's first nationwide open access policy for scientific research was implemented by the US National Institutes of Health in 2008 (Suber 2008). What we now recognize as peer review was born out of US Congressional oversight into research in the mid-1970s (Baldwin 2018). And many countries now have their own research impact evaluation systems, perhaps none more carefully designed than the UK's Research Evaluation Framework (REF 2021).

The goals [of BOAI] were simple: by making information free and easier to access and reuse, we could democratize research, dramatically lower publishing costs (by untethering publishing from publishers), and better serve the public good.

A SIXTH BRANCH EMERGES

Amidst this centuries-long evolution of open thought and practices, participants at a 2002 conference in Budapest (the Budapest Open Access Initiative, or BOAI) advanced the idea that open access meant only one thing: that in addition to being free, research also needed to be licensed in a way that optimized the potential for its unrestricted reuse, free of its typical copyright restrictions. The goals were simple: by making information free and easier to access and reuse, we could democratize research, lower publishing costs (by untethering publishing from publishers), and better serve the public good.

The language used in the BOAI declaration was lofty and Panglossian, reflecting the vision of the Internet circa 2002 that we were on the cusp of a world where information would soon flow freely across borders with little cost and enormous benefit for all mankind. Adding fuel to this declaration, several of the BOAI signatories would in the coming decade become the most prolific, eloquent and vocal opponents of high profits in commercial science publishing, including Steve Harnad, Leslie Chan, Jean Claude Guedon, Peter Suber, Michael Eisen, two representatives from the Open Society Institute, and one representative from SPARC (the Scholarly Publishing and Academic Resources Coalition; SPARC in particular would lead the anti-publisher march over the next 10-15 years).

Subsequent modifications to BOAI made at conferences in Berlin and Bethesda stipulated that research also needed to be made immediately available, with no delay allowed between publishing and free access to the public.

THE SIXTH BRANCH BECOMES ALL WE NOTICE

Over the next decade, promoted by the effective voices who helped craft this statement, supported by the money and organizing acumen of SPARC and the Open Society Institute,[5] and made timely by the spiraling cost of journals for academic libraries where, prophetically, commercial publishers played the role of the boogeyman to perfection,[6] the BOAI approach to open access became the bedrock philosophical foundation for most subsequent open access policies, and it continues to be so even today. All other historical branches of open access have been ignored.

This isn't to say that BOAI's policy recommendations were wrong. To many believers, they were exactly on target. Rather, the most vocal post-BOAI open advocates tended to portray open access as

5. At the time, SPARC was part of the American Library Association. It became a separately funded lobbying group in 2016.
6. The number of scientific journal articles published doubles roughly every 17 years (Bornmann 2021) due to a steady increase in research spending, the emergence of new research disciplines, a splintering of existing disciplines into new specializations, and other factors (see Annex). Trying to stay abreast of these changes, publishers note that their cost per article published has dropped over this doubling period, but the total costs of subscribing to all available content has still been too high for university libraries to bear. Richard Poynder's 2019 essay, "Open access: Could defeat be snatched from the jaws of victory?" gives one of the most detailed accounts of this history (Poynder 2019). For an insider's account of the politics at play, read "Public access policy in the United States" by T Scott Plutchak, Fred Dylla, Crispin Taylor and John Vaughn (Plutchak 2022).

a contest between good and evil. Policy debates became urgent, polarized and confrontational—even personal. The policy space became a battlefield where there was no middle ground, and no willingness to understand issues from all sides, ignoring the different histories involved and the differing needs and points of view centuries in the making. Ideology was not only trumping the expert-driven democratic policymaking ideal, it was beating it into the ground with a hammer of righteous might (see Box 3 and Plutchak 2022). As one research leader remarked on the OSI listserv in 2018, we were going about reforming science in a very unscientific manner.

Today—and despite a large, meaningful and influential array of open tools, policies and efforts...[and] a thick alphabet soup of important organizations and principles...the BOAI approach has become an article of faith for most of the world's significant open access policies...

Today—and despite a large, meaningful and influential array of open tools, policies and efforts, from the Panton Principles and FAIR Principles governing open data (2009 and 2016 respectively) to a thick alphabet soup of important organizations and principles (DORA, GitHub, OSF, Lindau, PubMedCentral, et al)[7]— the BOAI approach has become an article of faith for most of the world's significant open access policies,[8] from Europe's Plan S to UNESCO's open science policy to the University of California's transformative agreement with Elsevier and the new US open access policy (the Nelson Memo).

The idea that open means free, immediate and licensed for unlimited reuse is not challenged. Most major funders have also fully accepted this approach to open access.[9]

As our global open access policymaking efforts move forward, it's important to remember there are many histories and forces still influencing open practices. Understanding this will help us better understand what needs to be done and where we might want to concentrate our efforts for maximum effect and sustainability. In this policy space, there is a tangle of history, actors, needs, motives, and objectives. We may want "open" to be a simple notion with a straightforward past and an obvious future, but as we shall continue to explore in this report, it is none of these things.

OSI

The Open Scholarship Initiative (OSI) was founded in late 2014 to listen to all sides in this debate, lower the temperature of the discourse, broaden understanding of various perspectives, and develop fact-based approaches to open access policy. There have been many other multi-stakeholder conver-

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7. In the 20 years since 2002, various declarations have added nuance and complexity to the cri de coeur of BOAI. For example, in 2010, the Panton Principles qualified that publicly funded science should be in the public domain (CC-0) and that licenses that limit the reuse of data (like CC-BY) should be discouraged. DORA in 2012 and the Leiden Manifesto in 2015 both took aim at Journal Impact Factors, arguing that qualitative evaluations of research should matter more than quantitative evaluations. FAIR in 2016 argued that data must be easy to find, clearly accessible, interoperable with other systems, and optimized for reuse. The Lindau Guidelines of 2020 reiterated the need for scientific data and results to be made "openly available," while adding that research and evaluation criteria must be transparent. Harkening back to the biomedical research declarations (see Box 1), Lindau also stated that science has a responsibility to society to communicate, educate and engage.
8. The 16-person 2002 Budapest meeting was followed by a 24-person meeting in Bethesda in 2003. The Bethesda group built on the Budapest group's work, adding provisions for how users will enact open access. A 2003 Berlin meeting that attracted around 100 representatives built on the Budapest and Bethesda definitions of open, culminating in the Berlin Declaration on Open Access, which is also a foundational philosophy in open access policy (Max-Planck 2003).
9. Our acceptance has arguably even made us blind to conflicts of interest and hyperbole. For example, the CEO of open access publisher Frontiers was deeply involved in the development of Plan S (Schneider 2019). As for hyperbole, the new US open access policy promotes the merits of open access but lacks factual support for its recommendations (Clarke & Esposito 2022).

BOX 3: THE GOOD VERSUS EVIL APPROACH TO OPEN ACCESS POLICYMAKING

The open access debate is more civilized today than it was during its heyday—roughly the 15 years between 2003 and 2018. In the words of T Scott Plutchak, describing the legislative and political efforts of the Scholarly Publishing Roundtable between 2009 and 2012—work that eventually led to the 2013 Holdren Memo's expansion of the US Public Access program—"One of the paralysing results of [the] pitched battle [between opposing camps at this time] was that individuals who might have been allies in other circumstances found themselves on the opposite sides of a very public rhetorical war" (Plutchak 2022). Still, although the public rhetoric may have died down, very strong differences of opinion remain. For example, to some in the open access community, publishers are not legitimate parts of the research ecosystem at all, but parasites who feed on it. This opinion is even reflected in the language of several major open access policy statements in use today, and factors into the philosophy of several leading groups in the open access funding world. In a sense, what open access policymakers are being influenced by is more than just the facts and evidence about open access, but by a belief that the effort to develop open access policies is a battle between good and evil. This is not an outlier opinion; even some in OSI support this philosophy and policymaking approach. From a democratic and evidence based policymaking perspective, however, these opinions make it difficult to focus on and be led by facts. Rather than working together to help researchers improve research communication based on their needs and perspectives, the good versus evil approach puts a thumb on our scale of objectivity.

CASE 1: SCI-HUB

The pirate publisher Sci-Hub probably best exemplifies the good versus evil approach. Created in 2011, Sci-Hub has used stolen and donated university credentials and other hacking methods to download nearly 90 million copyrighted books and journal articles from research publishers, which it then distributes for free through the Sci-Hub website. Publishers have successfully filed numerous copyright infringement injunctions against Sci-Hub but the site keeps moving to new internet service providers and therefore keeps operating. Many researchers around the world see Sci-Hub's work as heroic; and even though many universities block the site, researchers around the world use it anyway because it fills an important need. Estimates vary but more than 50 million articles per month are downloaded from this site (Owens 2022). Justifying its actions on the Sci-Hub home page and even soliciting funds for its legal defense, the website states "The position of Sci-Hub is: the project is legal, while restricting access to information and knowledge is not. The current operation of academic publishing industry is massive violation of human rights" (Sci-Hub 2023).

CASE 2: PLAN S

The EU's Plan S is transforming the world of scholarly publishing. The plan's coordinating body is cOAlition S. As stated on the cOAlistion S website, "Publication paywalls are withholding a substantial amount of research results from a large fraction of the scientific community and from society as a whole. This constitutes an absolute anomaly, which hinders the scientific enterprise in its very foundations and hampers its uptake by society....[Our] collective duty of care is for the science system as a whole, and researchers must realise that they are doing a gross disservice to the institution of science if they continue to report their outcomes in publications that will be locked behind paywalls.... There is no valid reason to maintain any kind of subscription-based business model for scientific publishing in the digital world, where Open Access dissemination is maximising the impact, visibility, and efficiency of the whole research process" (Coalition-S 2023).

CASE 3: CHARITABLE FOUNDATIONS

Charitable foundations like Gates, Mellon, and Arcadia are major players in open access reform, leading and contributing heavily to open access policy reform efforts around the world. For several of these foundations, their work is fueled by the philosophy that our current system of scholarly communication is unjust. These groups are not necessarily wrong, of course, nor are they required to act objectively like government policymaking bodies, but the influence of these groups in the open access space has been significant, and has created so much policymaking overlap between advocacy channels and official policy channels that it's difficult to tell where ideology ends and objectivity begins. On the Arcadia Fund's website, we read that "Access to knowledge is a fundamental human right. It advances research and innovation, improves decision-making, exposes misinformation and is vital to achieving greater equality and justice. The internet has transformed how we share, find and use information. But some materials that should legally and morally be free for anyone to access are still constrained by paywalls and restrictive copyright regimes.... Restrictive copyright laws are a significant barrier to open access. They benefit few, while denying many access to vital knowledge. We support efforts to challenge and improve existing laws, regulations, exceptions and limitations so that people have better access to knowledge they need" (Arcadia Fund 2023).

sations happening as well, such as FORCE11, the Research Data Alliance (RDA), the Committee on Data of the International Council for Science (CODATA), and the Open Access Scholarly Publishers Association (OASPA). OSI's unique value proposition has been to bring together high-level representatives from all key stakeholder groups and organizations and have them work directly together to find common ground on key issues in scholarly communication—not just open access, but tangential issues like impact factors, peer review and the culture of communication in academia. An important part of our mandate has also been to represent and protect the interests of all countries in this conversation, not just focus on what works for the EU and US.

...most participants in OSI agree that (1) Research and society will benefit from open done right; (2) Successful solutions will require global and inclusive collaboration, (3) Connected issues (like peer review and impact factors) need to be addressed, and (4) Open isn't a single outcome, but a spectrum of outcomes.

Where does OSI stand on current OA policies? As noted in our 2020 Common Ground paper (Hampson 2020) it's fair to say most participants in OSI agree that (1) Research and society will benefit from open done right; (2) Successful solutions will require global and inclusive collaboration, (3) Connected issues (like peer review and impact factors) need to be addressed, and (4) Open isn't a single outcome, but a spectrum of outcomes.[10] Beyond this, OSI participants have a wide variety of opinions, and our role isn't to speak with one voice. There are some in OSI who are thrilled with these policies, and others who aren't. It's also probably fair to say that amongst the analyst community—and this is the community which has been most active in OSI conversations over the years—there has a been a considerable amount of discussion regarding the pros and cons of various policy approaches, and a general understanding that we need to be on the lookout for unintended consequences.

Probably the most impactful transformation happening today involves flipping the subscription model for scholarly publishing to a model where authors pay for publishing via article publishing charges (APCs). The APC model is mandated by Plan S, covering a large portion of the EU (even though this affects a small global portion of publishing, publishers have been transitioning to Plan S requirements for years now), and is strongly directed by the new Nelson Memo covering all federally-funded US research (which will give a huge new push to the transition).[11] The general idea is that authors can simply tap their research budgets to pay for publishing, and in exchange the publisher will get paid and make the article free to read.[12]

There are many other transformations happening as well, of course, such as eliminating embargo periods, requiring a CC-BY license on all work in all disciplines, improving data availability, negotiated agreements at major universities whereby access to published work and APC charges are bundled together, and more, It is unfortunately well beyond the scope of this paper to dive into each of these policy prescriptions at length. For our purposes here, many in the OSI community have expressed four general concerns about the overall nature of these reforms: (1) ignoring the unintended consequences of APCs; (2) ignoring the evidence that in practice, openness exists along a broad spectrum of out-

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10. To help better understand the differences between different types of open and make sure we're all talking about the same things when it comes to analysis and policymaking, OSI constructed a model called DARTS. This model illustrates how different types of open differ with regard to their discoverability, accessibility, reusability, transparency, and sustainability. The DARTS model is described in more detail in Figure 1..
11. To the Nelson Memo's credit, it does not mandate specific actions, just specific outcomes, so it remains to be seen whether this latitude will create better outcomes for open than Plan S. The smart money at the moment says that this policy will force the widespread adoption of gold open—APC-funded journal articles where the publishing costs are paid by authors.
12. Or even better, these publishing charges will be paid by a third party like a research foundation. This ideal approach, although still rare, is called "diamond OA."

comes; (3) our tendency to overreach and design policies for which we lack the requisite expertise; and (4) forcing one-size-fits-all open solutions on researchers, even where these solutions don't match researcher needs and resources.[13] The following subsections describe each of these concerns in more detail.

...many worry that our widespread use of APCs will widen the chasm between the haves and have nots in research, and substitute one equity imbalance with another: the inability to pay for access (paywalls) due to high subscription costs, with the inability to publish (playwalls) due to high APCs.

THE UNINTENDED CONSEQUENCES OF APCs

The APC-funded approach to open (which is central to policies like Plan S) is not free. Indeed, APC charges have risen to stratospheric levels for premium research journals over the last few years, now topping US$10,000 per article for publishing in top research journals. Even the average APC charge (around US$2600 for OA mirror journals, although there is wide variation by field, publisher, and journal quality; see Smith 2022) is now far higher than most researchers around the world can afford unless they are based at a major institution in the US or EU or are well endowed by their private funder.[14]

As noted is OSI's official critique of Plan S, many worry that our widespread use of APCs will widen the chasm between the haves and have nots in research, and substitute one equity imbalance with another: the inability to pay for access (paywalls) due to high subscription costs, with the inability to publish (playwalls) due to high APCs. Since this chasm roughly equates to a fracturing of the open access policy space along economic and regional boundaries, the US and EU will have their own rich open universe, other parts of the world will have their less endowed universe, and the gaps between these worlds may end up hurting research instead of helping it (for many reasons: technical difficulties with sharing, cost differences, protectionism, less collaboration, and more).

The APC approach to open access also doesn't reduce the power of major commercial publishers to the degree BOAI and other OA ideologies originally intended. The power of major commercial publishers is increasing instead, because the APC model is proving to be quite financially robust (Pollock 2021 and Zhang 2022) and because society and university publishers need help navigating the rapidly changing regulatory landscape.[15]

This power will probably continue to grow in the coming years as publishers lock in their consolidation by offering value added tools to their customers (like advanced search and synthesis). Rich countries and institutions who can afford to climb the ladder of publisher-controlled offerings will partake in a buffet of new capabilities made possible by more open access, while lower income institutions and countries will have to make do with the bare minimum Author Accepted Manuscripts and Excel spreadsheets mandated by open policies. There is no money or incentive to make this kind of advanced access available for everyone everywhere. Rather, everyone will be required to contribute their information for free, and only the rich will be able to extract maximum value from it.

THE BROAD SPECTRUM OF OPEN OUTCOMES

As discussed, our most influential open access policies are not, unlike actual public policy, grounded in a wealth of evidence, nor have they been developed through the expert and impartial consultative

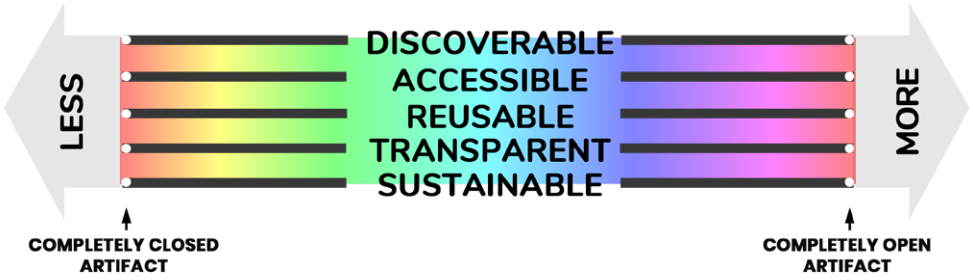
13. These points and more are also discussed at length in OSI's other policy perspectives (available from the OSI website at osiglobal.org). Again, these are just points raised in OSI, not points everyone in OSI necessarily endorses.
14. See Scaria 2018, Kwon 2022, and Nwagwu 2018 for discussions about the cost burden on Global South researchers, who are much more likely than their Northern counterparts to pay APC costs out of their personal budgets. See Zhang 2022 for the global cost of OA. See the DeltaThink website for ongoing news and analysis of the OA market (deltathink.com).
15. Plan S and other OA mandates have set timetables for doing away with the subscription model, and these smaller publishers need help navigating this change and complying with all the new and complex reporting requirements.

process we expect to see in democratic societies. Instead, they are ideologically grounded. This ideological approach makes sense to those who consider the act of locking research behind subscription paywalls to be an inherently immoral act. For this group, trying to put commercial publishers out of business is a morally justified imperative. But not everyone feels this way. In practice, open access efforts are driven by a variety of motives such as the desire to improve impact, efficiency, reproducibility, accountability, transparency, and collaboration. Many researchers also readily appreciate that publishing adds value to the research record through processes like gatekeeping, peer review and preservation, and note that without a reliable process akin to quality journals, the scientific record may become unreliable.

Ideology says open is, at minimum, CC-BY licensed information without embargo, but evidence clearly shows that open comes in many different forms and looks different for different users in different fields and different parts of the world.

This difference between ideology and evidence is also apparent when it comes to defining what open means. Ideology says that open is, at minimum, CC-BY licensed information without embargo, but evidence clearly shows open comes in many different forms and looks different for different users in different fields and different parts of the world. OSI participants developed an information model called "DARTS" to describe this open spectrum, where the five letters of this acronym stand for discoverability, accessibility, reusability, transparency, and sustainability. On this spectrum, we allow for the fact that some kinds of open are free to read but still copyrighted; other kinds may be closed to the public but robustly open and interoperable within designated user groups (this solution is common in clinical research); and still other kinds are public domain licensed but not very discoverable, transparent or sustainable. So-called "green" open, which accounts for the vast majority of open resources, is exactly

FIGURE 1: OSI'S DARTS OPEN SPECTRUM



DISCOVERABLE: Can this information be found online? Is it indexed by search engines and databases, and hosted on servers open to the public? Does it contain adequate identifiers (such as DOIs)?

ACCESSIBLE: Once discovered, can this information be read by anyone? Is it available free of charge? Is it available in a timely, complete, and easy-to-acceess manner (for instance, is it downloadable or machine-readable, with a dataset included)?

REUSABLE: Can this information be modified? Disseminated? What conditions (both legal and technical) prevent it from being repurposed or shared at will?

TRANSPARENT: What do we know about the provenance of this information? Is it peer reviewed? Do we know the funding source (are conflicts of interested identified)? What do we know about the study design and analysis?

SUSTAINABLE: Is the open solution for this information artifact sustainable? This may be hard to know---the sustainability of larger, more established solutions may evoke more confidence than new, small, or one-off solutions.

The DARTS framework is currently only a concept and not a measuring tool, although quantifying this tool might help make it useful to open research in other ways. For example, imagine running a scale from let to right, and then assigning a value for each DARTS attribute of a paraticular information artifact. Assignng a transparency score of zero means we know nothing about where this information came from, whereas a nine means we are very clear about this. Doing the same for each DARTS attribute, we could then assign a perfectly open object a DARTS score of 99999, and an absolutely closed object a score of 00000. Almost all information exists somewhere in between. This paper, for example, will have good discoverability and accessibility (although not as good as a commercially published report), limited reusability, acceptable transparency, and good faith sustainability (although not perfect, like commercial publishers). Therefore, its DARTS score might be 77586 or some such.

this: a hodge-podge of information that is free to read but whose discoverability, accessibility, reusability, transparency and sustainability vary widely. This diversity reflects the fact that different user groups have different resources, needs, incentives, motives, conventions, restrictions, and so on. It doesn't mean they shouldn't strive to improve their openness, but it also doesn't presuppose that one type of open is necessarily superior for all users and circumstances. Movement toward better open solutions should continue, but this movement should be based on evidence and need, not assumptions.

...BOAI-compliant articles (for which Gold OA is a rough proxy) account for only a small fraction of the total.... What researchers want and need for open information, then, isn't necessarily always the same as what's being prescribed. OA policy may require one outcome, but evidence shows that many different outcomes are possible, and even preferred.

Indeed, after 20 years of pushing for ideologically perfect open solutions, most of the world's open information is still published in other formats (which isn't to say closed, just imperfectly open). Estimating the exact distributions of open outcomes depends on which indexes are analyzed (different indexes skew toward different journal types and disciplines), which regions of the world are being measured, and the sampling methodology used (see Box 4), but according to a recent analysis of eight million journal articles listed in the Web of Science between 2015 and 2019, BOAI-compliant articles (for which Gold OA is a rough proxy) account for only a small fraction of the total (Table 1 and Simard 2022). What researchers want and need for open information, then, isn't necessarily always the same as what's being prescribed. Open access policy may require one outcome, but evidence shows many different outcomes are possible, even preferred.

TABLE 1: PERCENTAGE OF OA PUBLICATIONS BY TYPE AND FIELDS (2015–2019)

Field	Total OA	Of which Gold*	Of which Green
Natural Sciences	45.4	19.9	36.3
Engineering and Technology	30.4	13.0	21.4
Medical and Health Sciences	50.0	20.8	40.4
Agricultural Sciences	35.9	17.1	22.0
Social Sciences	35.5	7.9	29.8
Humanities	21.2	5.9	15.8
Unknown	35.8	2.2	31.3
All Fields	42.9	18.1	33.8

Source: Simard 2022.
*Gold OA represents open access materials which have been made open through APC charges and made immediately and freely available to the public without embargo. It does not necessarily mean the materials are CC-BY licensed, however. DeltaThink estimates that of all the open materials currently being published during this same time period (2015-2019), about 55% in aggregate was CC-BY licensed, meaning that only about 10% all published materials (55% of 18.1%) are strictly BOAI-compliant. See Pollock 2022. This figure is consistent with other global estimates of gold open (see, for example, Zhang 2022 and Piwowar 2019).

How can we know for sure which of these outcomes are best? We can't—we need more research, without which our policy conversations have been stymied and our positions hardened along ideological lines. This need for more research isn't a red herring argument like the tobacco industry used in the 1970s and 80s to slow down anti-smoking policy. In truth, as a community we have conducted almost no solid research into fundamental questions, such as which researchers need open and why, what types of open work best in each field, how short embargo periods can go, the cost-benefit of replacing the subscription model, the open access citation advantage (see Box 8), and more.[16]

16. OSI has tried to raise funding for this work but hasn't been successful.

BOX 4: WHOSE EVIDENCE?

Scholarly communication research isn't an exact science. Researchers will typically investigate open access in unique ways from one study to the next, segregating their findings into different types of open that aren't necessarily comparable, or using the same category names like green and gold but defining these categories in slightly different ways, or sampling data from different publication indexes, over different time periods, focusing on different fields and countries, or using different sampling methodologies. As a result, these studies always arrive at different conclusions, often markedly so, about how fast open access is growing.*

Some of the most methodologically refined analyses to-date have taken measurements across multiple indexes, regions, fields and time periods (like Piwowar 2018 and Archambault 2016), but even here, the aggregate data from these studies may be less meaningful than accurately understanding whether a particular field or country is currently making progress toward its open goals. And across all studies, none to our knowledge have fully captured the breadth and depth of green open, which is defined in a variety of ways by researchers but should arguably include all research-related information that is free to read and not clearly gold or bronze, from preprints to self-archived reports on university websites, to datasets available in repositories (and not otherwise CC-BY or CC-0), to most of the information in massive archives like PubMed Central, and copyrighted work that is now free to read everywhere, not just academic journal articles in OA repositories (see, for example, the wealth of infomation being catalogued by coherentdigital.net).

This inconsistency and variation is important to understand for two reasons. First, because our analyses can vary so widely, OA policymakers can be tempted to use hand-picked statiscs that support their favorite OA story line, such as rapid growth rates for their preferred form of open. This bias is not unusual in policymaking, of course, but we can help give policymakers a more solid foundation of evidence by firming up our research methods. Second, only two types of open are deemed "acceptable" by most of the world's major OA policies: gold and diamond.** Thefore, it's important to develop a better understanding of how these forms of open are actually faring, particularly with respect to their historic growth trends and to other forms of open. As noted in Table 1 and Figure 1, the marketplace has a wide variety of open outcomes.

How do we know which of these outcomes is working best for researchers? We don't. Many studies over the years have tried to measure the growth of open solutions, but there haven't been any studies to-date (to our knowledge) that investigate which of these different solutions are the ones actually preferred by researchers. We do know from surveys (see, for example, Hampson 2023) that the APC solution is widely disliked, so we can infer from this that gold open is not an outcome most researchers look upon fondly (at least in aggregate) if given a choice. Some researchers also don't like the idea of paying to publish their work, and others feel that pay-to-publish journals are lower quality, or have lower reputations or lower readership. University tenure committees typically feel the same way, although this attitude is gradually changing. These factors might help explain why gold open has been stuck at below 20% of all open outcomes (and only around 5-10% of all published work; see OSI 2021) for the last 20 years.

Gold open will surely grow in the coming years, though, due to the influence of Plan S and the Nelson Memo, piled atop current growth trends (Piwowar 2019). This isn't necessarily a bad development if the issue of APCs can be resolved. But given historical growth trends, it may be helpful to gather more evidence about what researchers actually want and need from open publishing solutions so we can make sure we focus on growing the right kinds of solutions. To-date, we can only tell that the marketplace is producing a wide variety of outcomes, and that most of these outcomes are not the ones OA policymakers want (at least yet). A first step in this process might be to fund more carefully designed and definitive studies that can give us a clearer picture of the open environment so policymakers can develop better evidence-based policies moving forward.

* For example, older, higher-impact, STM-centric work will be listed in indexes like Scopus and WOS (Web of Science). Measuring the open content in these indexes (as in Simard 2022) will tend to show slightly lower growth. Newer journals are more likely to be picked up by newer indexes like Unpaywall, which detects the DOI of journal articles (older articles are less likely to have been assigned a DOI). Measurements done from this index (like Piwowar 2019) will tend to show higher growth.

**Gold open is where the final version of record of an academic journal article is made freely and immediately available for the public to read and reuse through author publishing charges (APCs), which are often (but not always) paid by the author, the author's grant funds, or the author's library or institution. Diamond or platinum open, which are far less common than gold but still acceptable to Plan S, are variations on this theme where fewer or no author charges occur. In these cases, publishing is managed and subsidized by a research community, academic community, or nonprofit and no publishing charges are drawn from the author's pocket, grant funds, or research institution.

If we follow the evidence, we may want to focus first on the highest priority communication needs of researchers instead of on the priorities highlighted by current OA policies.

What we can clearly see from a number of researcher surveys over the years[17] is that at minimum, getting free and immediate access to journal articles isn't the only concern researchers have. Researcher also want lower publishing costs, improved connections with colleagues, and increased visibility and impact for their research work. This isn't to say that improving access isn't an important goal, just that it is one of many goals and we may not want to reach it by trampling on other goals and creating a world of unintended consequences which end up being harmful to research on balance. If we follow the evidence, we may want to focus first on the highest priority communication needs of researchers instead of on the priorities highlighted by current OA policies. Exactly how these priorities might rank is discussed later in this report.

OVERREACH

Open access policymakers are generally guilty of at least two kinds of overreach. The first kind involves designing policies without possessing the needed expertise. Open access, open science, open data, and other open movements all have different perspectives and priorities. An open science led effort makes no sense for humanities researchers; an open access led effort makes no sense for open data. Today, however, we see a good deal of mission creep, where open access advocates are designing policies having to do with the future of open data, and where plans for the future of journals are designed with STM disciplines in mind, not the humanities. While there is some overlap between these communities with regard to tools and basic principles, they are in fact very different. Therefore, it is ill-advised from a policymaking perspective for open access advocates alone to write such policies—as is the case with Plan S, the UNESCO open science policy, and the US Nelson Memo—since the facts and nuances of all open practice communities are not even remotely captured in policies like these. The reverse situation would never be tolerated by the open access community, where open data advocates working alone decided what the future of open access should look like.

Open access, open science, open data, and other open movements all have different perspectives and priorities. An open science led effort makes no sense for humanities researchers; an open access led effort makes no sense for open data. Today, however, we see a good deal of mission creep, where open access advocates are designing policies having to do with the future of open data, and where plans for the future of journals are designed with STM disciplines in mind, not the humanities.

To elaborate on the case of open data, all major open access policies have open data requirements (usually including provisions to make data FAIR—findable, accessible, interoperable and reusable—or to deposit data in specific repositories) but most lack any evidence-based operational details. In truth, open access policymakers (as distinct from the open data experts) have very little grasp of what open data actually looks like, particularly in clinical research where the OA community wants to see faster discovery. This data realm is awash with challenges, such as protecting patient privacy (conforming with existing data protection laws like HIPPA and GDPR), protecting proprietary data (owned by drug companies who sponsor research work), preventing the misuse and misinterpretation of data, and struggling to make the sharing of datasets complete, timely and compatible, even when this data is

17. A separate list of these surveys is included in References section of this report.

TABLE 2: COMMON DATA GOVERNANCE STRUCTURES AND THEIR ATTRIBUTES

Governance structure	Number and linkage of parties	Degree of data Availability	Degree of freedom to use data	Challenges common to the governance success	Primary governance design pattern
Pairwise	One-to-one	Medium/ High	Medium/High	Uneven status of parties, value of data	Informal or closed contract
Open Source	One/some-to-many	High	High	Rights permanently granted to user	License
Federated Query	Many-to-many, via platform	High	Medium/Low	Defection of creators	Contract and club rules
Trusted Research Environment	One/some-to-many	Medium/Low	Medium/Low	Users agree to be known, surveilled	Data transfer and use agreements
Model-to-Data	One-to-many	High	Low	Not all who apply can use data	Restricted analyses, data curation
Open Citizen Science	Many-to-many	High	High	Capacity for analysis is uneven	Contract or license
Clubs, Trusts	Some-to-some	Medium/Low	High	Easy to create things governed more liberally. Trusteeship can be revoked.	Club / Trust rules
Closed	Many (to none)	Low	High	Fundamental limits to collaboration	Public laws, security protocols
Closed and Restricted	Some (to none)	Low	Low	Fundamental limits to collaboration	Public laws, security protocols

Source: Mangravite 2020

being generated by the same research group. OA policymakers have not even begun to understand the complexity, diversity, and best practices of this real world sharing, yet they are designing one-size-fits all policies that mandate sharing nonetheless based on open access ideals. Table 2 describes of some of this complexity, and shows how the type of data sharing envisioned by open access policies fits into this array of other data sharing models.

In the meantime, there is a long list of promising work being done in open data and many success stories to share, but these experiences originate from efforts that have nothing whatsoever to do with global open access policies. For example, there are a number of highly successful research collaboration efforts that demonstrate what the cutting edge of open access development can accomplish (like DataSpace, Vivli, SDSS, CERN, GenBank, DataSphere, and Sage Bionetworks), and what evidence-based data sharing and collaboration challenges exist on the road ahead.

OA policymakers have not even begun to understand the complexities of and lessons learned from...real world [data] sharing, yet are designing one-size-fits all policies that mandate such sharing nonetheless.

These data sharing networks are most often developed through private partnerships with strict and distinctly BOAI-unfriendly data sharing guidelines and eligibility, not through generalist OA policies and repositories. Open access policymakers have not studied, learned from, or even cited these examples. See Boxes 5-7 on the following pages for more detail.

A second and equally important type of overreach is that policymakers often grant special powers to open that aren't merited. Take the widely touted claim, for example, that open access increases citation rates. The evidence for this phenomenon is actually not clear, nor is it clear that focusing on increasing citations instead of increasing research quality is the right approach to take (see Box 8).

BOX 5: REAL WORLD OPEN DATA USE POLICIES

OA policies requiring open data deposits are mostly silent on the details that make this data actually useful to researchers, such as data management, vetting, and curation. Leading repositories that already manage vast quantities of research data have designed intricate policies to add this kind of value to open data (which isn't always openly licensed) as well as to protect discovery, copyright and patient privacy as needed. The data sharing agreements upon which these resources are constructed are legal documents that typically define (at minimum) how long data can be used, for what purpose(s), by what means, what constraints will apply, and financial, confidentiality and security requirements. Many of these agreements (especially in the life sciences) also protect against misuse by allowing only qualified participants to deposit and use data. None of these real world data sharing practices are acceptable under the open data policies designed by open access policymakers, however. Instead, these OA-designed policies only articulate a vision for CC-0 licensed data that is uncurated and available for anyone to use and reuse.

CERN (RAW DATA POLICY)

It is not practically possible to make the full raw data-set from the LHC [Large Hadron Collider] experiments usable in a meaningful way outside the collaborations. This is due to the complexity of the data, metadata and software, the required knowledge of the detector itself and the methods of reconstruction, the extensive computing resources necessary and the access issues for the enormous volume of data stored in archival media. It should be noted that, for these reasons, general direct access to the raw data is not even available to individuals within the collaboration, and that instead the production of reconstructed data (i.e. Level-3 data) is performed centrally. Access to representative subsets of raw data—useful for example for studies in the machine learning domain and beyond—can be released together with Level-3 formats, at the discretion of each experiment. (See CERN 2023)

GENBANK

The GenBank database is designed to provide and encourage access within the scientific community to the most up-to-date and comprehensive DNA sequence information. Therefore, NCBI places no restrictions on the use or distribution of the GenBank data. However, some submitters may claim patent, copyright, or other intellectual property rights in all or a portion of the data they have submitted. NCBI is not in a position to assess the validity of such claims, and therefore cannot provide comment or unrestricted permission concerning the use, copying, or distribution of the information contained in GenBank. (See NIH 2023a)

VIVLI

(A) Data Use Agreement—All Data Requestors requesting data must execute the Data Use Agreement (DUA). The DUA is the product of extensive negotiation with the organizations that contribute data to Vivli. This agreement is non-negotiable. If granted access to the data, it is for the express purpose outlined in the research proposal. Any changes to that proposal will require re-review and approval by the data contributors involved; (B) Qualified Statistician—All research teams submitting a Vivli data request must include a qualified statistician. The statistician must have a degree in statistics, or similar field, or publications relevant to the proposed research where the individual conducted the statistical analysis; (C) Publication Plan—The dissemination plan must include a definitive statement to publish and disseminate your findings to contribute to furthering scientific knowledge. (See Vivli 2023)

There are, of course, many other examples of how real data sharing is working in today's research environment (such as DataSphere, CAVD DataSpace, Yoda, and Sage Bionetworks), many high-profile success stories in sharing science data (like CERN, the Hubble Space Telescope, the Human Genome Project and the Sloan Digital Sky Survey), and many other open data research repositories in use (not even including institutional repositories; see https://www.nature.com/sdata/policies/repositories). And owing to the experience and expertise of these groups, as well as to the efforts of the many outstanding organizations working to create best practices in data management and data repository function (such as the Research Data Alliance, COAR, CODATA, JISC, NISO and OpenAIRE), we have also learned a lot about the pros and cons of various data governance structures (see Table 2 on the previous page), and the challenges involved in sharing more research data (see Box 6 on the following page). Our goal with open solutions policies, then, should be to learn from all this history and experience rather than trying to reinvent the wheel. What we may find is that the "imperfect" open approaches that have evolved in the marketplace are the ones that actually work. By learning from these, we can create better and more realistic policies; at the same time, we can help these existing systems operate even more efficiently by bringing them into the fold regarding best practices in open data.

BOX 6: REAL WORLD OPEN DATA CHALLENGES

Competition collaboration, and data sharing are three key drivers in research. Each of these drivers has unique practices, outcomes and challenges, but they are also all closely linked and affect each other. Competition has always been fundamental to the very fabric of research, for example, but as research becomes increasingly complex, collaboration is also increasingly important, and along with this, data sharing as well. Still, relatively few researchers (around 15%) currently share their data outside a limited group of colleagues in any comprehensive and meaningful way (notable exceptions include astronomy, high-energy physics and genomics; see NASEM 2020) due to a variety of concerns and challenges. Similarly, the race to discover has always been a key part of science, but this race sometimes leads to a hyper-focus on secrecy, a temptation to commit fraud, hiding negative findings, and other behaviors that conflict with the needs of good science and open science.

Understanding how these three drivers operate and are evolving in the real world is important for understanding how to improve the research of tomorrow. For example the needs and concerns of researchers with regard to data sharing generally fall into six main categories: Impact, confusion, trust, access, effort and equity.

1. **IMPACT**: Will my research have greater benefit if I share my data? What benefit will I get from this personally? Will my open data efforts be well received by colleagues and tenure committees?
2. **CONFUSION**: Where should I begin? What kind of license should be used? What data should be shared, in what format, with whom, and in what repository?
3. **TRUST**: Will my open data be misinterpreted or misused? Will my potential discoveries be scooped?
4. **EFFORT**: Will complying with data requirements take up too much time? Different publishers and repositories all have different compliance formats and requirements. Will I be responsible for maintaining my data over the long-term?
5. **ACCESS**: Who needs access to my data anyway and for what reasons? Some datasets are so large that they can't be uploaded via the Internet. For what purpose will my data be used? Would data summaries suffice instead?
6. **EQUITY**: Overall, is this data sharing mandate even fair to me and my colleagues? For example, data processing capabilities vary widely by region, field and institution. Researchers from lower resource institutions often lack the huge support networks and processing facilities that more privileged researchers might take for granted. So, why should these lower resourced researchers share their hard-earned information and then not be able to extract any value from it?

There are also many challenges regarding the data itself. These include:

- How can we fund and maintain the infrastructure necessary for data processing, curation, and preservation?
- How do we protect against link rot, and data decay and data obsolescence over time?
- Big data keeps getting bigger. Can our sharing tools keep pace?
- What happens to data once a research facility is shut down and data needs to be preserved and curated for decades more?
- What happens to long tail data, and the data that sits on laptops or personal websites with minimal or no attached metadata or documentation? Not being able to capture this contributes to issues like irreproducibility, duplicate research, and innovation loss.
- Who pays long term for data care and maintenance?
- How do we ensure the timely sharing of critical data (insofar as rapid sharing impinges on secrecy)?
- How do we ensure better data quality, consistency and completeness?
- How do we standardize data formats and collection processes (where necessary) to ensure data completeness and comparability?
- How do create internationally agreed-upon minimum standards for metadata (further complicated when metadata are not in English)?
- How do establish interoperability and searchability between data platforms (without which researchers need to search and make requests across multiple platforms)?
- How do we create internationally agreed-upon standards for Data Availability Statements?
- Can we streamline the governance structures used by different platforms?

Other challenges include the fact that very little funding support is available to facilitate data sharing, and to improve data infrastructure systems; code sharing needs to be improved (for many kinds of research, sharing or reanalyzing data without the original code means just sharing and preserving a jumble of numbers); high level data sharing policy often conflicts (for example, the EU's GDPR conflicts with most global clinical trials data sharing policies, and this conflict has yet to be resolved; see Staunton 2019 and Hampson 2021 for more detail), and more (e.g., regarding which metrics are best for evaluating open data, and how to reward open data practices).

Source: Derived from Hampson 2021a

BOX 7: THE UNRECOGNIZED CHALLENGE OF DATA CURATION

To-date, none of the major, global open solutions policies or even the discussions leading to these policies have focused on the importance of curation in making research information useful. What is curation? Essentially, it means organizing information. This organization is everywhere and all around us: imagine grocery stores where food is not organized into aisles, amazon.com without consistent ways of cataloguing and displaying product information, ancestry.com without metadata that enables different family trees to connect together, fields of study without a sophisticated understanding of the knowledge that already exists and how it's organized, or search engines that don't know how to crawl the web. Organizing information is a prerequisite to making it useful (at least for humans).

In an undertaking like research, organizing information has added dimensions like making sure units of measure are standardized across fields, making sure the data being collected across studies is consistent, filling in missing pieces of data, adding explanations, and otherwise properly cleaning, documenting, labeling, transposing, and formatting work for sharing. All this effort takes time and money (someone needs to do this, and not for free), and the time for doing this is limited because projects need to report data within a given window, grant funding eventually runs out, and principal investigators and researchers eventually move on to other projects.

How much time and money is needed? No one knows for sure; data curation isn't an activity that has been well investigated and documented, and the needs obviously vary widely based on factors like data volume, complexity, privacy considerations, intellectual property constraints, and the number of collaborators (see Perry 2022). For sure, the most widely used and long-lived curated resources require massive ongoing investments of time, money and attention. Also, while "openness" is important to some of these efforts, it's irrelevant to others; the common denominator isn't openness but finding reliable and relevant information, converting this into something useful, and then making the curated resource accessible to the world as part of a cohesive narrative. Here are a few good examples of freely available curated research resources:

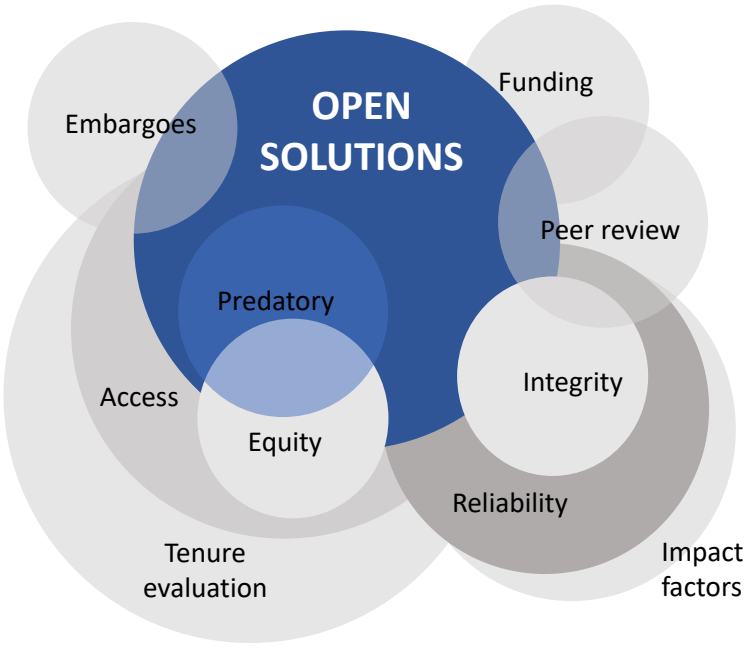
- **WHO**: Founded in 1948, World Health Organization today manages and maintains about 75 different curated data collections related to global health and well-being as mandated by UN Member States, covering everything from HIV/AIDS cases to malaria, COVID, nutrition, injury, mortality, maternal health, mental health, immunization status, and tobacco use. Data collections are typically CC-BY licensed but a wide variety of copyrighted information is included in these collections. See who.int.
- **IHME**: The Institute for Health Metrics and Evaluation (IHME) works with collaborators around the world to develop evidence that sheds light on the state of global health and provides policy makers with accessible and usable information tools and resources. Over 500 people work at IHME. Founded in 2007, funding support comes from the University of Washington, the National Science Foundation, the Gates Foundation, and elsewhere. Much of what IHME collects and curates is free, but much is included with permission. See healthdata.org.
- **TAIR**: The Arabidopsis Information Resource is a database of genetic and molecular biology data for Arabidopsis thaliana, a widely used model plant. Launched in 1999, data available from TAIR includes the complete genome sequence along with gene structure, genome maps, genetic and physical markers, DNA and seed stocks, related publications, and information about the research community. TAIR is managed by the nonprofit Phoenix Bioinformatics Corporation (which manages other bioinformatics resources as well) and is also supported primarily through institutional, lab and personal subscription revenues. See arabidopsis.org.
- **ALLEN BRAIN MAP**: The Allen Institute for Brain Science was established in 2003 to accelerate neuroscience research worldwide by sharing large-scale, publicly available maps of the brain. Research teams conduct investigations into the inner workings of the brain; the institute also publicly share all the data, products, and findings from their work on brain-map.org, including data, analysis tools, and lab resources. This information is copyright protected, not CC-BY licensed. See portal.brain-map.org.
- **UW DRUG INTERACTION DATABASE**. The University of Washington's Drug Interaction Database (DIDB) uses a small army of PhDs to read thousands of variously-licensed peer reviewed studies every year (as well as drug labels and NDA studies), and then manually extracts qualitative and quantitative human and clinical information related to interacting medications, food products, herbals, genetics, and other factors that can affect drug exposure in humans. Launched in 2002, DIDB is today used by hundreds of pharmaceutical companies, regulatory agencies, CROs, academic institutions and clinical support organizations around the word. Sustainability is made possible through DIDB's licensing and subscription revenues. See druginteractionsolutions.org.
- **USAFACTS.ORG**: USAfacts.org curates US government data and provides users with a polished finished product. For example, search for climate databases on data.gov and you get a long list of downloadable documents plus links to climate-related state, federal and nonprofit websites. Click the climate tab on USAfacts.org and you get a long page of easy-to-read graphs and graphics plus clear text summations and links to relevant resources. The mission of USAfacts is to provide authoritative, easy-to-use, nonpartisan data to US citizens. The site is privately funded by former Microsoft co-founder Steve Ballmer; it accepts no outside donations or funding. See usafacts.org.

Or consider how excited the policy world is becoming about open science. Like the UNESCO policy before it, a major open science policy being developed by the US National Academies Roundtable (NAS 2022), considers open science to include transparency ("scientific process and results should be visible, accessible, and understandable"), inclusiveness ("process and participants should welcome participation by and collaboration with diverse people and organizations"), accessibility ("data, tools, software, documentation and publications should be accessible to all (FAIR)"), and reproducibility ("scientific process and results should be open such that they are reproducible by members of the community"). However, this policy and similar ones attempting to define open science are simply describing what good science looks like and has always looked like. Transparency and reproducibility are not new ideas—as mentioned earlier, they are the fundamental building blocks of research—and research has always been global and deeply interconnected; and integrity is a function of good science, not open science.[18]

...open science means good science, but the reverse isn't necessarily true. Good science doesn't necessarily mean open science.

In other words, open science means good science, but the reverse isn't necessarily true. Good science doesn't necessarily mean open science. There is obviously some overlap between all these concepts, but in a Venn diagram, the "open" circle just intersects with lots of issues related to research reform, from improving access and equity to having a role in improving transparency, reproducibility and reliability, to also having a role in important issues like impact factors, tenure evaluation, and peer review (see Figure 2). Open science policies can play a role in addressing all these issues, but they won't solve all of them. Policymakers often forget this and use the term open science when what we really mean is something else. As Jon Tennant noted in 2020 (Tennant 2020), "Rebecca Willen has ... identified that there might be two, perhaps three, different sub-movements that intersect in different ways, involving 'open science', 'replicable science', and 'justice-oriented science'.... [I]t could be the case that now, open research is diffused in such a wide variety of ways that there cannot plausibly be a single, cohesive community and set of practices that define it.... Instead, Open Scholarship, Open Research, and Open Science might best be thought of as overlapping/intersecting 'boundary objects' (Moore 2017) that represent this inherent diversity."

FIGURE 2: SETTING REALISTIC EXPACTATIONS FOR WHAT OPEN SOLUTIONS CAN ACCOMPLISH



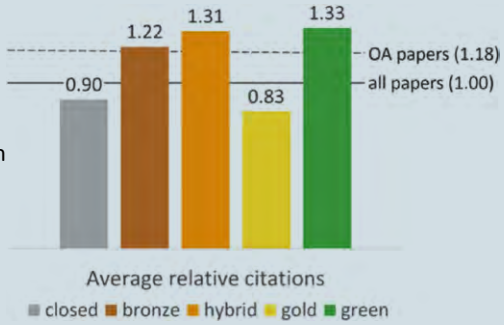
18. The US National Institutes of Health defines "research integrity" as "the use of honest and verifiable methods in proposing, performing, and evaluating research; reporting research results with particular attention to adherence to rules, regulations, guidelines, and following commonly accepted professional codes or norms" (including espousing shared values such as honesty, accuracy, efficiency and objectivity). See NIH 2023. So, for example, high integrity research includes ensuring proper analyses and objective conclusions, while avoiding bias, conflicts of interest, plagiarism, p-hacking or fake data.

BOX 8: IS THERE REALLY AN OPEN ACCESS CITATION ADVANTAGE?

How can we know for certain why some research articles are cited more often than others? Is the difference due to funding level? Promotion (through Twitter, radio interviews, or conference presentations)? Accessibility (whether through open access or some other means, like SciHub)? Salience (maybe an article deals with an issue of urgent importance to a particular group of researchers)? Uniqueness? Does publication language play a role? What about readability? Publication venue? Researcher seniority? Number of authors? Graphics? Metadata? Or maybe where the article is indexed? And how do we account for publication age (where older publications may have accumulated more citations than newer publications), field of study (different fields cite at different rates), strength of network, and negative citations (where work is being cited because it's bad, like the Wakefield study linking vaccines to autism)?

No doubt all these factors (and others) exert at least some amount of influence on citation rates, but a number of studies over the past 20 years have tried to determine whether simply being published in open access format creates an open access citation advantage (OACA) by itself. Unfortunately, very few of these studies have attempted to account for even some of the above-mentioned factors that might be involved in this calculation. Colby Lewis (Lewis 2018) looked at a number of studies conducted between 2011 and 2017 and concluded that there was no definitive answer about the OACA and that more research was needed (other noteworthy studies since Lewis include Basson 2021 and Correa 2021). A 2021 study (Langham-Putrow 2021) looked at 134 studies published on the OACA since 2001 and found that about half confirmed the existence of the effect, a quarter found it did not exist, and another quarter found OACA exists but only in certain fields, indexes, publication types, or types of open. Here again, more research is was called for. As the scholarly communication firm Clarke & Esposito noted in their June 2021 newsletter, "You might think that after 20 years of research and more than 130 studies on the subject, we'd have a clear picture of the effect that open access publishing has on an article's citation performance. Unfortunately, decades of poor studies and a mystifying unwillingness to perform experimental controls for confounding factors continues to muddy the waters around the alleged open access citation advantage.... [For example], of the 134 studies examined [in the Langham-Putrow study], only 40 acknowledged the possibility of confounding factors, which is fairly astounding. As early as 2007, it was clear that things like selection bias... were likely to invalidate any correlations that could be drawn. Yet even among the 40 studies that acknowledged potential confounders, only a subset made any effort to control for those factors [and these showed no OACA]."

Studying this issue is challenging, however, and many accomplished researchers have tried. Let's say for the sake of argument that we accept a good faith effort to find the answer as being good enough for policy-making purposes. One of the best and most cited studies to-date has been conducted by Heather Piwowar and Jason Priem. In their 2018 report, Piwowar and Priem (Piwowar 2018) tried to determine how much open access literature existed in the world, how the growth rate of open was changing, and as a relatively brief aside, what the citation rate of open access articles might be. Their findings, which aligned with several other well-done studies (e.g., Archambault 2016), showed that green open has the highest citation rate, and gold the lowest. On average, across all fields and all types of open, the OACA measured about 18 percent.



Source: Piwowar 2018
In this figure, the "average of relative citations" or ARC value is shown. An ARC value above 1 means that papers are cited more frequently than the average citation level for all papers.

However, lest we celebrate too soon, it's important to note that Plan S and BOAI-compliant open (gold open) was actually found to have a lower OACA than even subscription (closed) articles. The highest OACA was for green open, which includes a mix of copyrighted, embargoed, non peer-reviewed and open materials. Hybrid and bronze open also performed well, but these formats are also not compliant with Plan S and BOAI. So even by this argument, if we accept the evidence showing there may be an open access citation advantage and that this advantage is completely independent of other factors, it is still for the wrong kind of open. For the kind of open our major OA policies are requiring, OA citation outcomes are actually the worst of the bunch.

All this said, it stands to reason that making research easier to access is beneficial by itself. Citations needn't be touted as a proxy for research impact since much great science throughout history has had a spotty citation record. Also, importantly, there is no correlation whatsoever between the quality of research and its citation record (Aksnes 2019), so citations are not a proxy for quality either. Indeed, focusing on citations may be a net negative, merely tempting researchers to game the system through dubious practices like fractional publishing (dividing a single study into multiple papers), and including large numbers of co-authors; both of these practices are on the rise. Rather than continuing to assert that open access is a route to more citations, and continuing to treat citations as evidence of superior scholarship, evidence and common sense suggest we should simply acknowledge that open access is a good way to share research findings more broadly. It may eventually become clearer that open access is indeed allowing research to be cited more easily and frequently, but this is not what the evidence currently shows, nor should we continue to assert that it matters one way or the other.

Attributing special powers to open science is nowhere more apparent than the claim that open science is why COVID vaccines were developed in record time. Both the UNESCO open science plan and the US Nelson Memo make this claim, and say this sharing represents the potential of open access (and even the victory of open access policies).[19] This characterization is mostly inaccurate. While the rapid sharing of data was important with COVID research and is a key potential benefit of effective OA policies, the evidence suggests a murkier role for open data in COVID research (e.g., with lots of misinformation being published rapidly in preprint form, and none of the actual proprietary vaccine-related data being openly shared). The true hero of our quest to rapidly develop COVID vaccines were policies that allowed researchers to conduct their due diligence rapidly, with ample funding, and in parallel with manufacturing instead of in sequence (see Box 9).

Our efforts must be guided by clear-eyed answers to questions like why, specifically, do we need open solutions, and which solutions work the best under which circumstances? We also need to develop, as a global community working together (in concert with other global policy efforts), a clearer understanding of our goals. Open isn't that goal. It's a tool that can help us reach our goals.

Open access does have the potential to speed discovery, though, and to vastly improve the value and impact of research, which is why so many people believe in open and want it to succeed. But in order to make progress toward this future, and build the right kinds of tools and policies, we need to be honest about our facts and assessments. Our efforts must be guided by clear-eyed answers to questions like why, specifically, do we need open solutions, and which solutions work the best under which circumstances? We also need to develop, as a global community working together (in concert with other global policy efforts), a clearer understanding of our goals. Open isn't that goal. It's a tool that can help us reach our goals. And if our current open policies aren't helping us reach these goals, or are even throwing sand into the gears of research, then we need to stop overreaching and either improve our knowledge of the space we're regulating, or allow for more flexibility to accommodate the expertise and experience of researchers who have a better understand of what they need.

ONE-SIZE-FITS-ALL

One-size-fits-all open access policies like Plan S are a bad fit for the world of research because, at the risk of sounding too obvious, this world is very large and diverse, encompassing a wide variety of research needs and resources, differing interpretations of what open means, numerous concerns about open, and copious amounts of activity from many different governments, agencies and institutions (recalling our previous discussion about the historically different paths for open policies):

- **VARIETY OF NEEDS AND RESOURCES:** It is well established the researchers in different fields and regions have different needs, resources, and applications for open solutions. Please see OSI's other Policy Perspective reports for more detail and references.
- **DIFFERENT INTERPRETATIONS:** Different stakeholder communities support open efforts based on very different interpretations of what we mean by "open." Working to create a world where more information is free to read has very different policy implications than a world where all publishing is paid by authors and is made immediately available for unrestricted reuse. Many researchers and institutions support open policies in a broad and generic sense, but far fewer may support the policies that prioritize strict licensing and liberal reuse (see Table 3, for example, for

19. See the three paragraphs of section 2 of the Nelson memo (Nelson 2022), for example, which describe how rapid sharing of science information led the charge against COVID: "Immediate public access to COVID-19 research is a powerful case study on the benefits of delivering research results and data rapidly to the people."

BOX 9: WHAT THE EVIDENCE TELLS US ABOUT OPEN POLICIES AND COVID VACCINES

Popular media accounts of the COVID crisis, and even the story lines woven into several major open access policies, claim that open science is a major reason for why COVID vaccines were developed in record time during 2020 and 2021. This claim is mostly fiction. While the rapid sharing of data was important for COVID research and is a key potential benefit of effective open access policies in general, the evidence suggests a murkier role for open data in COVID vaccine development

Genetic sequencing data was quickly shared during the early stages of the crisis, but this kind of rapid sharing normally happens anyway in global health emergencies (such as AIDS, Zika and Ebola; the World Health Organization has well established guidelines for this). Rapid sharing happened during the COVID crisis as well, along with a surge in open access preprints (preliminary research that hasn't yet been peer reviewed yet), but this much hyped surge actually constituted ony a small fraction of the total number of articles published on COVID (Brainard 2021). In addition, the total number of datasets made publicly available to researchers and the number of peer reviewed COVID articles authored in traditional format were not exceptional, especially the information that was of a usuable quality. A high percentage of papers published during this period were junk, focusing on topics like hydrochloroquine, which misdirected both scientists and the public. This isn't surprising. The rapid and widespread sharing of actually useful and usable data happens far less frequently in medical research than open access proponents imagine for a number of reasons. Chief among these reasons in medicine are intellectual property concerns (since a lot of research work is industry sponsored and has patents attached), and privacy protections for clinical trials participants.

What did make a significant difference with accelerating COVID vaccine development—apart from global sharing of the sequencing of the SARS-cov-2 genome—was cutting the evaluation and safety monitoring times for moving from phase 1 to phase 3 clinical trials (where phase 1 trials look at safety and efficacy in small groups, and phase 3 trials are widespread and involve thousands of volunteers), widespread dedicated funding for this work, and the parallel production of all possible vaccine candidates so that by the time the winning candidates crossed the line, vaccine doses were already manufactured, bottled, and distributed to staging areas around the world. In addition, established journals were able to squeeze efficiencies out of the system and do more with less over the short term, managing higher submissions and reviewing more papers faster.

This isn't an example of open access, open data or open science. It's an example of accelerated research logistics like the world saw with NASA's Apollo program in the 1960s. In this case, these logistics cut years off the normal drug development timeline. Indeed, we're really burying the lede by claiming that this miracle of science was a victory for open. The evidence suggests that instead, we should focus more on the sorts of process improvements we used with COVID vaccines if our goal is to speed discovery, and not rely (incorrectly so) on open solutions alone to deliver the benefits we need.

how our OSI2022 researcher survey participants define open). Misinterpretations also happen at the analysis level: it's often the case that policymakers and analysts misconstrue the facts about open because they are, for example, looking at only one index (typically limited to high impact STM journals), examining journal-level statistics instead of article-level statistics (there are a great many journals that produce very few articles), categorizing all green articles as open (when in fact the majority of archived green is still copyrighted material), or assuming that all open is CC-BY licensed. One needs to read the fine print on studies to make sure we're really comparing apples with apples.

- **NUMEROUS CONCERNS:** It is well established that many researchers have a variety of reasons for not favoring blanket open solutions, including but not limited to affordability, reliability, sustainability, practicability, usability, privacy, and secrecy. Please see OSI's other Policy Perspective reports for more information and references. The negative impacts of these policies are also a major concern, varying by field, region, type of open, and more. Our policy solutions need to work for all researchers everywhere and not just STM research in the US and EU.
- **A WORLD OF ACTIVITY:** The open access policy reform space encompasses a diverse array of actors, definitions, methods, needs, barriers and goals, as well as an endless variety of motives, adaptations, and best practices. There is also a great deal of inspiration and innovation from all corners. No one is sitting still; everyone is listening, learning, and developing new tools and systems for the future. Some of this development is aligned with the idealism of Plan S; some is focused on national interests; some is more narrowly tailored to institutions or disciplines. This is all far more activity

than any one organization can track, including OSI. Developments are everywhere and often well below our radar; debates in one corner of the open universe are often completely disconnected from and uninformed by debates in another corner; information issues of great relevance in one field are completely unheard of in another field; policy issues of great relevance in one region have no priority in another region.

As an observatory, OSI hasn't been able to keep pace with the totality of these developments and synthesize them for consideration by UNESCO. We have done what we can with our limited funding, but we are also aware of our limits and of the limits of any group making policy or advising on policy. Perhaps it is because of all this diversity and activity that policymaking bodies have seemingly given up trying to embrace it all and are instead simply buying into overly simplistic depictions of open that aren't accurate or representative. Or, maybe OSI's message about diversity just isn't getting through to policymakers as well as open advocacy messages. Either way, as Jon Tennant observed in 2019, our lack of common understanding in this space has "impeded the widespread adoption of the strategic direction and goals behind Open Scholarship, prevented it from becoming a true social 'movement', and separated researchers into disintegrated groups with differing, and often contested, definitions and levels of adoption of openness" (Tennant et al. 2019).

TABLE 3: WHICH OF THESE CONDITIONS ARE NECESSARY FOR RESEARCH INFORMATION TO BE CONSIDERED "OPEN"?

Condition	% saying this is OFTEN or ALWAYS important
The work is published according to best practices (e.g., such that it is properly reviewed, indexed and archived)	88%
The information must be free to read	83%
The work is transparent as necessary for all good research (e.g., with regard to methods, sources, funders, and potential conflicts of interest)	80%
Data is included	73%
The information must be available to read immediately without any delay (e.g., subscription journals often impose a 12-month embargo for non-subscribers)*	73%
Publishing costs are paid by authors (or their funders or institutions), not by subscribers	44%
The publisher discloses their profit margins to the public	44%
The protocol (if there is one) is pre-registered	44%
The publisher avoids mixing free to read content with subscription content (as is currently the case with the journals published by most scholarly societies)	34%
The information can be re-used in any way without your permission (including copying and pasting everything and selling it commercially)	27%

Source: OSI2022 Global Researcher Congress, week 2, questions 8 and 9 (Hampson 2023).

*This response is analyzed in OSI Policy Perective 5 (Hampson 2023). Concerns other than embargoes may also be reflected here, including publishing delays and library access delays. Future surveys will try to understand this concern more precisely.

BOAI signatory Leslie Chan agrees. Long a powerful advocate for the development of open access policies, Chan notes in his latest work that "Far from a democratizing force, open science has become a practice of complying with standards and funders' policies and mandates, further exacerbating deep-seated structural inequalities in knowledge production. Reflecting on our many failed attempts at reclaiming the knowledge commons and co-creating open infrastructure, I call for new imaginaries and narratives of what open scholarship may look like or aspire to be." (Chan 2023)

SUMMARY OF POLICY OPTIONS

What might Dr. Chan's new and improved global open scholarship narratives look like? At their core, these ideas must be built on solid foundations of researcher input and support, fact-based assessments, and global equity. They must also embrace diversity. Given the many different paths, histories, ideas, perspectives, needs, methods and goals of open, layered atop a vast diversity of regional and

...as Jon Tennant observed in 2019, our lack of common understanding in this space has "impeded the widespread adoption of the strategic direction and goals behind Open Scholarship, prevented it from becoming a true social 'movement', and separated researchers into disintegrated groups with differing, and often contested, definitions and levels of adoption of openness"

institutional resources, global open policies cannot possibly prescribe how open is defined in all circumstances and how it must be addressed, nor should these policies aspire to do so. Rather, they should embody and empower an affirmation of our common goals and needs, and be built around flexible frameworks for addressing these goals and needs together so that no field, institution or region of the world is left behind. Research is and always has been a global enterprise. Preserving this inclusive and unifying aspect of research is essential.

There are many examples of policies that meet these requirements. Boxes 10-12 on the following pages describe a dozen such policy frameworks that have been mentioned at some point in OSI since 2015 (which doesn't indicate an endorsement; we're just noting that these ideas, among many others, have been noted over the years in reports or discussions). Table 4 illustrates the main differences between these frameworks (bearing in mind that hybrid policy frameworks could certainly be constructed). The most significant difference between these policy frameworks is that some are more complete and action-oriented than others. Only one (Plan A) is truly comprehensive, meaning it has all the features needed to fully reboot the global OA policy mindset. Six policies are action-oriented, meaning their main reason for being is to develop new solutions to open. The remaining five policies are passive, which isn't to say they are ineffective, but that they lead from behind by laying the groundwork for and encouraging the development of new OA solutions, but stop short of investing the time and money needed to develop and pilot these new solutions. All frameworks are flexible and general, all embrace a diversity of approaches to open, and all lead to the same end point: A world where research is being shared more freely, and in a manner that maximizes collaboration, objectivity, and equity. Being general and flexible, all these policies can interact with each other at the margins in productive ways.

IN PRAISE OF GENERALITY AND INCLUSION

None of these policy frameworks are fully developed, which is an intentional oversight. Filling in the policy particulars is best left to governments, research networks and individual research institutions after they choose the most appropriate OA policy framework for their needs. This is an important point. Laws, codes, and statutes require specificity, whereas policy guidance is often best described briefly. For instance, the UN Declaration on Human Rights contains 1772 words (UN 1948) and describes these rights only in general terms.[20] The United States Declaration of Independence contains only 1337 words (not including the names of the signers). In contrast,[21] UNESCO's 7400-word declaration on open science (UNESCO 2021) hits most of the same high notes about open as OSI's Plan A, but then goes on to bury these overarching ideals under mountains of detail specifying acceptable outcomes. Would-be adopters are likely to miss the main points of this policy, or worse, ignore them because they agree with the overall tone but disagree with the specifics. Imagine if Thomas Jefferson had written an additional 5,000 words about his predictions for the future of the United States and his specific implementation requirements. Would the impact of his first 1337 words have diminished?[22]

20. As an aside, article 27 of this declaration states that "Everyone has the right to the protection of the moral and material interests resulting from any scientific, literary or artistic production of which he is the author." It's possible that open access mandates conflict with this article to the extent a researcher's copyright interests are taken away unwillingly, or a researcher's data is made public before they have a chance to analyze it.
21. Not to pick on anyone here, but just by way of relevant example.
22. In the case of the US, the exact details on how to operate a democracy have been added over hundreds of years as the needs and structures have become clearer, beginning with the Articles of Confederation in 1781, followed next by the Con-

TABLE 4: TWELVE POSSIBLE OA POLICY OPTIONS

		POLICY OPTION											
		Compre-hensive	Action-oriented						Passive				
		Plan A	Common ground	Research comm	Nework-centric	Stake-holder	Tech-centric	Hail Mary	Research-centric	4-point	Mani-festo	Procla-mation	Doc-trine
KEY FOCUS POINTS	General & flexible	■	■	■	■	■	■	■	■	■	■	■	■
	Recognizes a societal obligation for open			■				■		■			■
	Embraces a diversity of policy approaches	■	■	■	■	■	■	■	■	■	■	■	■
	Improves global equity	■	■	■				■		■	■	■	■
	Values evidence over ideology	■	■	■	■	■	■	■	■	■	■	■	
	Works on specific solutions	■			■	■	■	■					
	Works on major goals (like climate change)	■	■										
	Looks to the future	■	■							■	■	■	
KEY ACTIONS	Learn more about OA*	■							■				
	Learn more about researcher needs	■		■	■	■	■		■				■
	Design & deploy new policies	■	■	■	■	■	■	■					
	Collaborate on common ground	■	■			■				■	■	■	■
	Address connected issues (like impact)	■									■	■	
	Work to make more research open	■	■			■	■	■		■	■	■	
	Make most critical info open asap	■	■										
	Improve open stan-dards & guidelines	■	■	■		■					■	■	
	Improve global research infrastruc-ture	■		■			■	■					■

*Develop a better understanding of how open is working (or not), how it works in various information ecosystems, its diversity and interactions with respect to different types of open and different form (code, text, data, OER, etc.), case studies of best practices, economic analyses, and more.

If we truly endeavor to build a world where open research reaches its full potential, then generalities that get us on the same page and empower us to work together toward common goals are the only way forward. We can't change the future, after all, by first unilaterally deciding what this future will look like[23] and then prescribing exactly how all of us must get there. Much like Jefferson's goals for democracy and freedom, our community's goals for scholarly communication can serve as guideposts and inspiration. To the extent our policies exclude researchers, fail to address their needs, or make research communication worse, we end up nipping the flower in the bud.

stitution in 1788 after years of heated debate, and followed thereafter by 200-plus years of amendments, laws, regulations, and agency policies. The Declaration provided the initial vision guidance; the Constitution provided a framework for operating policy.

23. In this case, especially given that we haven't even begun to wrestle with how developments such as artificial intelligence, big data, blockchain, quantum computing and other technological innovations will affect research and research communication in the coming decades.

BOX 10: COMPREHENSIVE POLICIES

PLAN A

OSI has long advocated an approach to open solutions that recognizes our common ground and common interests and requires us to work together. OSI's Plan A describes one such approach (see plan-a.world; also see the Annex section of this report). Plan A was launched by OSI in April of 2020 as a trial balloon to see what kind of feedback this general concept would receive. About a dozen organizations and individuals signed on to the plan, but we didn't make a concerted lobbying effort to collect signatures. In the final analysis, this approach may be too involved and too detailed for most. It makes sense as the framework for a years-long international effort to build a new open solutions policies from scratch, but the political and funding support for this kind of approach doesn't appear to exist.

Plan A recommends that the international scholarly communication community begin immediate and significant action to:

- Discover critical missing pieces of the open scholarship puzzle so we can design open reforms more effectively;
- Design, build and deploy an array of much need open infrastructure tools to help accelerate the spread and adoption of open scholarship practices;
- Work together on finding common ground solutions that address key issues and concerns (see OSI's Common Ground policy paper for more detail, Hampson 2020); and
- Redouble our collective efforts to educate and listen to the research community about open solutions, and, in doing so, design solutions that better meet the needs of research.

In pursuing these actions, our community should:

- Work and contribute together (all stakeholders, including publishers);
- Work on all pieces of the puzzle so we may forge a path for open to succeed;
- Discover missing pieces of information to ensure our efforts are evidence-based;
- Embrace diversity;
- Develop big picture agreement on the goals ahead and common ground approaches to meet these goals; and
- Help build UNESCO's global open roadmap.

Plan A recommends that the community's work in this space be:

- Common-goal oriented;
- Accountable;
- Equitable;
- Sustainable;
- Transparent;
- Understandable; and
- Responsive to the research community.

Writing in generalities can also lead to policy that is more inclusive, not only because we don't actively foreclose options, but because we invite a broader range of input, interpretation, collaboration and innovation. A famous (and probably overused[24]) example from public policy history is how the world's major urban centers were struggling in the late 1800s to dispose of increasingly large piles of horse manure. Horses were still the dominant form of transportation, and city streets were piling high with millions of pounds of horse manure every day. Architects in New York began building stoops on all new buildings, elevating front entrances a half-story from street level so they could stay above the mountains of waste and all the flies and rats it attracted (Paul 2016). New York city planners predicted that at the current rate of accumulation, city dwellers would be buried several stories deep in horse manure by the 1930s. Something had to be done.

When the world's first international urban-planning conference was held in 1898, it was dominated by discussion of the manure situation. But the architects, public health officials and social workers who attended were unable to imagine cities without horses—industrialists and innovators were not invited

24. But this example is memorable so we'll use it.

BOX 11 (SECTION 1 OF 3): ACTION-ORIENTED POLICIES

COMMON GROUND FRAMEWORK

OSI's 2020 Common Ground policy paper (Hampson 2020) describes in detail what a common ground approach to open solutions policies might look like. This approach isn't quite as extreme as the total policy reboot called for in Plan A. It might appeal to governments and institutions who want a foundational framework to justify open policies, but don't want to invest the time and resources into rebuilding a framework from the ground up. The main focus of this approach is on controlling the direction of open so it makes sense for research and is producing the desired benefits. The core ideas of this approach are as follows:

- Work together to get all research materials somewhere onto the DARTS open spectrum (see Fig 1). Around 70 percent of the world's research is closed and off the spectrum entirely (according to Piwowar 2018, and not even counting research materials we're excluding like industry and government reports). If we can focus on getting more research somewhere onto the DARTS by valuing all types of open outcomes and not judging which outcomes are superior to others, then over time we can work together to improve all open outcomes.
- Work together to immediately improve access where it's most needed. What kinds of outcomes are wanted by researchers and where? Where are improvements needed and why? Where possible, we can solve these access gaps quickly through targeted reforms instead of through slow systemic changes.
- Work together to improve and clarify standards and guidelines so researchers know exactly what is expected, why, how they will pay for open work, how they will benefit, what tools and resources are available to use, how their efforts will be evaluated, and so on.
- Develop different open policies for different users and audiences. Learn about the unique needs and perspectives involved (especially researchers) so we can work together to build the best solutions to the most pressing problems. Involve researchers in this process. They are the key stakeholders in research communication but are usually not consulted about reform efforts in any meaningful way. Help them work together on relevant challenges in ways that fit the needs and norms of their fields.
- Work together (whether this means by field, or by institution, network, government, region, or whatever makes sense) across all stakeholder groups to to address urgent research needs and achieve common research goals. The community should also focus on grand research goals like climate change and cancer. These broad and ambitious goals are the most challenging to solve but they also bring the most ideas and resources into focus, and provide a vector for sustainable funding and the nurturing of large datasets (and from this focus, the development and sharing of highly effective best practices).
- Discourage ideologically hardened solutions (e.g., we must do things this way because BOAI says so) that make it difficult to work together as a community. Value diverse perspectives and follow the evidence instead to address real needs with realistic and effective solutions. Also, set realistic expectations. Be wary of claims that open solutions are a panacea for all that ails research.
- Integrate different areas of open advocacy. The open access community should not be developing open data policies for example; we need more collaboration in order to create policies that make sense and will have the desired impact.
- As they are encountered, fix existing open policies as needed to mitigate undesirable side effects, particularly those that are reducing equity. Also work to address the many issues related to open research, from impact metrics to peer review to the culture of communication in academia. Our open future will not reach its full potential without a substantial and sustained effort to reform these issues.
- Pilot useful open solutions—not just solutions that make information open, but solutions that can combine, curate and standardize data, make new connections, bridge the gaps between disciplines, see new fields, and make new discoveries—in short, do work that proves open is the future.
- Look beyond. As a community, look beyond the journal article and figure out what we really need. What tools and systems should we build? To what end (specifically)?

because urban planning at the time was mostly about architecture (Erickson 2014)—so the conference adjourned after just three days (Morris 2017). Fortunately, a technological solution to this crisis emerged soon thereafter. Electricity had just started arriving to cities in the late 1800s, and the internal combustion engine was catching on. By the early twentieth century, cars outnumbered horses and electric trolleys replaced horse drawn ones. The manure crisis was averted (albeit, exchanged for the beginning of the climate change crisis).

BOX 11 (SECTION 2 OF 3): ACTION-ORIENTED POLICIES

RESEARCH COMMUNICATION APPROACH

Rather than focusing only on open access, governments, funders and research institutions might instead choose to focus on improving research communication writ large. The need to improve research communication is well established and many of the aspirations for OA policy actually have more to do with research communication than OA. The ideal OA policy may therefore be a subcategory of policies designed to help address broad research communication needs and priorities. These needs and priorities will vary by field, institution and region. From a global perspective, if this approach is used, then a research communication-based OA policy framework might look something like this (from OSI's 2022 researcher surveys; these priorities are discussed in more detail later in this report):

- Improve policies and systems that help researchers stay up to-date on the latest information in their fields.
- Improve research data repository and processing systems so researchers can get the most benefit from sharing their data and being able to see and use other research data.
- Improve policies to help lower the costs of research publishing and access.
- Improve policies that help researchers receive equitable credit and recognition for publishing in open formats (instead of focusing primarily on the high impact journal record).
- Improve systems that help researchers communicate with each other and with policymakers and the general public.

NETWORK CENTRIC

A more narrowly focused strategy is to facilitate the development of information and data sharing networks in specific fields. Doing this would leapfrog the need for getting everyone on board with specific policies. Instead, only the most motivated networks of researchers would seek support for this work and reap the benefits of more open engagement. Over time, best practices and lessons of experience will emerge from this genre of open engagement that will make future networks easier to start and more effective. These networks need:

- Commitment to a fundable goal (like sharing the data from all research in one area of study).
- Dedicated funding to support research data collection, curation, synthesis, long term maintenance, and outreach (to network members). Depending on the needs and goals involved, this could mean several million dollars annually. An overly broad goal like sharing all research from all studies is unlikely to attract a funding patron. Smaller (but still ambitious) networks centered around discrete research fields are more fundable.
- Flexibility. Every network will have unique needs and requirements regarding data architecture, data formats, data gaps, privacy restrictions, usage restrictions and so on. A centralized effort to help these networks grow and thrive can help provide funding, infrastructure and best practices so that each new network isn't tasked with reinventing the wheel.

Experts who stay in their own silos make bad predictions about big picture issues....

This parable has been told many times with varying aims. Climate change deniers have used it to claim we shouldn't worry about global warming because technology will come to the rescue; anti-regulation types have used it to suggest that all government policymaking efforts are comically flawed. In this case, the lesson we're drawing out isn't denialism or blind faith, but the power of inclusion. Experts who stay in their own silos make bad predictions about big picture issues, from the architects, public health officials, and social workers who met alone in New York to discuss the future of horse waste, to the many business, military and engineering tycoons around the world who never saw a practical use for what the Wright brothers had invented, to politicians who never saw the need for social safety nets, to tech wizards who thought the computer would never amount to more than an electronic recipe box, to techno utopianists who thought the Internet and social media would only lead to global peace and understanding. For complex and interconnected challenges, one group alone cannot see the full picture.

BOX 11 (SECTION 3 OF 3): ACTION-ORIENTED POLICIES

COORDINATED STAKEHOLDER-DRIVEN POLICIES

OSI's Common Ground and Open Solutions policy perspectives (Hampson 2020 and 2021), describe what kinds of reforms can happen and are currently happening at the individual stakeholder level. These types of reforms aren't neces-sarily new. What would be new and helpful is if these groups could start coordinating ther action more broadly (to the extent possible since publishers can't collude), and also start building their efforts on evidence-based foundations rath-er than on the shaky precedent of BOAI (simply duplicating bad policy isn't the ideal). If we pursue a more collaborative and evidence-based approach, we might end up with a framework of interlocking OA policies that makes sense. For example, at the OSI2017 meeting (see OSI 2017), representatives from different stakeholder groups identified a num-ber of top priorities. Infrastructure groups agreed they could help push for more global standards and integration; journal editors wanted to work together to improve global journal standards through mentoring and networking; libraries discussed working together to improve the global capacity for open; open knowledge groups suggested reducing the jargon around open to make it better understood, and to also establish better financial sustainability for a diverse open environment; commercial publishers offered improving the ability of coordinating groups like OSI to engage on this issue; research universities noted the need to think more critically and creatively about developing programs and plat-forms that meet the actual needs of researchers; and scholarly communication experts recognized the need to continue learning more about the open space and gather more input from researchers, Each of these stakeholder group actions is effective; woven together in a coordinated fashion, they would create a powerful and sustainable force for change.

TECH-CENTRIC APPROACH

A tech-centric approach to open policy reform focuses on developing technical solutions to open without necessarily being wedded to any single open policy. In this sense, it is an important generalist approach to open solutions. Also, the advocates and audiences for various tech solutions already exists, as well as the funding in many cases; this approach is not necessarily new. What is needed in this solution space is more funding and action, particularly with regard to improving the global infrastructure for research, including:

- More xml formatting of journal articles, which allows for easier sharing and mining of articles
- Better and more widespread use of research object identifiers like PIDs and DOIs, and researcher identifiers like ORCID
- More infrastructure work: Better resources and services are needed for research communities around the world to conduct research and to archive, analyze, and share their findings. Different organizations are working on different aspects of these challenges. Many of the most needed and reliable management resources are private, however, which is problematic over the long term with regard to accessibility, accountability, and making needed reforms (from major indexes which are heavily weighted toward Western STM publishing, to impact factors that over-value citations and are therefore easily gamed, to needed lists of predatory journals that are privately calculated). Community ownership and operation may require public (or at least community-wide) funding. Data repository development and integration may be the most pressing infrastructure challenge, however. At present there are thousands of different data silos and data standards. Continued work on standards and interoperability is important, as well as focusing on improving the infrastructure resources and data processing capabilities available for researchers everywhere.

HAIL MARY

In American football, a Hail Mary happens when the quarterback throws the ball as far downfield as possible in an attempt to score quickly. There are a number of policies in research communication reform that fit this description—decidedly action-oriented but still considered too far on the fringes to be taken seriously (yet). These actions include (but are certainly not limited to):

- Develop a global All-Scholarship Repository (ASR; see the Annex section for details), and as part of ASR, nuture the development of new kinds of science communication professionals who are funded by research grant overhead charges and whose job is to manage and improve research communication workflows and outputs.
- Buy the entire backlist of research publications currently held by commercial publishers and make everything publicly available immediately. Assuming this could even be done, the cost might be many billions of dollars,* but this amount could be split between governments (based on research output, so the US and China would each contribute close to a quarter of this amount—an unlikely possibility if the price is actually this high).
- Deploy AI tools to help root through. coalesce and translate global research, looking for more connections and previously unknown work. Developing a better understanding where to focus research will make our research spending more efficient and effective, and will also lead to more breakthroughs and faster discovery.

* The combined 2022 revenues for the largest commercial academic publishers was approximately US$5 billion. Publishers making huge profits for many years (as is the case here) can be valued at 20 times earnings. However, the goal wouldn't be to buy the companies, just the backlists.

BOX 12 (SECTION 1 OF 3): PASSIVE POLICIES

RESEARCH CENTRIC

Similar to Plan A, a research-centric policy framework might appeal to governments and research institutions who want to do more but also want to base their policy designs on objective evidence. Unlike Plan A, however, there is no commitment with this policy approach to work together or to design and deploy new open solutions—just a focused commitment to find answers that better inform decisions about what to do next (if anything). The action items in this approach are to:

1. Develop a clearer understanding of how open ecosystems work in text, data, code, government, and OER.
2. Collect case studies highlighting the variety of open approaches used in each of these open environments. Focus on examples that constitute the most common and impactful use, not necessarily all outlier solutions.
3. Evaluate the economics of each of these open approaches. Where (if anywhere) are we saving costs? Where are costs being shifted? What are the current and emerging financing impacts and sustainability concerns? (Note that most of this analysis already exists.)
4. Identify the best practices and lessons of experience across fields and types of open.

AFFIRMATIVE 4-POINT POLICY

An affirmative 4-point policy framework is a cheerleader approach, encouraging the adoption of open solutions without explaining the reasons why or specifying a course of action. This approach is good if the goal is to simply nudge research toward more openness but not necessarily toward specific solutions, and if adopters don't want to do all the fact-finding, piloting, and collaboration needed in the common ground approach. The four affirmations of this policy approach are as follows:

1. Knowledge is a public good. It is vital for the continued and equitable progress of knowledge that public knowledge be made freely available for everyone everywhere to see and use. Therefore, free to read should be our default mindset for all research communication. From there, we should expand as possible (e.g., for code, data, or unrestricted reuse), or restrict as needed (e.g., to protect patient privacy, patents, government or industry secrets, etc.).
2. There are many stakeholders in the knowledge production process, and each stakeholder is part of this process, not the owner. Stakeholders must therefore work together to ensure all viewpoints are represented and that communication solutions are equitable, sustainable, and in the best interest of research.
3. Open solutions will necessarily come in a variety of forms, including forms that may not be ideally licensed or that may limit access to more finely curated or processed information. While it is important for public knowledge to be freely available for everyone everywhere to see and use, we must at the same time acknowledge the incentives and needs for systems that collect, curate, publish and analyze information and whose outputs may not be publicly accessible. Research requires both: not just piles of raw, unprocessed information, but also value-added outputs that take time and resources to develop. Our focus should be on what we're trying to accomplish with open rather than what open means and the methods we employ.
4. Innovate and learn. Don't lock into ideological-driven policies that are built on scant evidence and may in fact create negative consequences for access. Flexibility and innovation are key.

Making global research more open is one such complex and interconnected challenge, and it doesn't lend itself to neat answers. If we're trying to help researchers succeed, we first need to develop as broad and accurate an understanding as possible about how the global research environment works. In this environment, researchers are the key stakeholders. It is essential to secure their input and involvement.

It may be surprising to note, then, that suitably large numbers of researchers have never been consulted in any meaningful way on any of the major OA policies currently in use.[25] The need for open has been pushed by governments, agencies and funders, and the solutions in place have been designed

25. UNESCO did consult a variety of science groups and institutions as part of it's open science policy effort, but these groups did not represent a variety of views and interests with regard to open, and researchers themselves were not consulted.

BOX 12 (SECTION 2 OF 3): PASSIVE POLICIES

MANIFESTO

Manifestos like DORA aren't policies per se, but they can read a lot like a 4-point policy or a common ground policy in that they help raise awareness and steer thinking. An open manifesto OSI proposed in 2018 reads as follows:

> Recognizing the importance of research to the future of humankind,
>
> Considering there are a wide variety of research fields in the world today, each with unique needs and perspectives,
>
> Acknowledging that researchers, research institutions and global regions everywhere are not equal with regard to their ability to participate in or reap the benefits from research,
>
> Committed to ensuring that that future of research communication is both effective and more equitable, and,
>
> Building on the work of the Open Scholarship Initiative (OSI), which has been engaged in partnership with UNESCO since 2015 to build such an effective and equitable framework for the future of global research communication, and building as well on the numerous efforts with related goals, such as DORA, FAIR, BOAI, the Leiden Manifesto, and the Lindau Guidelines,
>
> Together resolve that research should adopt these 10 policy goals for research communication—that researchers everywhere should:
>
> 1. Follow and help improve established best practices regarding the ethical conduct of research (as outlined in existing legal frameworks, institutional guidance, and more). This is relevant to research communication insofar as faulty research that gets published and publicized, that uses forged data or fake analysis, or that plagiarizes other research poses a threat to the research ecosystem.
> 2. Avoid publishing in fake and predatory journals, which lack adequate safeguards to ensure the work they publish is of sufficient integrity.
> 3. Make research work readily available and discoverable to research peers worldwide to the extent possible (taking into account concerns such as competition and misuse). This goal is achievable through a variety of means, from publishing work in some type of "open" format (of which many varieties exist), to ensuring that data is included with work, ensuring that old work doesn't sit in file cabinets, and ensuring that null-hypothesis outcomes get published.
> 4. Support efforts to improve equity in research through improved access, through the recognition and reduction of funding and evaluation biases, and other means. As part of this effort, be aware that "one-size-fits-all" solutions crafted in the Global North (such as the article publishing charge) may harm equity and access for researchers in most parts of the world.
> 5. Support efforts to make research work more accessible to policymakers and the public through journalism, outreach, plain language abstracts, and other means.
> 6. Follow established best practices with regard to archiving and preserving the published research record.
> 7. Participate in reviewing and critiquing the work of peers worldwide (however these processes continue to evolve).
> 8. Evaluate research based on merit, not on its "impact", or the "impact factor" of the journal in which research is published.
> 9. Support continuous efforts to improve research replicability, reliability and transparency.
> 10. Support efforts to improve the usability and reusability of research and research data (by means that include but are not limited to using more open licenses, sharing data through research networks and repositories, supporting data standards work, and more).

BOX 12 (SECTION 3 OF 3): PASSIVE POLICIES

PROCLAMATION

A longer version of the manifesto is the proclamation. OSI proposed an open solutions proclamation in 2021 (Hampson 2021; also, see the Annex section of this report). The principle of the proclamation is the same as the manifesto, but it has more trappings of diplomatic language. Our 2021 proclamation closely follows the logic and rationale for Plan A and is modeled after the opening language of the 2021 UNESCO Recommendation on Open Science.

DOCTRINE

Doctrines like FAIR and the Panton Principles are also effective ways of encouraging policy development (to the extent these doctrines form the basis for policies but aren't complete policies by themselves). For this report, historian Jason Steinhauer reviewed the key research information doctrines developed over the last several decades (part of his work is contained in Box 1). We can convert Jason's synthesis into a new doctrine for open communication in research—we'll name it the Tennant Doctrine in honor of our late colleague Jon Tennant—built on our historical need for sharing research information and grounded in the reality of how sharing takes place today:

1. All actors in the researcher ecosystem have a responsibility to engage, communicate, and distribute information widely and equitably across the world. No actors within this ecosystem are shielded from that responsibility, regardless of how well they benefit from the current models.
2. More must be done to meet researchers where they currently are, recognizing that they will not abandon current models and systems overnight if there are not proper incentives and rewards for them to do so.
3. New investments in infrastructure and culture must be made to make the transition to open access smoother and more sustainable.
4. Global conversations must be held that are diverse and multi-stakeholder, to ensure the knowledge sharing inequities of the past are not repeated in the future.

by governments, funders, open activists, libraries, and publishers.[26] Researchers haven't even been consulted after the fact; it sometimes seems the only time the OA community hears from researchers is when they sign petitions complaining about the OA policies that have suddenly intruded on their academic freedom (see, for example, Kamerlin 2018).

In everyone's defense, researchers are not a monolithic group. From art historians to virologists, astronomers to sociologists, postdocs to emeritus professors, academicians to private industry experts, there is no typical profile of a researcher and no single group of researchers whose opinions can serve as a proxy for all researchers everywhere. Researchers are also busy, not just with their research work but in many cases also with grant-writing, teaching, mentoring, attending conferences, writing papers, and more. All this diversity and scarcity makes it difficult to truly understand the perspectives of all researchers everywhere when it comes to designing policy.

Still, given how important it is to include researchers in conversations about the future of research communication, this oversight is significant. OSI has tried to include as much input as possible from researchers in its deliberations over the years. A number of prominent researchers have participated in our conferences and online discussions, and we have made every effort to incorporate their viewpoints into our analyses and recommendations. Several large surveys have also been conducted in recent years that attempt to measure various facets of researcher opinions about open access. We have reviewed all this work, and also attempted to fill some remaining gaps in our understanding by conducting our own global surveys of researchers in early 2022.

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26. Of course, libraries and funders serve researchers, so they endeavor to craft policies in the best interest of the individual researchers they serve (as well as students, administrators, and others). However, in any large scale and representative sense, researchers are not now nor have they ever been directly involved in the global OA policymaking process. As a group, they are not driving the conversations about need, or creating OA tools and processes. Researchers are also likely to be working on open solutions separate from official open access policy efforts. For example, they may primarily rely on a wide array of open data tools and processes (such as data sharing networks) which are not typically represented in open data policy conversations.

SUMMARY OF OSI'S 2022 RESEARCHER SURVEYS

Box 13, below, contains a summary of key findings from the major researcher surveys conducted over the last five years. These surveys give a consistent portrayal of researcher perspectives across many fields, institutions and countries, where researchers generally dislike APCs, have concerns about sharing and reuse, and value academic freedom, journal quality, and impact. Researchers aren't necessarily happy with current OA policies, but they aren't particularly aware of the details or agencies involved.

BOX 13: SUMMARY OF KEY FINDINGS FROM MAJOR RESEARCHER SURVEYS

Researcher attitudes about communication practices have been measured through a number of quality surveys in recent years. The surveys cited below are listed separately in the Annex section of this report. An overview of all these non-OSI surveys reveals a pattern consistent with the findings from OSI's 2022 researcher surveys (see Box 14):

- Most researchers believe there is value in anyone being able to access their research (Taylor & Francis 2019, Wiley 2019a).
- Most who publish in open format are motivated by the desire to increase the impact of their work. Only about a third are motivated by the desire to increase transparency and reuse (Wiley 2019a). In open data, the reuse motivation is higher—maybe around a half (Wiley 2019b).
- Most researchers know relatively little about the details of ongoing research communication reform efforts and policies (Taylor & Francis 2019).
- Only a fraction (maybe as low as 1 in 5) believe funders have a right to control where to publish. For 84% of researchers, the single most important factor in research communication is allowing scholars the freedom to publish where they choose (Taylor & Francis 2019)
- There are a host of concerns about data sharing and reuse. The most commonly cited problems are a lack of suitable infrastructure for data sharing, and a lack of incentives. There are also concerns about misuse and scooping, concerns about copyright and licensing, and the time and effort needed to make research data openly available (Perrier 2020, Davies 2019, Stuart 2018). Other concerns include fairness (where better resourced researchers with superior computing facilities mine open data), science deniers (where "requests for information are motivated by the desire to discredit their work and professional reputations"), a lack of oversight regarding compliance, and difficulty adapting FAIR requirements to datasets that are also constrained by sensitivity and privacy considerations (Hrynaszkiewicz 2021).
- Designing new data sharing philosophies and systems that allow data and research to make more of an impact is preferable to doubling down on our current approach that simply enables more sharing and reuse. Our current systems which are filled with bad and incomplete data and fraught with peril—relying on bad datasets, getting scooped, an imbalance between risk and reward, etc. (Hrynaszkiewicz 2021, NASEM 2020, Faniel 2020).
- The top priorities for researchers when picking a journal are roughly as follows (with response percentages starting at around 90% and dropping to 65%): the journal has a good reputation in field, it is well read, it focuses on the researcher's specific area of research, it has high impact factor, it is free to publish in, it belongs to a scholarly society in the researcher's field, and it has short turnaround times. Whether the journal is fully open access ranks dead last at 30 percent (Taylor & Francis 2019).
- CC-BY has historically been the least preferred type of license. About a third of researchers dislike this type of license the most, while only 10% like it the most. Conversely, CC-BY-NC-ND has been the most preferred type of license (Taylor & Francis 2019).
- Opinions about APCs vary by wealth, region, career stage and field of study (Segado-Boj 2022). Time period is also a factor since the negative affects of APCs are only now coming to light. In 2019, most researchers (particularly in the Global South) reported not having the funds to publish in open access (Wiley 2019a, Scaria 2018). Also in 2019, most researchers reported that if everything was published in APC format it would have a large negative effect on their ability to publish, with AAAS survey respondents reporting the need to make tradeoffs between research and publishing (Taylor & Francis 2019, AAAS 2022).
- Overall, the top problems in academic publishing may rank something like this for many researchers: Pressure to publish in high-impact journals, publication delays, paywalls, lack of accurate measures of journal/paper quality, insufficient publishing-related resources, inadequate benefit of peer review in improving quality, irreproducibility, and tedious journal processes (Editage 2018).

These findings largely align with what we found from OSI's 2022 researcher surveys, summarized in Box 14.[27] From these surveys, we learned that most researchers want new communication solutions and are ready to embrace the ones that address their key needs. These needs are most urgently to lower the costs of journals for authors and institutions, and also to improve research infrastructure, narrow the global access equity gap, make more journal articles (plus accompanying data) free to read and quickly accessible, find the right research papers to read and stay up-to-date on the latest research, ensure free classroom for journal articles use while limiting misuse and commercial reuse, ensure the continuation of a high quality publishing environment, retain the freedom to decide where to publish avoid one-size-fits-all solutions, ensure proper credit and recognition (especially as it relates to advancement), make more of an impact on society, improve collaboration and communication with colleagues in the same field, and reduce administrative workload and improve funding sustainability.

Overall, this group recognizes that developing successful OA policies will require broad collaboration, and that researchers are a key stakeholder in this conversation. They also believe science and society will benefit from the right policies. However, these policies cannot be one-size-fit-all approaches anchored in a limited understanding of the broad spectrum of global research communication needs and perspectives, or in the idea that open is a narrow construct since there are in fact many different kinds of open.

BOX 14: SUMMARY OF KEY CONCLUSIONS FROM OSI RESEARCHER SURVEYS

OSI's 2022 researcher surveys returned findings that are consistent with the other major surveys of researchers conducted over the last several years. The main conclusions from OSI's surveys are as follows:

- The overwhelming majority of researchers think there are better ways of structuring research communication, and would like to hear about and explore new ideas and policies. Indeed, most say there is an urgent need for many reforms in scholarly communication, led by lowering costs. However, only a few think these reforms should involve reinventing the wheel or creating one-size-fits-all policies for all researchers everywhere. In addition, most researchers want to retain the freedom to publish wherever they see fit.
- Communication plays a significant role in research, particularly journals. However, the communication priorities of researchers are general in nature when it comes to OA (like being able to access research for free and being able to communicate effectively with colleagues). More granular communication concepts like reusability are a much lower priority.
- The overwhelming majority of researchers recommend creating a system that makes sure the research world doesn't divide into those with means and those without. Top reform ideas include improving repositories, simplifying licensing, and building new infrastructure capabilities.
- Relatively few researchers say that current OA policies have helped their research. Others haven't noticed any changes so far, or have noticed changes but to these haven't mattered, or these changes have hurt their work.
- Most researchers are familiar with key OA concepts but are not aware of OA agencies and their policies.
- Most researchers define open as being free to read material that is high quality and transparent and has data included. Most do not believe that copyright license or the format of journals (hybrid, gold, etc.) are important components of open.
- When it comes to licensing, most researchers are interested in free classroom use and are wary about poor quality reuse and commercialization.
- Most researchers dislike APCs, and say that publishing has become too expensive for them.
- Adoption and uptake issues include a mismatch between needs and solutions, a lack of viable options, quality concerns, academic freedom, doubts about the effectiveness of OA policies, and high costs.
- There is widespread support amongst researchers for OSI's conclusions: There are no one-size-fits-all solutions in OA, OA exists on a spectrum of outcomes, researchers are a key stakeholder in scholarly communication, and real solutions will require broad consultation and cooperation (see Table 5).

27. See Hampson 2023 for a detailed description and analysis of these survey findings.

As noted in the last bullet point of Box 14, not only do the findings from these different surveys align with each other, they also align with the general points of agreement among OSI participants (as mentioned earlier in the "OSI" section of this report; see Table 5) that there are no one-size-fits-all solutions in OA, OA exists along a spectrum of outcomes, researchers are a key stakeholder group in scholarly communication, and real solutions will require broad consultation and cooperation. There is also strong overlap between the concerns researchers have about OA policies and the concerns many in OSI have noted about the overall nature of global OA reforms (also as described earlier in the "OSI" section)—to wit, how policymakers are: (1) ignoring the unintended consequences of APCs; (2) ignoring the evidence that in practice, openness exists along a broad spectrum of outcomes; (3) overreaching and designing policies for which we lack the requisite expertise; and (4) forcing one-size-fits-all open solutions on researchers, even where these solutions don't match researcher needs and resources

...the findings from these different surveys align with each other...[and] they also align with the general points of agreement among OSI participants...that there are no one-size-fits-all solutions in OA, OA exists along a spectrum of outcomes, researchers are a key stakeholder group in scholarly communication, and real solutions will require broad consultation and cooperation.

Going forward, then, and based on what we can tell from our analyses about what researchers want and what research communication experts think should happen, open access policymakers should turn their focus to the following:

TABLE 5: RESEARCHER AGREEMENT WITH OSI POSITIONS

OSI position	% of researchers who sort of or strongly agree
There are no one-size fits-all solutions in scholarly communication.	100%
Successful open solutions will require broad collaboration. It is important to hear from and work with all stakeholder groups in our efforts to reform the scholarly communication system.	96%
Researchers are a key stakeholder in this conversation. Reforms need to be made in collaboration with researchers so we don't end up damaging research in the process and/or making access issues worse.	92%
Publishing is a critical part of the research process.	88%
Science and society will benefit from open done right.	88%
"Open" exists along a spectrum of outcomes. There are many different kinds of "open."	88%
The incentives for making more information open are not aligned—i.e., the rewards and benefits aren't currently commensurate with the effort.	80%
Connected issues need to be addressed. There are many parts of the scholarly communication system that need improving, not just making things more "open."	76%
There is much common ground in the research communication reform space, and we should build on this common ground	76%
The culture of communication in academia needs to be reformed. There is too much attention paid to things like impact factors and publishing record.	72%
Making information more open is just a means to an end. It is not the end goal itself.	72%
It might be worth thinking in terms of "open solutions" that are integrated instead of open access plus open data, open code, etc.	68%
We need to learn more about the issues here before making global changes.	64%

Source: Hampson 2023 (OSI2022 Global Researcher Congress, week 4, question 1)

1. **GIVE RESEARCHERS THE SOLUTIONS THEY WANT AND NEED.** Researchers are looking for ways to lower costs, improve collaboration, improve impact, ensure quality, and generally make their research lives better. These needs are not the focus of our current global OA policies. At best, these policies focus primarily on much lower priority concerns like reusability, embargoes, and CC-BY licensing (see Box 15 and Table 6). At worst, they have been sold as a magic elixir that will cure all that ails research, but they can't and won't. Some researchers will benefit from these policies, others will not; some issues will be addressed, the highest priority issues will not; some regions of the world will be able to adopt these solutions, most will not.

BOX 15: WHY CC-BY?

All major global OA policies specify a CC-BY license for publishing because this is what aligns best with the BOAI definition of open on which these policies are based. There are three problems with this approach. The first problem is that there are many different kinds of open information, created by different researchers with different needs and different motives. As a result, many different solutions and licensing options for open have come about over time (recall Figure 1 about the DARTS open spectrum).

The second problem is popularity. We know from previous researcher surveys that CC-BY may in fact be the least popular copyright license made available to researchers (Taylor & Francis 2019 and below table).* CC-BY-NC-ND is the most popular type, allowing unlimited reuse with attribution but also preventing commercial (NC) and derivative (ND) use. Granting an exclusive right to publish is currently the most popular type of copyright license overall among researchers surveyed, wherein authors retain copyright and publishers manage reuse requests. We know from OSI's and other surveys that researchers are concerned about commercial and derivative use, so the fact they like CC-BY-NC-ND better than CC-BY is not surprising.

License type	Most preferred	Second most preferred	Least preferred
Exclusive license to publish	23%	21%	21%
Copyright license	18%	24%	16%
CC-BY-NC-ND	26%	15%	9%
CC-BY-ND	13%	17%	13%
CC-BY-NC	9%	15%	15%
CC-BY	10%	8%	29%

Source: Taylor & Francis 2019

The third problem is utility. Is CC-BY even the right tool for the job? Researchers want to be able to cite and excerpt work and use academic papers for classroom instruction. CC-BY grants these rights, but so do existing Fair Use and Fair Dealing copyright laws (in the US and UK respectively). CC-BY also provides an easy path to free access, but it isn't the only path (as noted, more restrictive variations of CC-BY also work, as does regular copyright). The unique benefit of CC-BY envisioned by BOAI is a world where researchers can reuse and remix journal articles at will, but do they even need or want this capability? We learned from our 2022 surveys (see Hampson 2023) that only somewhere around 14% of researchers are looking for the ability to copy and paste large chunks of text (others may be interested in this ability but not researchers; see Table 6). Indeed, most simply seem interested in the free to read nature of open (apart from open data and code, which are governed by CC-0 and not CC-BY). Added to this, the prospect of having work misused is an outcome no one wants but is very real using CC-BY.

Given all this, what compelling reason exists for sticking with CC-BY as the default license type for OA? Coming at this question from a different angle, what features do researchers actually want and need in a copyright license for their work? Such a license should, at minimum (based on what we learned in our surveys) include rights like free classroom use, and the right to immediately share finished products within a peer community. It might also include a prohibition on commercial and derivative reuse without permission from the author. Maybe this new kind of license (let's call it CC-EDU) should be the new standard? Maybe copyright retention will become the new standard? Taking either approach would show respect for researcher concerns and might also open the floodgates to a much broader, faster, and productive transition to open content.

* This said, Pollock 2022 shows that CC-BY accounts for about 55% of all open licenses as counted in Crossref. The dispartity between these two data points might be due to the fact that Crossref measures listings by their DOI's, and these identifiers are more likely to be associated with open access articles.

TABLE 6: TIERS OF RESEARCHER CONCERNS (NOT JUST COMMUNICATIONS-RELATED)

Concern	%*	Communications related?
Tier 1 concerns (66%+ of researchers say this is ALWAYS important)		
Stay up-to-date on all the latest research in my field	76%	X
Get funding for my research work	66%	
Tier 2 concerns (33-65% of researchers say this is ALWAYS important)		
Infrastructure support from my institution (good facilities, etc.)	64%	
Find, hire and keep good staff	60%	
Design good research studies	60%	
Make an impact in my field	60%	
Find the right research papers to read	59%	X
Publish in a journal	57%	X
Collaborate with other researchers	56%	
Read research papers for free	54%	X
Get proper credit and recognition for my work	52%	X
Effectively communicate my findings to fellow researchers	50%	X
Publish in a prestigious journal	48%	X
Advance in my field	48%	
Make an impact on society	48%	
Figure out what to read—there's so much information out there	47%	X
Job security	47%	
Publish affordably	47%	X
Freely and rapidly share my research work with other researchers around the world	41%	X
Effectively communicate my findings to the general public	41%	X
Effectively communicate my findings to policymakers	41%	X
Tier 3 concerns (0-32% of researchers say this is ALWAYS important)		
IMMEDIATELY (without waiting for embargo periods) read what other researchers have published in a subscription journal	32%	X
Publish in the right journals	32%	X
Publish enough—the pressure to "publish or perish"	28%	X
Make my data available in a format that others can see and use	28%	X
See the data generated by other researchers	25%	X
Protect my research from getting "scooped" before I can publish it	24%	X
"Register" my discovery (publish quickly so the world will recognize I was the first to discover something)	24%	X
Pay	24%	
Publish quickly	20%	X
Reuse the data generated by other researchers	18%	X
Protect my research from misuse	16%	X
Regulation	16%	
Protect my research from theft	8%	X
Copy and paste large chunks of text from other research papers or otherwise reuse these works (beyond what is already permitted by copyright under Fair Use and Fair Dealing)	6%	X
Competition	4%	
Other	4%	

Source: OSI Research Communication Survey, question 5 and OSI2022 Global Researcher Congress, week 3, question 2
*% column is averaged across the two source questions

As we consider designing new research communication policies, we should keep researcher needs and priorities squarely in mind. Rather than merely creating policies that satisfy the definition of BOAI, researchers and the research world would be better served if we focus on the communication solutions researchers actually want and need.

Before we can take this more considered approach to OA policy reform, it will first be necessary to better understand exactly what these need are—and these will differ greatly by region, discipline and field. In time, research will greatly benefit from solutions that are centered on meeting these specific objectives and that truly involve researchers in creating the best solutions. This strategy will also help improve the discourse around research communication reform from one where we merely prescribe blanket solutions to challenging issues to one where we search for best practices and fact-based solutions that researchers actually want and need.

In time, research will greatly benefit from solutions…that truly involve researchers….. This strategy will also help improve the discourse around research communication reform from one where we merely prescribe blanket solutions…to one where we search for best practices and fact-based solutions that researchers actually want and need.

2. **DO SOMETHING ABOUT APCS.** The high cost of publishing figures prominently in researcher concerns. It may even be accurate to say that cost is the number one concern of researchers. APCs have been touted for years as the best possible solution for publishing, even though many groups (including OSI) have warned that the widespread use of APCs will widen the gap between the haves and have nots in research, and substitute one equity imbalance with another—the inability to pay for access with the inability to publish. Indeed, as costs have shifted (in different ways for authors in different fields and institutions, with some authors relying on support from grants, foundations, or libraries to pay for APCs, others less so, and still others not at all), the cost burden for many authors in an APC-based world is now much heavier than it was in the subscription world it is trying to supplant.[28]

   All this said, it's possible the disruption we're witnessing today will be resolved over the next five to ten years as adjustments take hold, such as APC waivers and discounts (all major publishers offer waivers and discounts to researchers from certain countries), or the increased willingness of funders and governments to cover APC costs as part of grant funding. For now, however, the subscription-to-APC transition in scholarly publishing is not being greeted by many (or maybe even most) researchers with open arms.

3. **RESPECT THE FACT THAT RESEARCH IS A PROFESSION.** Many individuals choose professions where making an impact is more important than earning a large salary. Research is one such profession. Nevertheless, these occupations are susceptible to the same challenges as all others, including recognition, retention, and promotion. In our 2022 surveys, as well as surveys undertaken by other organizations (see Annex), researchers place a limited amount of value on open research. They want to be able to connect effectively with their peers, read the work of other researchers, publish economically, and have an influence. We can score a victory for open

28. To the extent this burden even existed before, since subscription costs were covered by libraries and publishing costs were mainly limited to page and color surcharges. Comparing overall system costs is more difficult. A proxy for this determination might be the profit margin of major publishers, and these margins have not decreased during the shift to APCs, so the system costs have probably not come down overall. Indeed, DeltaThink estimates that the OA market is currently much more financially robust than the subscription market (Pollock 2021). Zhang 2022 estimates that the overall costs for our increasingly APC-funded model of scholcomm may now be higher than they were in a subscription-based model.

access inasmuch as these research communication goals align with open policies, but the vast majority of researchers (globally and across disciplines) are not primarily motivated by the desire to make their work accessible. This is what we should expect.

However, this incentive dichotomy researchers perceive is rarely respected in the world of policymaking. Researchers are told the quest for knowledge belongs to all humanity and that they should be entirely motivated by participating in this pursuit, disregarding incentives which better align with their career demands and objectives. This is the essential premise of our current OA policymaking environment: that open outcomes are the highest priority, and valued more than quality, reputation, and cost. In the meantime, the majority of academics face the career-driven reality that quality, prestige, and cost are more important than open. The challenge of our future OA policymaking efforts is that we must achieve both goals, collaborating with researchers to develop solutions that align with their career incentives while also meeting the needs of a more open research environment.

...[the] incentive dichotomy researchers perceive is rarely respected in the world of policymaking. Researchers are told the quest for knowledge belongs to all humanity and that they should be entirely motivated by participating in this pursuit, disregarding incentives which better align with their career demands and objectives.

OSI has long maintained that researchers are key stakeholders in the OA policymaking process, or at least that they should be. Over the years, our group has closely tracked survey research in this subject to gain a deeper understanding of researcher viewpoints on open access. Numerous researchers who have participated in OSI's conferences and online discussions have also provided us with guidance, information, and perspectives.

Even after all this work, though, we cannot say for certain, of course, what all researchers everywhere think about OA policies, but we can say for certain that policymakers must do a better job of engaging with and listening to the global research community. A policymaking strategy that does a better job of listening to researchers and addressing their top priority demands is necessary because there is a great deal of unmet need and misaligned incentives, potential for harm from our current policies, and a great deal of benefit to be gained from new and better policies.

BROADER STILL

So far, we've made the case that the many global stakeholders in research communication (researchers in particular) haven't been working together, and that they should be working together, to develop OA policies that work for all researchers everywhere. It's important to recognize for perspective that this lack of collaboration extends far beyond OA policy. Research communication is a broad and incohesive field and typically doesn't work across boundaries at all.

Research communication is less a field, in fact, than a collection of unrelated activities with dissimilar needs and goals, including specializations such as science writing and outreach for public audiences, journal editing, grant writing, technical writing, research administration, tech transfer, project management, data management, education (with different specializations for different grade levels), public relations, policy analysis, and informatics. The diversity of needs being addressed include sharing, access, affordability, visibility, transparency, clarity, multilingualism (e.g., see Helsinki Initiative 2019), precision, privacy, secrecy, and persuasion. And the philosophies, approaches, skill sets, goals, and best practices

involved vary by region, field, study, institution (including industry), audience, purpose and budget. We talk in this report about research communication reform as though everyone in research takes this to mean open access reform, but in conversations across the entire spectrum of research communication professions, open access barely rate mention in many official reports, and even then only in the most general and generic way.[29] Therefore, should broad research communication reform policies be written even more broadly than proposed in this report so they give direction and unity to what more of the world considers to be research communication?

We talk in this report about research communication reform as though everyone in research takes this to mean open access reform, but in conversations across the entire spectrum of research communication professions, open access barely rate mention in many official reports, and even then only in the most general and generic way.

This may already be happening at some level. For example, in June 2022 the General Secretariat of the Council of the European Union issued a proclamation on "Research assessment and implementation of Open Science" touching on many of these broader issues like research assessment, innovation, education, multilingualism, public policy, and economic development. The details of Plan S don't even rate mention in this statement. In this broad policy proclamation, EU member states are simply encouraged to develop research that is high quality, impactful and shared for the benefit of all.[30]

Similarly, the US Nelson Memo sets up new open requirements for researchers but is otherwise solution agnostic. It's likely that the net effect of this policy will be to push the US (and world) toward more gold OA solutions (that is, research published using APCs and carrying a CC-BY license), but at the same time this directive doesn't insist on CC-BY licensing or APC funding, so in this sense it is a general policy directive pushing US research communication reform in a general direction without getting entangled in specifics (see Crotty 2022).

The open policy strategy currently being developed through a US National Academies Roundtable process is another example of an emerging generalist policy, which is a bit surprising given that the effort is being chaired by reformers from the more ideological side of the OA policy divide (leaders of the Open Research Funders Group effort), and because the early organizing work around this effort was very activist sounding.[31] Now, after several rounds of input from agency and research leaders, the emerging policy is sounding general in nature, soft-pedaling to university leaders what an open future should look like (see Box 16, below).

Granted, the NAS Roundtable is not technically centered on open science or open scholarship. Rather, it is an attempt to align incentives across sectors so efforts to support more open and equitable prac-

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29. This lack of visibility and focus has meant that funding for research communication reform efforts has long been hit and miss. For example, the National Science Foundation has its own ideas of what research communication looks like, and only funds communication work that fits its thinking. The same is true with other government and nongovernment funders. There hasn't been any big picture agreement of what this field looks like and what it needs, especially when trying to include industry research as well. By contrast, the good versus evil approach open advocacy groups adopted years ago (stirring up anger over publisher profit margins and directing this anger into effective rallying cries for funding and action) has been a wildly effective way to increase visibility and focus. When your rallying cry is "kill all the publishers!" you're going to have a more effective fundraising campaign than "let's find common ground!" (see Lozada 2022 for an interesting overview of the rhetoric of advocacy). This appearance of polarization masks the moderation in this space, however. There are many stakeholders in the scholarly communication reform space who don't object to change, but at the same time would rather not blindly accept the promises of open activism without more evidence and a more solid plan of action.
30. The conclusions put forward in the 2019 14th Annual Berlin Science Communication Debate sponsored by Bosch are another example of a broad policy recommendation. See Bosch Stiftung 2019.
31. See, for example, Crow and Tananbaum 2020. Greg Tananbaum is a former SPARC consultant, the founder and director of ORFG, and the Head of Secretariat for the NAS Roundtable on Aligning Incentives for Open Scholarship.

tices in one sector are not met with counter efforts in another just because of the way policies are constructed.[32] Still, this policy effort could have easily steered into the weeds like Plan S, but it didn't (or at least hasn't so far), and this is significant. We see the same dynamic with Plan S itself, whose policy evolution process so far has been to set steep requirements (with regard to funding disclosure, data deposits, transition time frames and more) and then soften these over time as compliance falls short of targets.[33]

BOX 16: ORFG GUIDE TO SUPPORTING OPEN SCHOLARSHIP FOR UNIVERSITY PRESIDENTS AND PROVOSTS (EXCERPT)

Open scholarship entails a culture shift in how research is conducted in universities. It requires action on the part of university administration, working in concert with faculty, sponsors and disciplinary communities. Universities should consider steps in three areas:

- Policies: Language and guidance should be reviewed for alignment with open scholarship, in particular: (1) academic hiring, review, tenure and promotion (valuing diverse types of research products; metrics that incentivize the open dissemination of articles, data, and other research outputs; and valuing collaborative research); (2) intellectual property (ownership, licensing and distribution of data, software, materials and publications); (3) research data protection (for data to be stored and shared through repositories); (4) attribution (recognizing full range of contributions); and (5) privacy (insuring that privacy obligations are met).
- Services and Training: Researchers need support to assure that data and other research objects are managed according to FAIR Principles: findable, accessible, interoperable and reusable. While the specific solution must be tailored to the discipline and research, common standards, including Digital Object Identifiers (DOIs), must be followed.
- Infrastructure: Archival storage is required for data, materials, specimens and publications to permit reuse. Searchable portals are needed to register research products where they can be located and accessed. Universities can recognize efficiencies by utilizing external resources (including existing disciplinary repositories) and by developing shared resources that span the institution when external resources do not exist. Presidents and provosts are encouraged to work with their academic senates to create an open scholarship initiative that promotes institution-wide actions supporting open scholarship practices, while remaining sufficiently flexible to accommodate disciplinary differences and norms

Source: NASEM 2022a.

The underlying reasons for this policy broadening are anyone's guess. Maybe this is what common ground looks like when taking many stakeholder perspectives into account. Or maybe what we're seeing here is some middle ground between activism and market forces. It's also possible we're seeing a fall from grace—a grudging admission that overly detailed OA policies don't work, or a realization that our techno-utopian visions of 20 years ago need updating.

...we must refrain from presenting open access and open science policies as...the single most significant reforms required for research communication. They are not.

In this broader context, one thing is certain: We need to keep in mind that research has always been both enormously diverse and globally interconnected. The development and expansion of research has always depended on communication, sharing, and build-

32. Quote from Dr. Susan Fitzpatrick, an OSI participant who is part of the NAS roundtable and the president of a foundation that is part of ORFG.
33. In November 2022, Plan S coordinating body Coalition-S reported that 27 publishers have complied with the price transparency requirements of Plan S, covering slightly more than 2000 journals (of which Wiley journals account for about 75% of this total; see European Science Foundation 2022 and https://journalcheckertool.org/jcs/). There are no firm figures for how many active journals and journal publishers exist in academia, but a ballpark number is somewhere north of 2,000 publishers and 40,000 journals (Hampson 2019b).

ing on the work of others. As a community, we must refrain from presenting open access and open science policies as the creators and forces behind this dynamic and as the single most significant reforms required for research communication. They are not. They are potentially very significant forces that, if implemented properly, might have a revolutionary influence—hence the attention and debate—but they are only one of many crucial reforms that must take place, many of which are interconnected. If we recalibrate our expectations for open solutions and at the same time refocus on solving the highest priority needs of researchers as well as addressing all these other crucial connected issues, we will be able to carve out an effective path for open solutions reforms that make sense and that fit logically within the broader needs and priorities of researchers and the broader research community.

HUMPTY DUMPTY

It's possible, and maybe even likely, that as the world continues down our current APC-based path toward OA reform, we're going to see more unintended consequences from our reform actions. Some of the major possible consequences are discussed below.

EQUITY

We've mentioned this issue already in this report but it bears repeating: The APC solution simply replaces paywalls with playwalls, and arguably, the latter is more damaging. APC charges have risen to stratospheric levels for premium research journals over the last few years, now topping US$10,000 per article for prestige journals. Even the average APC charge (around US$2,600 for OA mirror journals, although there is wide variation by field, publisher, and journal quality; see Smith 2022) is now far higher than most researchers around the world can afford unless they are based at a major institution in the US or EU or are well endowed by their private funder (see Scaria 2018, Kwon 2022, and Nwagwu 2018 for discussions about the cost burden on Global South researchers, who are much more likely than their Northern counterparts to pay these APC costs out of their personal budgets).

"...[the results of this study] strongly suggest that APCs are a barrier to OA publication by scientists from the low-income countries of the Global South."

While most publishers do offer APC waivers and discounts to researchers from lower income countries, and around 200 publishers also support the Research4Life UN-Publisher partnership providing free and low-cost access to research publications, a recent study of this waiver system confirmed that very few Global South authors publish in high APC mirror journals, and that "the authorship of OA mirror articles is overwhelmingly concentrated in high-income countries" (Smith 2022). The researchers note that "Despite being based in countries nominally eligible for APC waivers, authors from middle-income countries published proportionately few OA articles, but authors in low-income countries published almost entirely subscription-only articles in Parent journals. Taken together, these results strongly suggest that APCs are a barrier to OA publication by scientists from the low-income countries of the Global South." The authors speculated there might be three reasons for this outcome: (1) In practice, waiver requirements can be stringent (e.g., publishers might only waive APCs in cases where every coauthor of an article is based in a country that is waiver eligible); (2) lack of awareness about the existence of these waivers (a hypothesis supported by other research); (3) even partial waivers on very high APCs is still entirely unaffordable (see Smith 2022). See Box 17 for additional discussion of APC waivers and discounts.

DIVISIONS

Closely related to our concern about equity is our concern that the research world is being split into different camps—wealthy researchers versus everyone else. The fault lines are already clear. While the US and Europe are careening toward APC-based policies, China is developing their own internal

BOX 17: WHAT ABOUT APC DISCOUNTS AND WAIVERS?

APC discount and waiver programs are probably the most talked about way to reduce the impact of APCs on researchers from countries and institutions with limited budgets. How effective are these programs? Unfortunately, not very, for the three reasons noted on the previous page: In practice, waiver requirements can be stringent (e.g., publishers might only fully waive APCs in cases where every coauthor of an article is based in a country that is waiver eligible); there is a lack of awareness about the existence of these programs; and even generous discounts on very high APCs are still entirely unaffordable to many researchers (see Smith 2022, AAAS 2022, Beard 2021, Mwangi 2021, Scaria 2018, Editage 2018, et al). Some have also suggested that an overly complicated discount and waiver application process is a fourth barrier to the success of these programs (Rouhi 2021).

Can we do better? For example, can we rethink the co-authorship residency requirements so authors from the Global South won't be discouraged from collaborating with colleagues outside their countries? Obviously, publishers don't want a dynamic to develop where researchers from the Global South are included as co-authors on papers for the express purpose of qualifying for an APC discount, but surely there are thoughtful formulas that could be implemented that can provide better financial support where needed without driving undesirable outcomes.

The second barrier—improving awareness—might be the easiest to overcome. Many researchers simply aren't aware these discount programs exist. There isn't a centralized tool out there that tells researchers everything they need to know about APCs (scattered resources exist but nothing major)—how much they are, who is willing to pay for them, what kinds of discounts exist, and so on. OSI has discussed developing such a tool since the market has yet to come up with a solution like this.

Overcoming the third barrier—inadequate APC discounts—might be more complicated. Publishers decide who gets APC discounts and under what conditions. Generally, they use country income rankings from the World Bank to guide their decisions. Researchers from countries in the lowest income threshold (tier one countries) typically receive a complete waiver of APC costs; researchers from countries on the next highest income rung (tier two countries) are eligible to receive 50% discounts on APCs. On a case-by-case basis, publishers will also grant discounts or waivers to researchers who are unable to cover these costs. Several major publishers also use guidelines established by the Research4Life (R4L) program, incorporating a mix of factors and not just World Bank country income rankings.

One way to expand discounts is to increase the number of countries eligible to receive APC discounts and waivers. Many researchers from tier two countries (like Brazil) are unable to afford the discounted price of expensive APCs (averaging $2600, but typically much more expensive for higher impact specialty and prestige journals). Granting these authors complete waivers instead of discounts would help. A second approach might be to increase the discounts offered to researchers from tier two countries from 50 percent to 75 percent. This would lower their average APC to about US$650, which is much closer to what authors typically pay to publish in regional journals. This approach still prices authors out of more expensive specialty and prestige journals, but at least it's a step in the right direction; variations might involve, for example, asking these higher priced journals to offer even steeper discounts to tier two countries—whatever percentage is necessary to bring the costs down to around US$500. Some have argued that increasing discounts would force many regional publishers out of business because they can least afford to offer steep discounts, or that higher discounts will be offset by higher APCs for researchers who can afford to pay more. To this first concern, we can exempt regional publishers from discount and waiver policies since regional journals are already priced somewhat affordably. Added to this, most researchers aren't concerned whether they can afford to publish in regional journals (which account for only about 12% of all articles—see OSI 2019), but whether they can afford to publish in a higher-impact specialty or prestige journals, which are priced much higher than regionals. Other approaches might be to trigger automatic discounts for any APCs above a certain level (in qualifying countries); or to make sure hybrids aren't excluded (for example, see Elsevier's hybrid discount policy at Elsevier 2022).

The fourth barrier—an overly complex discount and waiver process—might be hurdled by redesigning discount systems so authors face less of administrative burden than now. At present, authors need to prove their eligibility prior to each submission, even though their article may not be accepted—a long, involved, and undignified process. A simplified system might involve having authors complete eligibility paperwork once through a separate and centralized system, and thereafter be re-registered as eligible for discounts (subject to periodic eligibility verifications).

Finally, there are those who argue that the entire discount and waiver system is fatally flawed since it is based on a fatally flawed APC payment system. If this turns out to be the case, there are still other solutions available to help provide equitable access to research articles. For example, since 2002, R4L has been working in partnership with publishers, societies and professional associations, universities and UN agencies to provide researchers from 11,000 institutions in lower income countries with free or discounted access to over 200,000 academic books, journals and databases. Most of R4L's support comes from the World Health Organization (WHO) and about 200 publishers, together accounting for about 78 percent of the organization's funding (see Research4Life 2022). Content collections available through the R4L Discovery Portal include Hinari (providing access to biomedical research), GOALI (legal), AGORA (agriculture), OARE (environment) and ARDI (development and innovation).

publishing system, India will have a national subscription system (recently announced; see Niazi 2022), Japan will have a light-touch hybrid system (Salter 2022), and the remaining 40 percent of the world's researchers will need to decide whether to pay to play, or create their own more affordable system. More research findings will be read across borders as a result of US and EU open access policies, but researchers from outside the EU and US will publish in other venues, likely at a lower cost, and these venues' visibility and significance, as well as the research they publish, may diminish over time as the higher priced venues become even more prestigious. Moreover, it's primarily the researchers from wealthy countries and institutions who will have access to the high-speed computing resources required to exploit global databases (to which Global South researchers are still expected to contribute).

Will these dynamics also result in wealthy researchers seeking out other wealthy researchers to help their publishing budget go further (see Matthew Effect, below)? Will it result in a Global South researchers being reluctant to collaborate with US and EU colleagues because only the wealthier researchers will be have the resources to process data and publish new findings and discoveries? Will it mean that issues of importance to Global South researchers will slide even farther down the global priority list? Combined with the impact of APCs on preventing researchers from the Global South from publishing in the first place, enlarging the gaps between these worlds may end up hurting research instead of helping it, for these and probably other reasons as well.

INTERNATIONAL RELATIONS

The damage to research caused by a world with such fragmented OA policies could also affect international relations. Suppose we continue along our current path and there is no relief for high APC prices (although there may be relief in time, as mentioned earlier). In this case, we might not only see impacts to research, but socioeconomic impacts as well, even political. Research and development is a major economic driver in all nations, and universities are the pillars of policy consultation, education, and social progress. What happens to the cohesion, promise, and growth that research brings to each country and the world when the rich countries co-opt the tools and benefits of research? Are we creating a system where research will cease being a global force for collaboration and unity?

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FRAUD

Scholars everywhere but especially in the Global South are on the lookout for lower priced APC options. This need has spawned a huge industry for predatory research publishing over the last decade. Predatory publishers pose as legitimate publishers but they aren't: they claim to offer peer review, expert editorial boards, high impact factors, indexing, professional affiliations, and physical locations in big cities but they actually lie about most or all of these things. Combined with promises of ultra-fast turnarounds and low prices, these fake journals can seem like reasonable alternatives to unsuspecting buyers, but even for savvy consumers, they are often the only affordable option.

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Experts worry that the articles from predatory publishers pose a risk to the larger body of legitimate scientific work. Researchers in the future might end up basing their work on poor quality or even fabricated findings; funders might invest scarce dollars and Euros on the wrong areas of research based on bogus findings; and governments and health officials might develop policies based on wholly

fictitious information and expertise. The emergence of the APC model has fueled this rise, but other factors like the spread of DIY desktop and web publishing technology have also contributed, where most anyone with a computer can become a "publisher" and make lots of money. Also to blame are academic evaluation practices that value publishing volume, easily faked journal reputation metrics that lure authors like moths to a flame, a lack of industry oversight, and for the most part (with very few exceptions) almost no punishment for the owners of these paper mills. Although there are no exact figures available, somewhere around 9% of the 3.5 million journal articles published every year, and nearly one-third of the world's 50,000 scholarly journals might be classified as predatory (see OSI 2021 and Anderson 2019).

THE MATTHEW EFFECT

The Matthew Effect is the principle of accumulated advantage—essentially, an explanation for why the rich tend to get richer. The continued use of APCs in scholarly publishing is going to lead to profound Matthew effects on researchers, journals, and research itself. How? With regard to researchers, we already know that most are concerned about the cost of publishing. At the same time, most don't work at a university that has a transformative agreement with a major publisher (where it is free for researchers to read and publish), and many don't live in a country or institution where APC funding is readily available. Therefore, we're going to see an uptick in authors shopping around for co-authors to help pay their publishing costs (even by authors who do have APC funding, so they can make their publishing budgets go farther). These sought-after authors are already privileged, working at wealthy institutions in the US or EU. As co-authors added for their deep pockets, these researchers will get even longer publishing resumes and more promotion and grant opportunities as a result (Farley 2021)

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With journals, previous research has established that APC prices are largely driven by market power and market concentration, meaning that the largest publishers with the best stable of journals in a particular discipline can charge higher prices for its products (prestige also matters but to a lesser degree; see Budzinski 2020). Since only wealthy researchers will have the resources available to publish in these journals (whether through lots of grant funds or access to transformative agreements), then it stands to reason only the most prominent researchers (see the first paragraph of this section) will be publishing in these journals. The end result will be that these journals will become even more important and will be able to charge even higher prices; by extension, all other journals and the researchers who publish in them will become increasingly less important.

Combining these two effects, it's clear that research itself will also be affected. What the privileged researchers focus on will be where the research attention goes and funding gets spent; and what the major journals publish will be what other researchers read about and what gets the highest consideration from grant evaluators and policymakers.

PUBLISHER POWER CONSOLIDATION

Economist Philip Morowski has studied and written extensively about how platform capitalism is re-engineering research from the bottom up, and is now in the early stages of monetizing the entire process of science. The big five publishers, says Morowski, have seen the writing on the wall for a long time with open access, so they have basically taken control of open science, open access and open data efforts so they can make more money from these movements. They're doing this by breaking up research into smaller component parts, and then using tech platforms to monetize each part, extracting all manner of value from the process in real time. So, instead of destroying commercial publishers, the

open movement has made them important loci of control within this newly engineered system (with publishers re-branding themselves as "information analytics" companies in the process). We've seen Morowski's dystopia begin to take shape in recent years as the big publishers have each acquired various key companies that give them beginning-to-end coverage of the entire publication cycle. Even if Morowski is totally wrong and what we're seeing in the marketplace is more benign maneuvering for advantage in a competitive and rapidly changing marketplace, there's no denying that publisher power has been increasing. What does this increase mean for the future of open solutions? How about the future of research? We're investing an awful lot in the judgment and expertise of privately held publishing companies to tell us what research we should and shouldn't be reading, and what the future of open should look like. There's an argument to be made that maybe the relationship between research and publishing was better before we started tearing it down and putting it back together Frankenstein style.

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CHANGES (DAMAGES?) TO OA INSTITUTIONS

There are many ways our current APC trajectory might create unwanted downstream changes to OA institutions. For example, when university systems negotiate transformative deals with publishers (whereby university authors basically pay a bulk publishing plus access fee instead of one-off APC charges), what does this mean for universities who don't have the market power to negotiate such deals? Will library consortia unravel as the larger institutions (who publish more) are in effect subsidized by the smaller institutions who publish less (Hinchliffe 2019)?

We might also see open access legacy publishers come under pressure. For example, what happens to PLOS, Frontiers, and Hindawi once authors realize they can publish in most any journal for a fee? That is, if authors are going to pay US$3,000 to publish an article, why not see what else that money can buy (in general, these legacy OA journals have lower Journal Impact Factors than the specialty journals who will be flipping from subscription to APC).

What about society journals and university publishers? Will they fold completely under the pressure of converting to APC format? For generations, subscriptions to society flagship journals formed the backbone of the revenue stream for these organizations. Or will they subcontract the management of their product lines to the major commercial publishers (a shift that has been accelerating due to Plan S because of the tremendous administrative burden involved; see Clarke 2018)? What impact will these changes have on the unique scholarship these institutions have been able to support over the years?

GOVERNMENT INTERVENTION

Over the short term we're going to see lots of debate around who should foot the APC bill. Researchers? Universities? Research grants (which for most research is the same as saying "government")? If the debate pushes too hard on this last option, government will push back.

Over the short term we're going to see lots of debate around who should foot the APC bill. Researchers? Universities? Research grants (which for most research is the same as saying "government")? If the debate pushes too hard on this last option, government will push back.

Asking governments to foot the entire publishing bill (through grant supplements), means either reducing the amount of money we actually spend on research (for example, if $5k of a $100k research grant needs to be earmarked for APCs, that means 5% less is available for research), or it's going to encourage lawmakers to question what on earth we're doing, meaning a lot more oversight

will be in store (at minimum, although this might not be a bad outcome). It definitely doesn't mean just getting a five percent boost across the board to cover publishing. Even during the best of times, politicians have a hard time boosting research spending. And in the US, it's almost comical to believe this that the current Congress will boost spending for research so American researchers can give away more of their American-funded work to the rest of the world for free.[34] The US is just not in that kind of financial or political mood at the moment. Instead, it wouldn't be at all surprising to see a Republican-controlled US Congress demand explanations for why US researchers are paying European publishers with US taxpayer dollars, or to clamp down on sharing until better solutions are developed.

One such solution? A highly-placed industry insider mentioned to OSI in 2019 that pushed far enough, we might see huge government funders like NIH simply create their own publishing capacity in-house, bypassing commercial publishers altogether. If APC charges become burdensome for US researchers and Congress catches wind of this, you can be sure that there will be serious talk about redirecting how this money is spent, whether it's toward an NIH publishing type of solution, or maybe some kind of national market power solution where the US treats publishers like drug companies and negotiates for lower bulk prices. The US is in the right position to do this; although China publishes slightly more papers per year than the US, the US is, by far, the world's most prolific publisher of high quality natural sciences research, so the participation of US-funded researchers in the global publishing ecosystem is tremendously important.[35]

...external forces could altogether derail our carefully crafted plans and Humpty Dumpty will be difficult to put back together again. It is not implausible that East-West political tensions could eventually result in information geowalls that undermine our OA policy objectives. Or that politicians not only in the US but throughout the civilized world withdraw their support for building high-functioning global databases through which research data can flow [to terrorist states].

If not APCs, are there any viable alternatives on the horizon? Time will tell. The APC landscape may eventually stabilize, or different open models like subscribe to open (S20) or even India's national subscription plan may become the wave of the future. Or, harkening back to the horse manure crisis of the 1890s discussed earlier, developments in artificial intelligence (think ChatGPT), big data, blockchain, quantum computing and other technologies may end up completely altering the way we go about digesting and communicating research information.

There is also the possibility that external forces could altogether derail our carefully crafted plans and Humpty Dumpty will be difficult to put back together again. It is not implausible that East-West political tensions could eventually result in information geowalls that undermine our OA policy objectives. Or that politicians not only in the US but throughout the civilized world withdraw their support for building high-functioning global databases through which research data can flow more freely across international borders to countries whose leaders are bent on death and destruction. Or that predatory publishing becomes such a problem that the researchers and the legitimate publishing industry will need to join forces to figure out completely new models for sharing research information because the old model has simply become too corrupted.

34, The nationalism here is just being described, not advocated.
35. This data point can be derived from a number of different angles. See, for example, the Scimago country rankings at https://www.scimagojr.com/countryrank.php. Or the Nature Index (https://www.nature.com/articles/d41586-020-01231-w). Or the highly cited article index (see the US Science & Technology Indicators website at https://ncses.nsf.gov/pubs/nsb20221/u-s-and-global-science-and-technology-capabilities).

We might also see some pushback against Plan S from within the EU, or pushback against the Nelson Memo from publishers (by way of, for example, stepping away from participation agreements with PubMedCentral (PMC), the world's largest green repository. Since it was first launched in 2000, publishers from around the world have been depositing historical data plus AAM versions of their research papers (with links to VORs) into this repository. Since around 2010, publishers have supplied almost 90% of the content in PMC (Williamson 2019). SpringerNature announced in early 2023 that it will no longer deposit the AAMs from its subscription journals into PMC but will instead leave this for authors to do (Crotty 2023 and Clarke & Esposito 2023). To be clear, SpringerNature is a leader in open access publishing and doesn't have many purely subscription journals left anyway (almost all are either open or hybrid). So the unintended consequence here isn't what impact NatureSpringer's move will have on the world's largest green open repository, but what might happen if other publishers follow suit.

WHAT NOW?

The most influential open access policies in the world today are rooted in the belief that open means one thing and that open solutions must fall within a limited range of possibilities. OSI's open access policy framework ideas, developed over years of research and global, multi-stakeholder consultations, clearly demonstrate that instead, open definitions and solutions are diverse, and the needs, perspectives, and resources of researchers from around the world cannot be captured by policies that are one-size-fits-all. As a result, OSI's policy framework ideas are broad and adaptable, with the primary goal of helping researchers everywhere succeed, and built on a deep, shared commitment to enhancing equity, following the evidence about what works, and ensuring that research can continue to be a force for good for all of humanity.

From this foundation of equity, objectivity, and researcher success, we can and should collaborate to do something with open access, rather than viewing open as an end in and of itself. OSI's 2022 research communication surveys suggest that vast majority of researchers agree with this perspective and approach, but it is crucial to test this assumption by redoing our survey (or a similar one) with a much larger sample size.

We are currently constructing a world where everyone has free access to Author Accepted Manuscripts but not official Versions of Record, where "open data" means spreadsheets deposited on GitHub, where only researchers from wealthy countries will publish their findings in the highest quality journals, and where the incentives for openness are not aligned with the career and needs of researchers, all of which leads to a costly and cumbersome global information hodgepodge.

The potential of OSI's approach to open reform is significantly more promising than our current approach. We are currently constructing a world where everyone has free access to Author Accepted Manuscripts but not official Versions of Record, where "open data" means spreadsheets deposited on GitHub, where only researchers from wealthy countries will publish their findings in the highest quality journals, and where the incentives for openness are not aligned with the career and needs of researchers, all of which leads to a costly and cumbersome global information hodgepodge. This approach should at minimum be supplemented with broad new policies that encourage innovation, generate new value for research and researchers, and contribute to achieving global equity parity between research communities. Not only will we enrich the global research dialogue, but global societies and economies as well.

Adopting these types of solutions does not necessarily mean abandoning Plan S, the Nelson Memo, the UNESCO open science policy, or university transformative agreements. Rather, it suggests that in

the future, broader and more flexible policies should be woven into a tapestry of open options and approaches that will make open research more feasible for researchers everywhere. Instead of continuing to implement policies that are one-size-fits-all based on rigid criteria, we can create policies that work well for everyone and better meet the original objectives and aspirations of the open access movement.

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What If the policy world has spoken, however, and APCs are the future for everyone? Is this policy approach still worthwhile? Absolutely. Practically, the majority of the world outside of the United States and Europe still requires viable open access policies. The concepts presented in this report can assist in laying this foundation and integrating policies from around the world. Philosophically, the world of scholarly communication is squeezing itself into a narrow approach to open access without understanding why, where this will lead, or the repercussions on the developing world. It is crucial to develop this understanding as soon as possible, before we are too far along in this shift, so we can still adjust our policies as needed. Otherwise, we risk missing out on the full potential of open access, and also fragmenting the research communication space which is so integral to research itself.

As noted early in this report, in our quest to develop a better future for research and research communication, it will surely help inform our discussions if we remember where this journey began, with so many different paths and histories. The concept of open scholarship wasn't suddenly invented with BOAI. Openness is what scholarship is and has always been about. The concept and practice of openness have evolved over centuries, influenced by politics, philosophy, research requirements, technology, and the market. Using BOAI as the cornerstone of contemporary OA policy is inaccurate and unjust, as this approach is neither democratic nor objective.

The correct approach to the future of open policy is to avoid getting entangled in ideological specifics and instead recognize that our original hopes for open access are all the same—born from a shared vision that open methods can help improve the visibility, transparency, and accountability of research, improve public education and participation, level the knowledge playing field, reduce publishing costs, and harness the Internet's potential to truly demystify information. This is the path originally envisioned by open access, not one in which costs rise, inequity increases, and the rich get richer, but one in which barriers fall, innovation accelerates, and all researchers everywhere benefit. The narrow ideological path to open is a dead end; the true promise of open lies down a road less traveled.

The narrow ideological path to open is a dead end; the true promise of open lies down a less traveled road.

This road less traveled is, oddly enough, a six-lane highway of diversity and innovation compared to the ideological path. On this road, we know where we're going, we avoid ideological detours, we work together to make the journey rich and meaningful, and along the information highway's hubs and spokes, development sprouts everywhere. Possibly, this journey takes place without many rules or structures, without lanes or speed limits. Or perhaps at least basic rules and structures will be useful. We know that better communication and collaboration are essential to the development of new and more effective policies, so structures that facilitate this communication and collaboration would un-

doubtedly be beneficial—perhaps even the same types of policy structures the international community uses for trade, security, intellectual property, and environmental policy, if the UN can support this effort.

It goes without saying that our current efforts to implement global open access policies are in no way comparable to these other global policy efforts. But in order to modify international research communication rules, one must at the very least take a more comprehensive, objective, democratic, international, and research-focused approach. Adopting this new and improved strategy will create a much higher return on investment for research and society than sticking with our current strategy.

It goes without saying that our current efforts to implement global open access policies are in no way comparable to these other global policy efforts. But in order to modify international research communication rules, one must at the very least take a more comprehensive, objective, democratic, international, and research-focused approach.

The next step in this process is for a body with global authority, such as UNESCO, to convene a large, representative, international gathering of researchers to discuss the policy recommendations presented in this report (a virtual summit would work). Based on what we know through OSI's work and through the researcher surveys that have been conducted so far, researchers are likely to support the approach put forward in this report, but we should first confirm this recommendation by consulting a larger body of researchers than we have been able to convene. UNESCO can then propose a framework that governments, universities, and research institutions everywhere can utilize to meet their open scholarship goals.

OSI's observations and recommendations are described in more detail in the many reports and presentations this group has produced since 2015. These reports and presentations are available from the OSI website at osiglobal.org and are also listed in the Annex section of this report.

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Annex 1: R2R Debate on Open Science

RESOLVED: OPEN PRACTICES MAKE SCIENCE BETTER

Presented at the Researcher to Reader (R2R) 2023: Debate Session

Authors and Presenters (in order of their presentation): Rick Anderson (University Librarian, Brigham Young University), Malvika Sharan (Senior Researcher - The Alan Turing Institute, and Co-Director - Open Life Science), Steven Heffner (Managing Director, Publications, IEEE), Catriona J. Maccallum (Director of Open Science at Hindawi Publishing), Karin Wulf (Beatrice and Julio Mario Santo Domingo Director and Librarian, John Carter Brown Library and Professor of History, Brown University).
Video recording of the debate is available on Researcher to Reader's YouTube Channel: https://www.youtube.com/watch?v=-jgfFfqCjo5M. Please cite this document as described on Zenodo: https://doi.org/10.5281/zenodo.7687845, DOI: 10.5281/zenodo.7687845. [In the reference section of this OSI policy paper, please see Sharan 2023]

INTRODUCTION

Credit: Rick Anderson

At the 2023 Researcher to Reader Conference in London, I moderated a formal debate of the proposition Resolved: Open practices make science better. The debaters were Steven Heffner (Managing Director, Publications at IEEE) and Karin Wulf (Director and Librarian at the John Carter Brown Library, Brown University), both arguing against, and Catriona MacCallum (Director of Open Science, Hindawi Publishing) and Malvika Sharan (Senior Researcher, Open Research at the Alan Turing Institute), both arguing in favour. The opening statements and responses are provided below.

OPENING STATEMENTS IN FAVOUR OF THE PROPOSITION

Credits: Malvika Sharan, Catriona Maccallum

Open practices actively facilitate transparent, participatory, collaborative and ethical research by enabling the involvement of diverse stakeholders, including those impacted by their outcomes. Through transparent reporting, openness reinforces ethical standards, scientific rigour and quality in research by opening up underlying data, research methods and processes for independent scrutiny – building accountability and public trust.

Open science is a discipline that encompasses various areas of research and promotes open ways of working, enabling equitable and inclusive approaches at all stages. For instance, open source software, open data standards, open education, citizen science and open access utilise open practices to enhance the diversity of knowledge and knowledge producers – leading to greater cognitive justice. Despite the diverse sets of goals and challenges across different sectors, like academia, industry, government and the public sector - and different disciplines, including the arts, humanities and social sciences - openness is the common thread that defines scholarship and advances the mission of making knowledge freely available for global access. Irrespective of domain-specific challenges, open practices contribute to (i) producing public goods like publications, tools, and practices; (ii) encouraging greater collaboration among researchers from different disciplines, and (iii) broadening the diversity of knowledge-producing actors (Arza, V., & Fressoli, M. (2017). Systematising benefits of open science practices).

Transparency and openness have proven to improve research integrity and accelerate scientific and research through replication and reproduction efforts. The worldwide response to the covid pandemic has shown just how impactful open practice in action looks on a global scale. Although stimulated by the urgency of tackling the crisis, it compelled the government, funders, researchers and members of society to come together, gather all resources they needed, create systems of knowledge exchange and prioritise human lives and public safety above all. To that end, UNESCO mobilised over 122 countries to

promote open science and made a joint appeal to reinforce international cooperation to lift patents for vaccine equity.

For equity to become a reality, it is important to explore: “to whom does knowledge belong? Who benefits from the production and circulation of research outcomes? Who gets to participate in the production processes? and, in what ways can research be used to increase the agency of more people over knowledge production?”. I am quoting Contextualizing Openness: Situating Open Science(edited by Leslie Chan, Angela Okune, Rebecca Hillyer, Denisse Albornoz, and Alejandro Posada), where the research team presents the Open and Collaborative Science in Development (OCSDNet) Manifesto, which thoughtfully and carefully emphasises – that open practices: enable a knowledge commons; recognise cognitive justice; practise situated openness; advocate individual’s right to research; foster equitable collaboration; incentivise inclusive infrastructures; and use knowledge as a pathway to sustainable development, equipping every individual to improve the well-being of our society and planet.

“Tragedy of Commons”, a phenomenon popularised by Biologist Garrett Hardin in 1968, is a common argument we continue to hear in the 21st century. Ironically, this was precisely what Elinor Ostrom debunked in the 80s and 90s. In her book, Governing the Commons, she highlights Hardin’s quote: “Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the common”. She states the limitations where - (1) Hardin focused on ‘access’ without ‘governance’; (2) he assumed little or no communication between the people involved; (3) he postulated that people act only in their immediate self-interest; and (4) he offered only two solutions to correct the tragedy—privatisation or government intervention. I will add the fifth point (5) his analysis of a “pasture open to all” and “herders” or as he emphasises “all men”, operate in the absence of the rest of the world, without intersectional perspectives, solidarity or collective actions. Rather than assuming that open to all means, accessible or beneficial to all, open practices work towards democratising access to resources, which in our case are funding, infrastructure, and support such as at individual, institutional, geographical and political levels, that diverse stakeholders need to address multi-fold challenges concerning them. Open practices are about access and reuse, rather than open for exploitation or opening up without considering the ethical implications. Openness builds shared agency and operates to dismantle power imbalance in researchcultureaswellasinfrastructureforco-creatingsolutionsthatareusefulforeveryone.

The consequence of a narrow, selective or partial view can fuel an ‘anti-commons’ or ‘anti-trust’ agenda, leading to excessive intellectual property rights or over-patenting, resulting in privatisation, vendor lock-in, commercial exploitation and underuse of scientific resources. What is knowledge good for, if it only makes the rich richer and does nothing to benefit the broader society? Isn’t it highly unethical, and in fact, a violation of human rights when systems of knowledge choose not to address the exploitation of labour and extraction of knowledge from already marginalised and disadvantaged communities? What role has western notions of meritocracy and scholarship - and western notions of publishing and gatekeeping - had in fueling thisinequity?

Since the release of the Budapest Open Access Initiative20 years ago, we have seen a social, economic and technical shift toward openness. However, the unwillingness of the research community, including publishers,to adopt the technological and cultural advances in the infrastructure has blocked us from taking full advantage of what openness can offer. At the heart of this cultural impasse is a financial and reputational reward system that locks in the economic and academic capital of those who already benefit from the system. Already privileged stakeholders have been self-selected to win in the existing system and vulnerable members advocating for new systems of open scholarship are ejected before their careers can get off the ground. Publishers - commercial and not-for-profit – as well as institutions gain financially from brands, legacy evaluation criteria and opaque publishing workflows that are no longer fit for purpose. New innovative and open publishing start-ups and platforms cannot get a foothold in the ‘market’ or are swallowed up by the oligopoly of existing publishers. There is a wholesale recognition of this challenge encapsulated in the UNESCO Recommendations for Open Science. It is primarily funders who are leading and driving the change required – Wellcome Trust, the EU Commission, UKRI and most recently the OSTP. These innovative funders are now transforming the policy landscape to

encourage, enforce and invest in open practices easing the routes to innovation that will serve not just-science but all of society.

Openness is not a panacea or a target in and of itself. It is an instrument, a tool, that we can use to improve research practice. Edge arguments against open practices minimise the complex, nuanced and situated openness and try to explain them through simplistic, reductionist and highly unrealistic metaphors created to glorify the notion of a 'free rider' – under the guise of academic freedom. Rather than upskilling researchers in best practices and transparent processes, the closed elitist academic system expects researchers to uphold perverse incentives and assessment processes. Justification of restricted access and closed collaboration often comes from the assumption that researchers inherently want to participate in the academic competition and race to climb up on the leaderboard even though participation in such an unfair system is restricted to only those who are able to pay the access and contribution cost. Knowledge sharing is not a competition or zero-sum game – we don't lose by sharing them, in fact, systemic progress depends on the knowledge of those who came before. Open practices allow us to expose and dismantle the restrictive, non-inclusive and discriminatory status quo in the socio-technical infrastructure of research and help find ways of increasing trust, developing norms of reciprocity, or crafting new rules with all stakeholders of research.

As an open science educator, I can't finish my argument without mentioning FAIR principlesthat provide a framework to make all research objects Findable, Accessible, Interoperable and Reusable, while maintaining privacy and protection where necessary. It is encouraged to be co-applied with the CARE principles, leading to Collective benefit, Authority to control, Responsibility and Ethics. The CARE principle was developed in 2018 in Botswana as a tool for responsible data governance through leadership by people who are producers and owners of the data. Developed by Indigenous and allied researchers and practitioners, CARE demands the decolonisation of practices and technology and safeguarding of vulnerable communities by protecting their knowledge such as land dataand indigenous languages against exploitation.

Radical collaboration and interdisciplinarity have allowed us to witness the emergence of good practices such as FAIR and CARE principles. Open sharing has also led to breakthroughs inresearch-be it the example of "big team science" of the human genome project, the distributed model of Wikipedia, the countless code base upon which data science continues to thrive or the fact that the COVID vaccines were made available in record time. Openness has proven itself time and time again for facilitating responsible research resulting in outcomes that are independently scrutinised, reused and improved upon.

In an era, where we are facing an unprecedented number of global challenges ranging from the pandemic, climate change, natural disasters and even wars, we need to acknowledge open practices as our duty as researchers and members of society. I urge you to choose openness – more precisely, 'transparency, interdisciplinarity and collaboration' – to become 'researchers without borders'. Let's use our privilege and position to reexamine access and assessment [for greater participation] in research so that stakeholders with a wider range of backgrounds, identities, expertise and domain knowledge are valued and given the opportunities to participate in research – improving research quality, reducing harm and sharing benefits.

OPENING STATEMENTS AGAINST THE PROPOSITION

Credits: Steven Heffner, Karin Wulf

This debate is framed as whether "open practices make science better." It seems inconceivable that anyone here would argue otherwise. Openness, transparency, collaboration, and cooperation – these are essential to the research enterprise. A full exchange of data and ideas in a discursive space free from bias and corruption would be a difficult vision to refute, and that debate would have little real-world practicality.

We cannot, however, be debating these values in the abstract; rather, we must be debating whether "open science" – which has come to mean a set of monolithic mandates for making published research freely available under certain terms – makes science better. Is "openness" as it is currently being implemented good for science? Here we think there is room for healthy disagreement.

We submit that we're on a path to openness that has fundamental flaws, ones that will significantly damage scientific progress. We further submit these practices will damage our global polity by ignoring the broader context of academic activity and sidelining, if not silencing, lines of inquiry fundamental to progress.

From our vantage we see 4 major problems with "open" as currently conceived and implemented.

1. It fails to support and sustain a diverse and high-efficiency scholarly communications system.
2. It fails to safeguard the incentive structure around high-quality research, instead creating mechanisms in the marketplace that are incongruent with the objective of truthseeking..
3. It fails to account for the sharp differentials among disciplines in how research is conducted, prepared, and shared–to the great detriment of our social fabric and civic health.
4. It fails to understand how the research enterprise unfolded over the last 100+ years and demands we prioritise free consumption above all else.

While we see other challenges with "open science", we will elaborate on these four.

1. We start with alterations in funding. The movement from the reader- or user-pays models of scholarly publishing will remove a significant amount of money from theecosystem.In the current subscription-based environment, upwards of 40% of publisher revenue comes from institutions that have no research output at all. These read-only customers are primarily (but not exclusively) corporate customers from R&D intensive sectors—some of the largest companies in the world in pharma, biotech, healthcare delivery, tech, aerospace, and energy. In a fully open access, author-pays world, these institutions will not be paying in. They'll be getting a free ride. Regardless of whether one thinks this is fair, this money will no longer contribute to the ecosystem. There's an assumption in open movements that the entire infrastructure is a given—metadata standards, linking structures, archiving services, abstracting, indexing, bibliometrics, fraud-detection, etc. These functions were primarily built by and continue to be funded by scholarly publishers. Innovation in the space, too, depends on continued investment to develop new ways to move faster, share data, encourage collaboration, identify misconduct, and enforcenorms. Is there a better way to fund this shared ecosystem and drive progress? Perhaps, but what's certain is that the current trajectory naively and recklessly defunds the enterprise we all believe in, with no conception of how to replace those resources.
2. This leads to our second point, regarding misaligned incentives. Open access mandates as they are currently being implemented set up perverse incentives that will impede and corrupt the scientific endeavour. The goal of research is to advance human knowledge. Scholarly communication facilitates this truth-seeking by bringing the best information forward for the widest possible group of scholars to synthesise and build upon. Vital to that dissemination of scholarly output is a disinterest in anything other than quality process and output. Publishers must be agnostic about the source of the knowledge-generation, the wealth or political ideology of the funders, and the conclusions of the research. They need to provide a fair, rigorous, and trustworthy application of peer review and an even-handed and useful presentation, the objective being quality science for the community of scholars and practitioners. Publishers and other intermediaries are incentivized in this endeavour by the approbation of the consumers. When they compete in this marketplace, publishers have incentive to produce more rigorously vetted content in a form suited for maximum utility. In the open access environment, the incentives for

high-quality output fade. Driving revenue is a simple volume calculation: publish more papers regardless of quality. And we've already seen that there are plenty of commercial concerns willing to publish as many articles as academia can pay for. And make no mistake: These publishers have willing accomplices in academia at all levels, which continues to incentivize output at a furious pace—Publish or perish! But this is not a question of whom to blame—academia's promiscuous output of underwhelmingly mediocre papers or commercial publishers' voracious appetite for APCs. Neither of these innate characteristics (ambition and avarice) can be fixed. Rather, as in all human systems, they need to be mitigated. So, it ought to be a question, rather, of how a system minimises the temptations of these groups to realise their worst instincts and, instead, incentivizes the creation of good science and the rejection of junk. The current vision for open access does neither of these things, but rather solidifies the unholy alliance of these pernicious behaviours. The result will be (and already is) a scholarly literature flooded with mediocre science – or worse, destructive misinformation – produced and published at scale with fewer tools from a de-funded discovery and curation industry.

3. Current policy and mandates around open practices fail to account for the sharp differentials among disciplines in how research is conducted, prepared, and shared. This insensitivity to the diversity of academic practices gives priority to the biggest volume and most well-funded fields, rather than allowing a critical assessment of social needs to drive ourpractices. This debate is framed around "open science," but it is really about research more broadly, and only in some particular places does science include the arts, humanities, and social sciences. The major drivers of openness are narrow: biomedical science in particular, and not even foundational fields such as mathematics much less social sciences such as economics. But as much as we need medicine and what technology brings us, we need the humanities as much – if not more. History, for example, is a vital perspective for understanding our experience. Autocrats know this. It is no accident that powerful entities are attacking historical knowledge and research; history is empowering. "Open science" ignores the low-cost, highly distributed way that humanities research is funded, and the intensive, highly skilled editing and preparation required to create carefully articulated work – labour supplied mostly by nonprofit publishers. Humanists expect their work to serve the public good, and they commit tirelessly to public engagement in popular print, broadcast, and social media – vital messages built from the expert work they circulate and publish among a community of experts. The mandates for openness make this work, which underpins all other inquiries, substantially harder if not impossible to pursue. It seems the height of folly that we even consider creating entirely new, more complex, and more costly systems with less editorial mediation and necessary labour to replace journals in the humanities and social sciences that cost libraries mere 100s of dollars annually. We cannot allow these critical fields of study to become the collateral damage of a primarily biomedical research ideology. These fields are not incidental; they are fundamental.

4. "Open science" mandates ignore all other urgent research issues and prioritise free consumption above all other virtues in the researchenterprise. "Open Science" conceives all issues as related to free and immediate online access. Essentially "Open Science" prioritises easy consumption of research as primary. We see this differently. The research enterprise in the West is the product of two historical moments: the late 19th century disciplinary commitments to empirical methods, and the mid-20th century expansion of funding for science largely as part of national security – both primarily first-world phenomena. In a world where we need to think about global cooperation in facing the major crises of our time – the imperilled climate, imperilled democracy – shouldn't we pull ourselves out of the constraints of that first-world Western context? Isn't it, in fact, imperative to empower researchers around the world, and particularly in the Global South, for the global public good? But instead the late 20th century global economy prioritised cheap consumption, and often to the detriment of workers in the global south. The

open movement likewise emphasises cheap consumption of research and, through its author-pays models, makes it difficult or impossible for researchers in the global south to participate. In short, the calls for "open" are well intentioned. They ask for things that, in theory, we should all want. However, in practice this movement is driving an inversion of the very things we profess to value. Is free access for theoretically needy users so valuable that we're willing to:

- Decimate a funded system ofinterconnectivity?
- Sacrifice a centuries-old method of values alignment around quality scholarlyoutput?
- Cedearobustinterdisciplinaryunderstandingofhumanprogresstothebest-fundedfields?
- Furthercomplicatediverseglobalparticipationinthesolutionstoourcommonproblems?

We, in opposition to the proposal, say NO.

RESPONSE
Credits: Catriona Maccallum

With respect to our honourable colleagues, their 4 arguments depend on a series of fundamental fallacies. They mistake a business model for open access and a business model of open access with the practices and principles that make up Open Science practices – and then they conflate the ability for others to access, discover, reuse and contribute to research with torrid notions of 'consumption'. And in relation to the deep inequities and lack of support for open infrastructure - where do we even begin... Thank God for funders - open practices wouldn't have gotten off the ground if it were up to researchers, scholarly societies and publishers....

They stated that "Vital to [the] dissemination of scholarly output is a disinterest in anything other than quality" And yet, they fail to recognise that the perverse incentives they deplore have been fueled by a lack of transparency and a deeply inequitable system of gatekeeping in both research and publishing practices. The system they want to keep intact for the sake of 'quality' has created the hypercompetitive culture that is causing the problem - a lack of willingness to share information in case you get scooped, the black box of peer review where bias is rife, the gatekeeping of knowledge that bars anyone who is different from having an influence on the system. Indeed, it is now so bad that misconduct has become almost commonplace and authors are willing to pay editors and reviewers to manipulate the peer review system - whether in open access or subscription journals.

The publishing system they extole has been propped up by privileged and profitable brands – run as much by not-for-profit societies as well as commercial publishers – brands that have locked in the supremacy of the global north both academically and financially. There is already more than enough money in the system to help fund open practices - it just requires redistribution. The irony of their argument is that it is actually increased openness that will help drive down costs and mitigate against the problems. It is the willingness to share data about what works and what doesn't work that has helped expose the lack of scholarship and research integrity in this so-called academic meritocracy. Making your work open makes it available for public scrutiny - and not just for academic peers. It makes us accountable to everyone in society.

Moreover, they make the argument that the Humanities should somehow be exempt from such open practices? To refer back to Ostrom, they believe the humanities are falling prey to the tragedy of the commons and should therefore be a privileged edge case, ring-fenced off from the rest of science. And the specific argument they put forward is because it is cheaper to publish and distribute that type of research and that the editing done by publishers is so skilled? If, as they say, "humanists expect their work to serve the public good" then why don't they make their work a public good by opening it up to everyone. Do the humanities not have rigorous scholarship and methodologies that should also be shared and independently scrutinised. Are humanities and history not subject to the same biases and inequities created by a lack of transparency that have been exposed in biomedicine? And why on earth

should biomedicine alone reap the benefits of open science? I agree wholeheartedly that the humanities are important - and way too important to be closed off. Members of the audience - how can you even think of opposing the motion...

RESPONSE

Credits: Steven Heffner, Karin Wulf

In the strict time allotted, We'll respond to two points in our colleagues' opening statement, and then return to the primary point of ours. First, our colleagues ask "to whom does knowledge belong?" Invoking vaccines, and the pandemic crisis, they call for "the production and circulation of scientific knowledge" to benefit everyone through expanded participation in both the process and fruits of research.

Yet the very framing of the question betrays the problem here. Knowledge does not exist independent of either contexts or resources. It literally does not grow on trees, so even if we could shift the ownership of the land and access to the orchard, knowledge isn't an apple. It's a complex and often ephemeral human product shaped by a set of institutional and other relationships.

Second, our colleagues lament that while there has been a "social, economic, and technical shift to open," researchers and publishers have been resistant. They are–we are, I guess–"block[ing] us from taking full advantage of what openness can offer."

But let us be clear. We are not "Team No." We are not "Team Luddite" – though with better historical contextualising we'd all use that analogy better and maybe in the best sense we are in fact Luddites, advocating for fair labour practices and for shared resources. But I digress, and I promised not to! We are not Team Elite Greedy Hoarders of Research, either. And neither are we Team Clueless Unthinking Legacy Publishing Addicted Leming Researchers.

Move Fast and Break Things is very Elon Musk 1.0 – even if Elon hasn't moved on from that mode, we have. Moving at Deliberate Pace and Building, Repairing, Recycling, and Repurposing is what the world has learned to value again.

Yesterday we heard a chemist raise many of the same questions we raised about Open Access, from a researcher perspective: about equity for researchers, about the lack of consultation with researchers, about the priorities of researchers. Calling for a return to the values that drove people into science and for research communities –communities of people who care about producing research for the public good– to come together in the firstplace.

So here we are not arguing against "openness" and "accessibility" which are inarguably good things but rather what "open access" has wrought. We are Team Context. Team Deliberate Process. Team Collaborative Research Practices for the Public Good. I don't know a single scholar who doesn't want to make their work moreaccessible.

As a historian, I have long lamented the ways that monolithic OA policies are making it harder, more expensive and more time consuming to just publish good humanities research –at the very moment when the world is in the direst need of history.

At the very moment when universities are cutting humanities faculty and majors, when politicians around the world are making it harder, even illegal, to teach evidence-based history, when democracies are threatened and autocrats are ascendant on a tide of historical misinformation and myth.

At this very moment when in fact we need more humanities research for a rising tide of crises that are not technicalortechnological,but social and political, and we are still having to argue about OA policies that are not fit for research diversity – of discipline and geography and researcher profile. Recent studies of the US and Canada make this plain. In Canada, of the 562 historians who earned a PhD between 2016 and 2022 only 10% secured tenure-track employment. We will not have historians to fund at this point.

You may ask what this has to do with OA. It has everything to do with driving agendas that are meant for one problem and generalise to the whole of the research ecosystem, with an overwhelming focus on hard and life sciences above all else.

We have prioritised free general consumption of one thing– expert published research–over all else. Let us reconsider how that value competes with other things of abiding value for humanity which the group assembled here is committed to advance.

CLOSING

Credit: Rick Anderson

At the beginning of the debate, the audience was polled to determine how many were in favour of the proposition and how many opposed; the result of this initial poll (97 respondents) was 87% in favour, 13% opposed. The debate then began, with a ten-minute opening statement provided by each side and then a three-minute response from each side. Discussion with the audience followed. After the discussion period, the audience was polled again; the result of the second poll (91 respondents) was 69% in favour, 31% opposed – accordingly, the opposed side (having moved the most votes) was declared the winner.

The participants did a magnificent job, and the debate was a model of its kind: rigorous, clear, respectful, and compelling. Not only did our debaters demonstrate the complexity and importance of the topic; they also modelled civil discourse on a contentious topic. The debate program generated an overwhelmingly positive response from the Researcher to Reader audience.

ACKNOWLEDGEMENTS

We thank the organisers of the Researcher to Reader 2023 (www.R2RConf.com). Find more on the webpage: https://r2rconf.com/r2r-conference-governance/. Malvika would also like to thank Arielle Bennett for sharing examples that were included in her speech.

Annex 2: Protest Statement Against APCs[1]

STATEMENT

ARTICLE PROCESSING CHARGE (APC) POLICIES ON OPEN ACCESS (OA) PUBLISHING MODEL: THE IMPACT ON DEVELOPING COUNTRIES AND THE NEED FOR A MULTILATERAL SOLUTION

Over the past years, the Open Access (OA) publishing models have been shaping the way we publish, allowing scientific articles to be freely available online without any funding or legal barriers. At a first glance, the OA publishing model apparently universalizes science, making it accessible to everyone, in agreement with the human right to science, as recognized by Article 27 of Universal Declaration of Human Rights (UDHR, 1948). The economic model that seems to have gained prominence, particularly for flipping subscription-based journals to OA and/or adopted by many prominent new titles, is one where the financial burden is shifted to the authors. Most often, this is bundled into one article processing charge (APC); though some hybrid journal titles have a non-OA APCs, and an additional OA charge, in case the author(s) are interested in publishing into so-called Gold OA. So let us call this Author-Pays OA, keeping in mind that the author charges are most often, though not always, termed APCs.

This model (the economic model of Author-Pays OA, not OA in general) often incurs extremely high publication costs for the authors. The exorbitant article processing charges (APC) that come hand-in-hand with the Author-Pays OA publishing model deepens the inequality between researchers from developed countries and those in lower income countries. This is exacerbated by the policies included in the "Plan S" initiative promoted by many European and American science agencies, with the support of the European Commission and the European Research Council. This plan, announced in 2018, requires that from 2021 scientific publications resulting from research funded by public grants must be published in compliant OA journals or platforms. This regulation highlights the global trend towards publications in OA journals, which offloads the costs of publication on the authors even though these grants themselves do not necessarily pay for APC.

The Author-Pays OA model represents a large barrier for the global scientific community, with particular impact on the progress of early career researchers. In developing countries, APC associated with the publication of scientific articles could represent a large proportion of the annual grants (as much as 35-130%). In general, OA fees/charges are too high given that the publishing industry depends on the voluntary, non-paid, peer-review activities of the research community. Although Biological and Medical Sciences are currently the most affected areas, in the near future, the OA model will impact other disciplines or fields of knowledge. Under this new paradigm, the ability to publish scientific research from developing countries in highly cited and reputable journals is at risk. To overcome this, researchers from developing countries may either not publish or share authorship with colleagues from developed countries to share the burden of the APC. It should be noted that although it is possible to request fee waivers, this option is often denied if the country does not qualify as a very low-income country.

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1. See Cabrerizo 2022 for the Nature article where this statement is linked (the link source is https://drive.google.com/file/d/1U73-PrfQ4ygQSRpy7C2OUApnLVIFSr2-/view). An author of the statement itself is not indicated.

Research and academic institutions also contribute to the problem by implementing evaluation methodologies based on journal-based metrics (such as Journal Impact Factors) to assess and compare the scientific contribution of individuals and institutions. Therefore, as recommended by DORA (San Francisco Declaration on Research Assessment) there is an urgent need for less biased new evaluation strategies.

Within the draft text of the UNESCO Recommendation on Open Science (CL/4363, from May 2021), an international framework for open science policy and practice was provided. The recommendation recognizes disciplinary and regional differences in open science perspectives, takes into account academic freedom, gender-transformative approaches and the specific challenges of scientists and other open science actors in developing countries, and emphasizes the need to advance towards open science reducing the digital, technological and knowledge divides between and within countries.

In the midst of this complex scenario, we believe that the international community should assume the challenge of exercising multilateral governance and academic cooperation in the face of the inequities that arise from this new OA publication model. To that end, the signing global organizations promote the creation of an ad hoc worldwide committee (**Global Initiative for Equitable OA Models**), working under the umbrella of multilateral global academic institutions or similar bodies. The Committee aspires to:

1. Establish a fluid dialogue between the various members of the scientific community, policy makers and representatives from governments, to further discuss options and implement joint actions for an equitable model of OA for the global scientific community.

2. Draft a global agreement aimed at enforcing equitable access to publishing in OA Journals moving away from Author Pays OA and toward models that either a) repurpose existing subscription funds to fund e.g. sponsored OA or b) subscribe-to-open OA; or obtain funding for academic publishing from institutions or other public sources (diamond/platinum OA). Regulation should include guidelines aimed at setting copyrights.

3. Create a global economic containment network to financially support the least developing countries and scientifically lagging countries in order to strengthen national scientific R&D systems in line with objectives previously established by the countries at the multilateral level, such as the United Nations Sustainable Development Goals (UN SDGs).

4. Set up a network of existing or new diamond journals from developing countries, aimed at promoting non commercial open publishing practices with clear and transparent regulations and strong standardized peer review processes. This can lead to new prestigious and recognized options where scientific communication will prevail over the interests from the publishing industry.

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This initiative arose from a group of young scientists who are members of The TWAS Young Affiliates Network (TYAN) and The Argentinian Young Academy (AJA), in collaboration with different National Young Academies and Institutions listed below. Under the premise that the universality of knowledge is a fundamental principle of science and a human right, we must encourage collaboration at the regional and global level that involves governments, multilateral institutions, regional organizations and transnational corporations.

--*--

To endorse this statement with your institutional logo, please send an e-mail to:acadjovenar@gmail-com. To adhere to this statement, please fill in the following form: https://tinyurl.com/signapcstatement

LIST OF NOBEL LAUREATES ENDORSING THE STATEMENT:

Paul BERG (1980 Nobel Prize in Chemistry), Jean-Marie LEHN (1987 Nobel Prize for Chemistry), Lou IGNARRO (1998 Nobel Prize in Physiology or Medicine), Jerome FRIEDMAN (1990 Nobel Prize for Physics), Richard ROBERTS (1993 Nobel Prize in Physiology or Medicine), Anthony LEGGETT (2003 Nobel Prize for Physics), Aaron CIECHANOVER (2004 Nobel Prize for Chemistry), Barry MARSHALL (2005 Nobel Prize in Physiology or Medicine), Craig MELLO (2006 Nobel Prize for Physiology or Medicine), Brian SCHMIDT (2011 Nobel Prize for Physics), Edvard MOSER (2014 Nobel Prize in Physiology or Medicine), May-Britt MOSER (2014 Nobel Prize for Physiology or Medicine), Takaaki KAJITA (2015 Nobel Prize in Physics), Richard HENDDERSON (2017 Nobel Prize in Chemistry), George SMITH (2018 Nobel Prize in Chemistry), Emmanuelle CHARPENTIER (2020 Nobel Prize in Chemistry), Giorgio PARISI (2021 Nobel Prize for Physics).

SIGNATORIES NATIONAL ACADEMIES, INSTITUTIONS & ORGANIZATIONS:

TWAS Young Affiliates Network (TYAN)
Academia Joven de Argentina (AJA)
Youth Innovation Promotion Association of Chinese Academy of Sciences (YIPA CAS)
The RSE Young Academy of Scotland
Young Scientists Network - Academy of Sciences Malaysia (YSN-ASM)
Cameroon Academy of Young Scientists (CAYS)
National Young Academy of Bangladesh (NYAB)
Belgian Young Academy (Jonge Academie, JA)
The Royal Society of Canada's College of New Scholars, Artists and Scientists (RSC SRC)
Burundi Council of Young Scientists
Sudanese academy of young scientists (SAYS)
National Academy of Young Scientists (NAYS)
Pakistan Thai Young Scientists Academy (TYSA)
The Global Young Academy (GYA)
Die Junge Akademie (Germany)
National Young Academy of Nepal (NaYAN)
Académie des Sciences pour les Jeunes en République Démocratique du Congo (ASJ-RDC)
Young Academy Finland
Nigerian Young Academy Ghana Young Academy (GhYA)
The Caribbean Academy of Sciences, Jamaica (CASJ)
UNESCO-The World Academy of Sciences for the advancement of science in developing countries (UNESCO-TWAS)
Consejo Latinoamericano de Ciencias Sociales (CLACSO)
Foro Latinoamericano sobre Evaluación Científica (FOLEC)
Izmir Institute of Technology
Women in Science Without Borders (WSWB)
Revista Argentina de Ciencias del Comportamiento (RACC)
Red de revistas científicas de Acceso Abierto no comercial propiedad de la academia (REDALYC)
Asociación Ibérica de Limnología (AIL)
Proyecto Primates Panamá Ciencia en Panamá
Asociación Panameña para el Avance de la Ciencia (APANAC)
Asociación de Investigadoras e Investigadores del Uruguay (INVUY)
Instituto de Investigaciones Biomédicas en Retrovirus y SIDA (INBIRS)
Open Access India
Nibö
Public Knowledge Project (SFU PKP)
Latin America Early Career Earth System Scientist Network (LAECESS)


TYAN
TWAS YOUNG AFFILIATES/ALUMNI NETWORK
Academia Joven de Argentina
RSE YOUNG ACADEMY OF SCOTLAND
YOUNG SCIENTISTS NETWORK MALAYSIA
NYAB
Jonge Academie
RSC SRC
BURUNDI COUNCIL OF YOUNG SCIENTISTS
SAYS
NAYS
TYSA
THAI YOUNG SCIENTISTS ACADEMY
GLOBAL YOUNG ACADEMY
Die Junge Akademie
NAYAN
YOUNG ACADEMY FINLAND
twas
THE WORLD ACADEMY OF SCIENCES
CLACSO
Consejo Latinoamericano de Ciencias Sociales
Conselho Latino-americano de Ciências Sociais
FOLEC
Foro Latinoamericano sobre Evaluación Científica
CLACSO
RACC
redalyc.org
UAEM
Asociación Ibérica de Limnología
Associação Ibérica de Limnología
AIL
PROYECTO PRIMATES PANAMA
Ciencia en Panamá
Investiga Uy
INBIRS
INSTITUTO DE INVESTIGACIONES BIOMÉDICAS EN RETROVIRUS Y SIDA
SFU
PKP
PUBLIC KNOWLEDGE PROJECT
LAECESS
niboe.info

Annex 3: OSI's Open Solutions Proclamation[36]

Preamble

Recognizing the urgency of addressing complex and interconnected environmental, social, health and economic challenges for the people and the planet;

Acknowledging the vital importance of factual information to respond to these challenges;

Committed to leaving no one behind with regard to access to factual information;

Recalling that one of the key functions of UNESCO is to maintain, increase and diffuse knowledge by encouraging cooperation among the nations in all branches of intellectual activity;

Recognizing the potential of open solutions to reduce existing global inequalities, accelerate progress toward needed solutions, and achieve the United Nations' Sustainable Development Goals;

Further recognizing that open solutions have a wide variety of definitions, motivations, goals, and adaptations that vary widely by field, region, and institution;

And taking fully into account, in the adoption and application of this recommendation, the great diversity of laws, regulations and customs which will determine how this recommendation will ultimately be adopted, be it hereby resolved that Member States:

1. Adopt the following recommendation on open solutions;

2. Take appropriate steps to give effect within their jurisdictions to the principles of this recommendation; and

3. Engage with UNESCO in the further development of the open solutions roadmap and action items at such dates and manner to be determined, in pursuance of this recommendation.

I. OBJECTIVE OF RECOMMENDATION

The objective of this Recommendation is to provide an international framework for open solutions policy and practice that recognizes the broad global diversity of open solutions actions and perspectives, and that also sets forward a roadmap for continued international engagement on open solutions and a growth in open solutions best practices, standards, and accomplishments.

II. DEFINITION OF OPEN SOLUTIONS

Open solutions is an umbrella concept that is being used by UNESCO to describe various movements and practices variously aimed at making scientific knowledge, methods, data and evidence more available and accessible (particularly to researchers from lower resourced regions and institutions);

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36. Much of the proposed language here is distilled and adapted from UNESCO's draft recommendation on open science. Note that even though this proclamation is drafted with UNESCO in mind, governments or institutions are invited to adapt this for their own purposes.

increasing scientific collaboration and the potential from this collaboration; increasing the sharing of information of all kinds for the benefit of science and society; opening knowledge to societal actors beyond institutionalized communities; improving the reliability and factualness of information through increased transparency and replicability; and other similar motives. Not all open solutions practices share the same motives, nor the same goals, methods, actions or stakeholders. Additionally, a complex of intersecting and overlapping 'open' elements are generally involved in the conduct of open solutions, including but not limited to open access (generally meaning users being able to gain free access to research reports published in science journals), open data (generally meaning that research data is licensed in such a way that it can be reused without permission), open source/code, open government, open educational resources, and more.

III. ROADMAP FOR ACTION

The roadmap of global action on open solutions adopted by Member States should itself be open and transparent, developed by Member States and the full international community of stakeholders, and respecting the wide diversity of needs and perspectives surrounding open solutions. At its core, UNESCO, the United Nations, and UN Member States should avoid regulating what we don't yet fully understand, or adopting one-size-fits-all solutions that may make open solutions adoption impossible for some, or making open solutions dynamics worse for developing countries. In general, our approach must be:

1. **USER-FOCUSED.** Open solutions tools, services and options must be developed with heavy input from the research community, with solutions and approaches driven by user needs and concerns;

2. **COLLABORATIVE**. Successful and sustainable solutions will require broad collaboration, not just to ensure that all perspectives are considered, but also to ensure there is broad ownership of ideas;

3. **CONNECTED**. There are a great many interconnected issues in the open solutions space. Developing an effective future for open solutions will require a systemic approach;

4. **DIVERSE AND FLEXIBLE**. There are no one-size-fits-all solutions to open solutions reform. Instead, there are many different pathways to reform, likely including many that have not yet been conceived or deployed. Diversity, creativity and flexibility in this undertaking should be paramount, at the same time noting that common ground actions will be critical;

5. **INFORMED**. We need a better understanding of key issues in open solutions before moving forward. The more accurate and honest our assessments, the more accurate and honest our reform efforts can be, the easier these efforts will be to promote, and the more successful they will be;

6. **ETHICAL AND ACCOUNTABLE**. We need enforceable, community-developed standards to ensure the integrity of publishing, archiving, and other related activities and products, and to ensure that unethical approaches are not embraced;

7. **COMMON GOAL ORIENTED**. We must discuss and plan for what the future of open solutions means, beyond just having easier access to information, including defining what we plan to do with open information, where we need data interoperability, what tools and procedures we need to achieve this interoperability, and more. By doing this, we can better focus on and strive for our community's common goals;

8. **EQUITABLE**. People everywhere need to be able to access and contribute content to the global body of research information with minimal barriers. To the extent practicable, information—particularly information central to life and health—should not be unreasonably constrained by issues such as high access costs, poor journal indexing, and a lack of capacity-building programs;

9. **SUSTAINABLE**. Open solutions reform approaches need to be sustainable, which flows from all the other elements in this list. The reform solutions we design need to be achievable, affordable, popular, effective, and otherwise maintainable over the long term;

10. **TRANSPARENT**. The global community needs to maintain as much transparency as possible in this effort (with regard to pricing, usage, ownership, and so on) in order to maintain trust in this effort;

11. **UNDERSTANDABLE AND SIMPLE**. The global community needs to agree on high-level, common-ground goals for open solutions reform—a general set of goals that are understandable, achievable, and adaptable. By setting out general goals that can be easily achieved, participation can be made simple and easy, with low barriers to entry.

12. **BENEFICIAL**. In the end, these reforms need to benefit research first and foremost. While the argument to improve benefits to society is central, these benefits need to be matured carefully, deliberately, and realistically in order to ensure that societal benefits are indeed being conveyed as intended, and that research is not being harmed in the process.

IV. AREAS OF ACTION

With this roadmap for action in mind, the four general areas of action that should be supported by Member States are to:

1. **DISCOVER** critical missing pieces of the open solutions puzzle so we can design our reforms more effectively;

2. **DESIGN**, build and deploy an array of much needed open infrastructure tools to help accelerate the spread and adoption of open solutions practices;

3. **WORK TOGETHER** on finding common ground perspective solutions that address key issues and concerns; and

4. **EDUCATE** and listen to the research community about open solutions, and in doing so design solutions that better meet the needs of research.

To the extent possible and at a more detailed level, Member States are also recommended to pursue these 10 specific areas of action, taking into account their individual political, administrative and legal contexts:

1. **PROMOTE** a common understanding of open solutions as defined in this recommendation within the scientific community and among the different open solutions actors at the institutional, national and regional levels;

2. **ENSURE** that public research funders require open solutions practices and that all information outputs from publicly funded efforts are as open as possible, and only as closed as necessary;

3. **EMBRACE** and combine the efforts of the many different actors in the open solutions space, including research funders, universities, journals, and scientific journals;

4. **ENGAGE** the private sector in discussion about the ways in which the scope of open solutions principles and priorities can be enlarged and mutually shared;

5. **DEVELOP** or encourage policies, including those at the institutional and national levels, that are supportive of a transition to open solutions. This includes but is not limited to helping establish regional and international funding mechanisms for promoting and strengthening open solutions; supporting the creation and maintenance of effective collaborative networks to exchange best open solutions practices and policies; promoting cooperation among countries in capacity building for data management and stewardship; and investing in open solutions infrastructure and services;

6. **COMBAT** the practice of predatory publishing, wherein 'fake' publishers publish anything for a fee regardless of merit and without adequate gatekeeping mechanisms in place, and in doing so corrupt the global body of factual information;

7. **REVIEW** research assessment and career evaluation systems in order to align them with the principles of open solutions;

8. **LEARN** more about the open solutions space by helping fund additional studies and fact-finding efforts as needed to ensure that open solutions efforts are fully informed and optimally effective and efficient;

9. **COLLABORATE** on finding solutions to urgent science-based challenges such as climate change, medical research and food security. Demonstrating the value of open solutions collaboration efforts will advance the cause of open solutions while at the same time providing an urgently needed service to humankind;

10. **ENTRUST** UNESCO with the mission to coordinate, in consultation with stakeholders and Member States, the development and adoption of an evolving and detailed global framework for action on open solutions, which will guide and stimulate international cooperation to advance open solutions for the benefit of humankind and planetary sustainability.

V. MONITORING

Member States should, according to their specific conditions, governing structures and constitutional provisions, monitor policies and mechanisms related to open solutions using a combination of quantitative and qualitative approaches, as appropriate. The UNESCO-established coordinating body, in a mechanism to be determined, will collect these statistics and share them with Member States.

Annex 4: OSI's Plan A

March 30, 2020 version

An inclusive, achievable, sustainable approach to global scholarly communication reform

INTRODUCTION

OSI is a diverse, global group comprised of many of the world's most knowledgeable and trusted experts on open access. These experts are advising the world's most influential institutions, and as a group, OSI is advising the United Nations Educational, Scientific and Cultural Organization (UNESCO).

In service to these institutions, and to the global research community, OSI's Plan A will help advance the world toward greater open access. Plan A participants will:

- Conduct much needed studies to fill in gaps in our understanding of the open research challenge
- Create new and needed infrastructure tools and resources to help accelerate our progress toward open
- Develop and distribute open educational materials, and conduct outreach in the research community to help familiarize researchers with open concepts and resources
- Convene, survey, and communicate with all stakeholders, and work in partnership with UNESCO to help build our community's common ground, and
- Lead ambitious efforts to open more climate change research and health/medical research.
- Who is this effort for and why does it matter? The movement to "free" our information is a global phenomenon that has been transforming culture for decades now. These pressures have led to massive innovation, but also unintended consequences, like the rise of fake news and the death of newspapers. It is therefore vital that the changes we make to research communication are well considered—that we fully understand the facts behind our reform proposals, that we work on reforms as a community since there are so many different and equally valid interests and stake, and that we understand our common interests and so we can work together toward our common goals and strive for an open research future that is rich, robust, and sustainable.

Plan A is a necessary first step toward making real and lasting improvements to the future of research communication. From this strong foundation, the sky's the limit.

THE PROPOSAL

OVERVIEW

The Open Scholarship Initiative (OSI) is the world's only large-scale, high-level, multi-stakeholder effort focused on developing an inclusive, achievable, sustainable approach to global scholarly communication reform. Over 400 top leaders in scholarly communication have participated in OSI since 2015, representing 250 institutions from 27 countries and 18 stakeholder groups.

Plan A is a synopsis of the main themes and recommendations that have emerged in OSI during this group's examination of the scholarly communication landscape. Over this period, OSI participants have

shared, analyzed, promoted, criticized and debated detailed perspectives and information through conferences, summit meetings, dozens of reports, and thousands of emails. In accordance with the group's goals and conversations, Plan A sets forth that the international scholarly communication community should begin immediate and significant joint action to:

1. **DISCOVER** critical missing pieces of the open scholarship puzzle so we can design our open reforms more effectively;
2. **DESIGN**, build and deploy an array of much need open infrastructure tools to help accelerate the spread and adoption of open scholarship practices;
3. **WORK TOGETHER** on finding common ground perspectives solutions that address key issues and concerns (see OSI's "Common Ground" policy paper for more detail); and
4. **REDOUBLE OUR COLLECTIVE EFFORTS** to educate and listen to the research community about open solutions, and in doing so design solutions that better meet the needs of research.

In pursuing these actions, our community should:

1. Work and contribute together (everyone, including publishers);
2. Work on all pieces of the puzzle so we can clear a path for open to succeed;
3. Discover missing pieces of information to ensure our efforts are evidence-based;
4. Embrace diversity. No one group has a perfect understanding of the needs and challenges in this space, and different groups have different needs and challenges.
5. Develop big picture agreement on the goals ahead and common ground approaches to meet these goals; and
6. Help build UNESCO's global open roadmap (described herein).

Plan A also recommends that the community's work in this space be common-goal oriented, accountable, equitable, sustainable, transparent, understandable, and responsive to the research community. While it is important to make research more open so society can benefit more from research, our approaches to this challenge must be developed carefully and in close collaboration with the research community. By doing so, we can ensure that research is protected during this transition, and that it is well-served by the outcome of our efforts.

MAIN ITEMS

Plan A proposes that beginning in mid-2020 and continuing for a period of five years, the global scholarly communication community cooperate and collaborate on four main categories of action: studies, infrastructure development, common ground work, and education/outreach:

1. **Studies**: We need to develop a better understanding of the scholarly communication landscape. Our community's lack of understanding about key issues has, for the last 20-plus years, made it difficult to create effective reforms. To this end, we propose working collaboratively to support and conduct studies that will help us find needed answers to questions such as (but not limited to): What are the exact dimensions and implications of so-called "predatory publishing" (how fast is it growing, how is it changing, how is it impacting research, and more)? How can we reduce misuse of the impact factor (is inventing a different impact factor the answer, and if so, what does this look like in practice)? Can embargoes be reduced or eliminated (and if so, how; we need to generate actual data on this)? What are the demonstrable impacts on research and

society of openness (the open access citation advantage is just one such measure; how else are impacts being measured and what kind of quantitative comparisons can we make)? What kinds of open are most effective in what fields and for what purposes (are CC-BY-licensed studies and studies with data used everywhere as intended, how does this use compare with other kinds of study formats, and more)? What global approaches will succeed at shifting the culture of communication in academia toward more openness? OSI has identified 12 such studies that should be considered, and that are foundational to designing approaches to open research that are evidence-based. OSI's study recommendations are flexible. Plan A participants will decide which studies to fund and in what order.

2. **Infrastructure development:** The global scholarly communication community needs new infrastructure items—products, services, tools, websites, and other resources—that will help encourage, achieve, sustain and monitor reforms in this space. Our community should develop these items together, and reasonably quickly, so reforms can be more easily adopted and the scholarly communication landscape can be more quickly and easily improved and maintained. OSI has identified seven infrastructure items for potential development, including an all-scholarship repository (possibly built using CERN's Invenio), an APC discount/subsidy database, an open index of all scholarly publications, an APC price comparison tool, a Yelp site for scholarly publishing, repository upgrades, publisher standards, and an annual "state of open" survey. OSI's recommendations are flexible. Plan A participants as a group will decide which infrastructure items to develop and in what order.

3. **Common-ground work**: There is vast common ground in the scholarly communication community. Most of the groups in this space from across the regional and stakeholder spectrum recognize and respond to many of the same challenges and issues. This commonality exists both within and between stakeholder groups. As a broad, global community, though, we have never taken time to work through our differing perspectives and identify specific ways we can work on these challenges and issues together at scale (there have been many instances of limited sharing and collaboration, including OSI itself, but nothing approaching a global movement to work together). OSI conference delegates have done this kind of work—their ideas and perspectives are summarized in OSI's "Common Ground" policy paper. These ideas and perspectives might be helpful seeds of a broader, global conversation. What are our common goals for the future of open? Can we create a common framework for understanding how open publishing practices overlap with open data, open education, and open code? Can we learn from the open movement writ large to inform and guide what we're trying to accomplish in academia and where we want this work to ultimately lead us? Are there specific common ground solutions identified by OSI that we can move forward with right away? Building on the common ground we have in this community, we have a better chance of developing the right detailed solutions together, in the right order, and for the right reasons, and these solutions will have a better chance of being adopted, sustained, and bearing fruit.

4. **Education/outreach**: The scholarly communication community has overestimated the degree to which researchers are informed and convinced about open scholarship. There is, in fact, a great deal of misinformation and lack of information in this space which is hindering progress. In order to make more and faster progress on open reforms, our community needs to be better informed with regard to "open" definitions, opportunities, impacts, processes, options, and so on (note that some of this information will come by way of new studies that more clearly identify the impacts of open). Our community also needs a better system in place for listening to stakeholder feedback, and for creating and adjusting to solutions accordingly. Of particular focus on the listening side, we need a clearer and more detailed understanding of exactly what researchers want and need, what they will use, and what we hope to accomplish with reforms so we can make sure to ask the right questions, collect the right data, and pursue the right

solutions. OSI has identified three key education/outreach programs to pursue, including international meetings where all stakeholders can discuss the outlines of a new global roadmap for open scholarship (both independently and as part of UNESCO's global roadmap effort), combating predatory publishing through improved awareness and standards, and working together to better understand the needs, goals and concerns of researchers in different disciplines, fields, labs, regions and institutions, and career stages.

In addition to these four main categories of action, Plan A also proposes that, in parallel, we begin taking immediate action as a community to improve the relevance of open research to researchers, and the value of open research to society, by:

1. Opening and centralizing all climate change-related research (to the extent it can be without compromising private health information);
2. Creating zero-embargo compassionate use access portals for patient families and for researchers combating health crises (whether through a new program or by strengthening and expanding the existing Emergency Access Initiative);
3. Creating a more robust Research-4-Life program for lower-resourced regions and institutions; and
4. Considering how to modify current openness programs to improve researcher use and engagement.

FUNDING DETAILS

The following funding details are flexible. Plan A funders will work together to decide which studies to fund at what level and in what order. Plan A funders are welcome to earmark their contributions for specific deliverables listed below, or request that their funding go toward different deliverables (subject to the approval of Plan A's advisory board):

BUDGET FOCUS

Plan A annual revenue (US$)	Studies	Infrastructure	Outreach & Education	Common ground work	Climate change focus	Compassionate use focus
$0				✓	✓	
$50,000			✓	✓	✓	
$150,000	✓	✓	✓	✓	✓	✓
$250,000	✓✓	✓✓	✓	✓✓	✓✓	✓✓
$500,000	✓✓	✓✓✓	✓✓	✓✓✓	✓✓✓	✓✓✓
$1 million +	✓✓	✓✓✓✓	✓✓✓	✓✓✓✓	✓✓✓✓	✓✓✓✓

STUDIES

Priority	Subject	Summary	Estimated cost (US$)	Estimated time required
1	Predatory publishing	What are the exact dimensions and implications of predatory publishing—how fast is it growing, how is it changing, how is it impacting research, and more? This will be a novel analysis using proprietary data. The findings will help guide policy response on this issue.	$75,000	1 year from funding
2	Impact factors	How can we reduce misuse of the journal impact factor? Is inventing a different impact factor the answer? If so, what does this look like in practice? This will be a novel examination involving statistical critiques of the JIF. The findings will help guide development of better tools and practices for assessing impact.	$50,000	2 years from funding

3	Embargoes	Can embargoes be reduced or eliminated? If so, how? This will be the first effort to generate actual data on embargoes via a blind study conducted with cooperation from major commercial publishers. Researcher surveys will also be conducted. The findings will help inform policy decisions regarding how quickly journal articles can be made publicly accessible.	$50,000	2 years from funding
4	Open spectrum	What kinds of open are most effective in what fields and for what purposes? What kinds of open are most desired by field and type of study? How are open and closed data being used today and what are the real-world pros and cons? Research team surveys will be conducted, alongside an extensive literature review. The findings will help align open policies with what researchers need and/or are able to use.	$100,000	2 years from funding
5	Culture of communication in academia	What global approaches will succeed at shifting the culture of communication in academia toward more openness? This study will involve a meta-analysis of existing work in this field, supplemented with surveys of university provosts. The findings will help inform the design of policies geared toward improving the acceptance and adoption of open practices at research universities.	$75,000	2 years from funding
6	Open impacts	What are the demonstrable impacts on research and society of openness? The open access citation advantage is just one such measure; how else are impacts being measured and what kind of quantitative comparisons can we make? This study will involve a meta-analysis of existing work on this topic, including interdisciplinary scholarship on systems. Combined with the understanding derived from other studies, this work will help policy makers and research administrators better understand exactly what impacts are being sought by open policies, what impacts can be reasonably expected, and how policies should change to improve impact.	$100,000	3 years
7-50	Other	Open roadmap development; global flip analysis; global publishing standards development; replicating the SciELO model in specific regions; improving scholarly publishing research; a closer look at publisher profit margins; other	$50,000 each	1 year each

INFRASTRUCTURE

Priority	Subject	Summary	Estimated cost (US$)	Estimated time required
1	APC discount/subsidy database	There are no databases of article processing charges (APCs) or subscription discounts or subsidies. Research4Life leaders have noted that building such resources would be immensely helpful to authors. OSI researchers will collect and input initial APC and discount/subsidy data over a period of six months, after which point publishers and discount/subsidy providers will be given instructions on how to keep their data current.	$20,000	6 months
2	APC price comparison database	APC price shopping may not exist yet simply because there is no tool to help facilitate this (price is a factor, but surveys have shown that authors care more about quality and impact than price). An APC price comparator tool might therefore be of service to the global scholarly communication community. No such tool currently exists. The development and deployment of this tool would need to proceed with care. While providing price information is valuable, we don't want to help promote fake journals either.	$20,000	6 months
3	Global open indicators + annual survey of open	Our community needs some way to better assess, on a regular and comparable basis, how much open exists and where, and where we need to focus our efforts for more improvement. This task can be triangulated upon from several angles, including an annual survey of the state of open (current surveys are irregular and don't have a common baseline or common methodology), and a global open indicators tool that can measure open more granularly and by region, country, field, etc. (the indicators tool may be developed in collaboration with UNESCO).	$75,000	12 months to develop + 2 months/year thereafter
4	Journal whitelist/blacklist lookup	This system-wide lookup tool will be used to verify whether a journal is listed on a particular index, and will help dissuade citing non-indexed and possibly suspect work. Journals will be encouraged to adopt an editorial policy whereby if a referenced journal does not appear on a whitelist, then authors must justify the citation.	$50,000	18 months to develop pilot
5	Yelp site for journals	OSI will build a few tools that have wide "category-killer" appeal and real paradigm-shifting potential for scholarly communication. A Yelp site for journals is one such tool. The core purpose of the Yelp site is to provide an easy-to-use, familiar-looking interface where customers (authors, editors, reviewers, funders and more) can rate scholarly journals and where publishers can provide important contact and product information—a link to their website, a summary of their products and services, links and credentialing badges that verify data such as indexing and impact factors, and much more. Customers will be able to search this database for publishers in their field, price range, region and more—like the actual Yelp site, searches can be filtered in a wide variety of ways. Customers will also be able to provide reviews regarding their experiences with publishers, which will help round out the data provided by Cabell's blacklist and other information sources. Ad revenue will help support the upkeep and sustainability of this product, with excess revenues accruing to OSI toward the development of OSI's other products (and studies); sponsorship support will also be important. This will be a complicated product to develop, launch and fine-tune, and very labor intensive as well.	$100,000	18 months to develop pilot

6	All-Scholarship Repository	The All-Scholarship Repository (ASR) is the ultimate game changer in scholarly communication. Rather than continuing to rely on (and expand) our global network of institutional and national repositories, and then exert herculean and ultimately inadequate efforts to connect the meta data in these repositories (which ends up only providing a glimpse into the contents of each repository, not full access to the contents themselves—at least at the moment), ASR jumps over this step and instead creates a single warehouse for all scholarly research content. In terms of architecture, ASR would be single database with many spokes—many independent owner/operator channels through which data can be added and outputs can be customized. The central ASR database would be replicated and archived continuously; it would also be cloned by owner/operators. A fuller description of the ASR concept and operation is available in the appendix of OSI's February 2015 report (OSIWG 2015).	$350,000	2 years to develop pilot version
7-50	Other	There are many good ideas floating around the scholarly communication community—developing an open impact factor, a global journal index, an iTunes-like single article download site, or global publishing standards; better funding existing infrastructure like DOAJ; and more. The Plan A funding group will decide which of these projects to prioritize.	Approx. $20,000-$200,000 each	Appox. 2 years for each pilot

OUTREACH/EDUCATION

Priority	Subject	Summary	Estimated cost (US$)	Estimated time required
1	Global Open Access Portal (GOAP)	Built in collaboration with UNESCO, this portal will be a comprehensive resource for all open-related information, organizations, definitions, processes, and so on.	$25,000 annually	6 months for pilot, 10 hours/week to maintain
2	OSI briefs & reports	OSI has accumulated a wealth of knowledge over its four years of operation. We are publishing readable two-page issue summaries (briefs) and longer policy papers that consolidate and translate this knowledge for lay audiences. A few of these have been published to-date; many more are planned. These materials will be a central component of UNESCO's GOAP.	$15,000 annually	1-2 months per report
2	Misc. education	A variety of one-off education efforts are needed for specific purposes—-for instance, to combat predatory publishing through improved awareness of this issue.	Varies	Varies
3	Misc. engagement	A variety of "engagement resources" are needed for bringing together the scholarly communication community (not events, which are described in the "Common Ground" section). For instance, our community needs an annual report similar to what the STM Association publishes annually on the state of STM publishing.	Varies (at the high end, $50,000 annually for survey or report)	Varies
4-50	–	There are a number of high priority needs in this space. The Plan A funding group will decide which of these to prioritize, with a focus on funding projects that provide broad and nonpartisan background on open (not projects teaching that open looks like x, or trading in negative stereotypes about publishers or other stakeholder groups, but projects that teach what open means to various constituencies, the benefits of open, ways to engage in open, etc.)	–	–

COMMON GROUND WORK

Priority	Subject	Summary	Estimated cost (US$)	Estimated time required
1	UNESCO open roadmap	Continue helping/advising UNESCO in creating a UN-wide roadmap for the future of open science	–	18 months
2	Meetings	Meetings are needed all stakeholders can discuss the outlines of a new global roadmap for open scholarship (both independently and as part of UNESCO's global roadmap effort), and where diverse groups can work together to better understand the needs, goals and concerns of researchers in different disciplines, fields, labs, regions and institutions, and career stages.	$50,000 per meeting	4 months planning and follow-up per meeting
3	Surveys	We need a clearer and more detailed understanding of exactly what researchers want and need, what they will use, and what we hope to accomplish with reforms so we can make sure to ask the right questions, collect the right data, and pursue the right solutions.	$20,000 per survey	6 months
4-50	–	The OSI2016 and 2017 workgroups came up with a long list of recommendations for collaborative actions in the scholarly communication space. These should be carefully looked at by the Plan A group as possible projects. See the OSI2017 report (on the OSI website) for details.	–	–

CLIMATE CHANGE FOCUS

Priority	Subject	Summary	Estimated cost (US$)	Estimated time required
1	Open policy meetings	Climate science is closed relative to many other fields. Figuring out how to make it more open is critical—to enable scientists from all countries and from all fields related to climate science to share their data more freely on everything from atmospheric carbon removal technology to methane capture to temperature modeling.	$50,000 investment per meeting (net invest is $0)	4 months planning and follow-up per meeting
2	Education conventions	Conventions are needed to educate business and policy groups about the range of existing tech options for carbon and methane capture. Presentations should also take place at these meetings on barriers to action, risks of uncoordinated action, forming international networks for investment and action, etc.	$100,000 investment per meeting (net invest is $0)	4 months planning and follow-up per meeting
3	Action frameworks	Once the data is clear and the barriers and risks have been assessed, action frameworks can begin taking shape. Openness will be key in this—establishing frameworks built on discoverable information, communicated clearly to policy makers and the public, with clear, sound, accountable objectives in mind and strong sustainability.	$75,000 annually	6-12 months to begin making measurable progress
4	Replicability	Once developed, OSI's climate change model can be replicated to other research challenges.	–	–

COMPASSIONATE USE FOCUS

Priority	Subject	Summary	Estimated cost (US$)	Estimated time required
1	Open policy meetings	Compassionate use access to medical research is spotty. Publishers have some one-off mechanisms in place for daylighting research during times of global health crisis (such as COVID-19 research. Several international conventions also exist. However, there are no turn-key procedures or resources in place. Figuring out how to make critically needed health and medical research available to researchers and policy makers (as well as individuals researching cures for loved ones) will fill an important needs gap in the scholarly communication space. The first step is to meet to talk about needs, gaps, barriers, possible solutions, etc.	$50,000 investment per meeting (net invest is $0)	4 months planning and follow-up per meeting
2	Action frameworks	Once the challenge is clear and the options have been assessed, action frameworks can begin taking shape. Openness will be key in this—establishing frameworks built on discoverable information, communicated clearly to policy makers and the public, with clear, sound, accountable objectives in mind and strong sustainability.	$75,000 annually	6-12 months to begin making measurable progress

WHY?

Scholarly communication tools and practices have been evolving for decades now. Where they end up decades from now is truly anyone's guess. Until then, there are many issues that need to be resolved, and many reforms that should be pursued.

So what's the holdup? Nothing really. There are a large number of organizations in the scholarly communication space who are working on reforms. Some of these groups are working together, most are not. Overall, our progress toward a more open research world has been growing steadily, although much progress remains to be made.

Or at least some people see it this way. Others are convinced that not nearly enough progress has been made to-date, which isn't wrong—they're just measuring progress differently. There are fundamental disagreements in scholarly communication about what kind of reforms we should be making. Some feel quite strongly that commercial publishers have no place in the future of research and that no reforms are complete unless publishers are excised from the picture. Others feel quite strongly that publishers have a centuries-long track record of serving the research community and that the tools and processes put in place by publishers are essential to retain because they facilitate good research and are valued by the research community. Still others are caught somewhere in between—-yes,

publishing is valuable, but exactly what is "publishing" in the digital age, and can't we do things more efficiently today than in years past?

There is also a wide range of disagreement over how fast needed reforms can and should happen. "Right now" is too slow for some, and "ten years from now" is too fast for others. On the fast side, advocates see the need for the immediate daylighting of research information that could cure cancer and reverse climate change. On the slow side, advocates see the need to move with caution lest we damage research with rash and ill-considered changes.

Aside from issues directly related to open access reform—what kind of open and how fast—there are also many persistent issues in this space that will require global cooperation to solve. The misuse of impact factors is one such issue, for instance. Impact factors at their most innocent simply tell researchers which journals are more important than others. At their most sinister they are used as a proxy for quality and drive publishing behavior that works at cross purposes to a more open world (what researcher, after all, wants to publish in a small start-up journal that is free to read if the real credit and glamor comes from publishing in the New England Journal of Medicine).

Plan A isn't advocating one particular approach or time frame, but rather a necessary and inclusive process. By working together—however quickly and aggressively we decide to do this as a community—on realistic, robust, collaborative solutions that improve the capacity of research for all researchers everywhere, Plan A's vision is that we will arrive at solutions that are both sustainable and highly effective—much more effective than any "solutions" imposed by outside groups with their own biases and agendas.

Indeed, Plan A's vision is that by working together, and only by working together, we will eventually—maybe 15 years from now, maybe less, maybe more—-arrive at an "Open Renaissance" where the research ecosystem will grow exponentially more powerful as more open and connected data catalyzes more innovation and improvement. New fields and directions will emerge based on "connecting the dots," funding efficiency will improve, and discovery will accelerate; the social impact of research will exceed today's levels (including improved literacy, public engagement, and public policy impact); and knowledge will become more of a global public good, with society reaping the benefits.

GUIDING PRINCIPLES

This work will be guided by 12 general principles that represent a global, multi-stakeholder, common ground perspective on the future of scholarly communication. Plan A's work and work products will be:

1. **Researcher-focused**. Research communication tools, services and options need to be developed with heavy input from the research community, with solutions and approaches driven by researcher needs and concerns.

2. **Collaborative**. Successful and sustainable solutions will require broad collaboration, not just to ensure that all perspectives are considered, but also to ensure there is broad ownership of ideas.

3. **Connected**. There are a great many interconnected issues in scholarly communication. We can't just improve the openness of information without also addressing issues such as the current functioning of impact factors, peer review, and predatory publishing. Reforming scholarly communication will require a systemic approach.

4. **Diverse and flexible**. There are no one-size-fits-all solutions to scholarly communication reform. Instead, there are many different pathways to reform, including many that have not yet

been conceived or deployed. Diversity, creativity and flexibility in this undertaking should be encouraged, at the same time noting that we should try to maximize adherence to the other principles represented here.

5. **Informed**. We need a better understanding of key issues in scholarly communication before moving forward. For instance, what is the impact of open research? The more accurate and honest our assessments, the more accurate and honest our reform efforts can be, the easier these efforts will be to promote, and the more successful they will be.

6. **Ethical and accountable**. We need enforceable, community-developed/driven standards to ensure the integrity of journal publishing, repositories, and other related activities/products, and to ensure that unethical approaches are not embraced.

7. **Common goal oriented**. We must discuss and plan for what the future of scholarly communication means, beyond just having access. For instance, we need to identify precisely what we plan to do with open information, where we will need data interoperability, what tools and procedures we will need to achieve this interoperability, and so on. By doing this, we focus on and strive for our community's common goals.

8. **Equitable**. Researchers everywhere need to be able to access and contribute information to the global body of research information with minimal barriers. To the extent practicable, research information—particularly information central to life and health—should not be unreasonably constrained by issues such as high access costs, poor journal indexing, and a lack of capacity-building programs.

9. **Sustainable**. Scholarly communication reform approaches need to be sustainable, which flows from all the other elements in this list. That is, the reform solutions we design need to be achievable, affordable, popular, effective, and so on.

10. **Transparent**. This community needs to maintain as much transparency as possible in this effort (with regard to pricing, usage, ownership, and so on) in order to address the trust issues that have plagued this space for so long.

11. **Understandable and simple**: This community needs to agree on a few simple, high-level, common-ground goals for scholarly communication reform—not anything specific with regard to publishing requirements, for example, but a general set of goals that are understandable, achievable, and adaptable. By setting out general goals that can be easily achieved, participation can be made simple and easy, with low barriers to entry.

12. **Beneficial**: In the end, these reforms need to benefit research first and foremost. While the argument to improve benefits to society is central, these benefits need to be matured carefully, deliberately, and realistically in order to ensure that societal benefits are indeed being conveyed as intended, and that research is not being harmed in the process.

ENACTMENT

It is important to note that the global "scholarly communication community" addressed by this Plan A is vague and amorphous. However, this community also has much in common, and it shares common goals and interests (see OSI's "Common Ground" paper for more detail). It is in this broad sense that we speak of community—not with the unrealistic expectation that every organization currently working in this space will or should stop what they are doing, leave their disagreements aside, abandon their own priorities and join hands, but with the knowledge that ample common ground exists in this community to support common action that benefits everyone everywhere. The vast majority of stakeholders in this space are not, after all, ideologically attached to any one particular approach—most

are simply trying to figure out what to do with regard to open policies. In addition, even groups who may be invested in one particular approach or perspective share a common desire to improve open. The contributions to openness supported by this plan—studies, infrastructure development, common ground collaborations, and education/outreach—will help all groups in this space and will help advance open for everyone.

With regard to enacting this plan, participants will decide how best to jointly manage Plan A and its activities. OSI will be the initial manager until such time as decided otherwise by the group, under a governance plan to be released at a later date. The goal is for Plan A to be fully operational by mid-2020 (i.e., beginning to work on targeted projects, studies, outreach, and other to-do items), with work continuing for as long as funding and interest continue.

FEEDBACK

Feedback on this plan from the global scholarly communication community is welcome. Comments should be sent to info@osiglobal.org. This plan will be revised over time in response to this feedback, and also in collaboration and consultation with UNESCO's open research roadmap effort.

FAQS

1. Where's the beef? I'm looking for a bold plan with lots of action.

    - Finding a common ground starting point for action is vital. What the scholarly communication community needs is a respectful, collaborative effort to work together on solutions that everyone has a say in developing and that will benefit everyone everywhere. Assessing the wealth of recommendations from OSI2016 and OSI2017 workgroup participants (see the OSI2017 report for details), the most frequently mentioned crosscutting issues were the need for more studies and the need to reform the culture of communication in academia. The most frequently mentioned approaches for reforming scholarly communication were studies, coordination and collaboration, outreach, new tools and programs, improved standards, pilots, resource development, and policy leadership. Plan A's focus is derived from these recommendations, overlaid with what the OSI group has learned and observed since these meetings about our internal strengths and about the environment for global reform. Specifically, what can realistically be accomplished and has the greatest chance of serving as a foundation for real and lasting improvement? Plan A is it, and from this effort, trust, accomplishments and progress will build and grow.

2. Is this a manifesto or a plan?

    - It's both—a description of the need to come together to solve a very important problem, and the mechanism for doing so.

3. This is for the benefit of publishers, right?

    - Wrong. Publishers need to know what to do. Plan A provides a framework for action that allows everyone to work together instead of everyone rowing in different directions.

4. Is OSI pro-publisher?

    - OSI is pro-stakeholder. Everyone deserves a seat at the table, even publishers, who have been targeted for years as being somehow culpable for not providing more information free of charge. The reality is that "free" isn't a sustainable business model. If we value what publishers bring to the table—gatekeeping, evaluation, editing, structure, organization, dissemination, and global integration—then we need to work with them to create effective and sustainable

change. If we prefer to wipe the slate clean and start all over again, that's an okay perspective too, bearing in mind that this approach has risks and may result in simply reinventing the wheel and ending up with the same costs and issues as before, just different players.

5. This is a lot of work. Who pays for it?

    - No one yet. OSI is currently (as of March 2020) seeking support for this plan. Our hope is that at least some of the larger signatories will be willing to each contribute a small amount of support to help get the ball rolling.

6. A lot of Plan A hinges on having adequate support. Is this a problem?

    - Yes and no. There is plenty for us to do in the short-term absence of full funding (see funding section for details)—continuing to write grants, write briefs, plan studies, build alliances, advise UNESCO, and more. This said, funding may be on the horizon for specific deliverables. Also, as Plan A gets promoted, funders may come on board (whereas if they haven't supported OSI in the past, this may be because OSI itself wasn't proposing to build anything).

7. What's the relationship between OSI and Plan A?

    - Plan A is an invention of OSI, representing the collective wisdom of OSI participants. However, in order to ensure that Plan A can grow and evolve in accordance with the wishes of the organizations who sign this plan, the current intent is for Plan A to become an independent group by the end of 2020, with its own management structure and governance rules. OSI will retain a seat on the Plan A board, and will likely continue to provide the bulk of Plan A's financial support.

8. Why 5 years? Why not now?

    - The open access movement has been pushing for "now" solutions for the past 20 years. They don't work, because "now" is not an acceptable substitute for appropriate consultation. The scholarly communication community has many stakeholder groups with a stake in the outcome of reform measures. It is essential, both for the success of these reforms and for their long-term sustainability, that the first step in these efforts involves bringing everyone together. From there, who knows? Maybe real reform will take only four years? But continuing to pursue "now" solutions for another 20 years isn't the right approach.

SIGNATORIES

Groups that sign Plan A indicate a willingness to working together to fulfill the plan's goals. A current list of signatories will be available online.

ANNEX

STUDIES

OSI will begin conducting studies that target key issues in scholarly communication where a lack of firm understanding is making it difficult to create effective policy reforms. These studies will be "leveraged" through OSI, not outsourced. That is, OSI has enough internal and volunteer capacity to do all the study design, oversight, writing and analyses in-house. Grant funds will be used mostly for data-gathering and statistical analyses. The OSI team will identify and hire researchers as needed (some may end up being OSI participants already) who can conduct original research work as needed, and

hire statisticians as needed to crunch numbers and maybe take a first pass at analysis, but the final writing and analysis will be done in-house by OSI participants. In this way, we can get the most studies possible with the smallest outlay of time and money. The studies we will conduct are as follows:

- **DECEPTIVE/PREDATORY PUBLISHING**: Exactly how fast is deceptive/predatory publishing growing, how much of it exists, and what are its dimension (by region, discipline and so on)? Very little definitive is known about this phenomenon, and yet it is perhaps the single most disruptive influence in publishing today (Anderson 2019; Strinzel 2019). As more emphasis is placed by libraries and funders on open access publishing, more open access publishing options are becoming available to authors. Some of these options are legitimate, some are not. This study will describe what we already know about predatory publishing, and will also enlist the aid of leading researchers who are part of OSI to suss out long-term data about the growth of predatory titles over time. A rough outline of this study is as follows:

Title: Using new and improved data to assess the academic journal landscape

Section	Description	Pages	New or novel?	Notes	Lead author?
Intro	Overview	0.5	No	Why can't we just do a count in Google? Well, for one, they won't let us. Second, there's no accounting for quality. The future needs to be built on systems that are reliable and accountable.	Glenn Hampson
What is a journal?	Essay	1	No		Rick Anderson
The growth of journals and journal articles	Statistics	2	Yes	This is a known concept but will use new/better data from 1findr	Eric Archambault
Breaking down the nature of this growth	Statistics	3	Yes	Same as above. Focus on regions, disciplines, rates, and types (open, subscription, hybrid, other; predatory, indexed, non-indexed), plus—from other studies—how this compares to growth rates for "other" types of science communication like white papers, blog posts, preprints; who is publishing and why; etc. (from other studies)	Eric for new material, Glenn for rest
Discerning legitimacy	Overview	0.5	No	A quick case for how we define real science publishing and how evolving publishing norms are making it easier to push these boundaries	Rick
The statistics of legitimacy	Stats	4	Yes	A detailed look at what Cabell's is doing, plus a detailed breakdown of the predatory landscape (rates, regions, disciplines, etc.), as well as a breakdown of what kinds of "violations" exist. How much of this "predatory" work is mixed in with real work, and how does this change the growth estimates that Eric came up with? This will need to be broken down by region and discipline—the aggregate numbers won't be revealing.	Simon Linacre
Testing assumptions	Stats	4	Yes	Random sample Google search results in various topics from different parts of the world to if what comes up in Google searches matches what "should" come up in terms of significance and legitimacy. [This is important insofar as GS is the primary search mechanism for a majority of the world's researchers.] For instance, does searching for "cancer vaccine research" return real work more often than not, or lots of predatory work? Understanding this will help us understand how worried we should be about fake science corrupting our knowledge base.	Not sure

Re-thinking the landscape	Informatics	2	Yes	How else can we visualize what's happening in scholarly publishing? For instance, would it make more sense to group journals into "read" and "not read" (and/or relevant and not relevant, compliant and/or noncompliant, etc.)? By audience saturation? Etc. In other words, is it necessary to think in terms of the growth of articles and journals if what's actually being used/read is remaining essentially unchanged (save for new journals covering new fields), or if journals are born and quickly die?	Glenn et al
Issues and recommendations	Policy	3	Yes	What are the issues that are important in this landscape (like inclusion and preservation), and what issues are preventing us from tracking academic scholarship more closely (ISSN errors, naming differences, indexing problems, completeness issues like poor inclusion of SciELO journals, etc.), how prevalent are these, and what can/should we do to remedy these? Is a global open index a solution (plus a global open impact factor)? These ideas will be explored more fully in a forthcoming OSI project.	Glenn et al

- **IMPACT FACTORS**: Impact factors are one of the most destructive, most corrosive measures used in science today (OSI 2016a, Bosman 2013). They are also one of the most important and widely used. How can both of these statements be true? Because impact factors are the statistic we love and hate—we know they are more or less meaningless (Lozano 2012), but we also know that high impact factor work translates into promotions and grants. And so we turn a blind eye to their shortcomings and keep using them. Much has been written about the use and misuse of impact factors (i.e., explaining what they were intended to measure versus how they are promoted), alternatives to the impact factor, and calls for broadening the metrics we use in assessments (particularly RPT). But nothing has ever been written about the statistical validity of this measure. In fact, the impact factor isn't mathematically valid at all for the purposes of measuring "impact" (for several reasons—the most significant of which are that this is an aggregate journal level metric and not an article level metric; also, citation counts are just aggregate, not positive or negative, so a bad article could be highly cited as an example of what not to do. After dissembling the mathematical foundation of impact factors, this study will propose how to remake the impact factor to improve its use. It will also rethink policies regarding how we use future impact factors in order to avoid perpetuating the "arms race" situation we have now where publishing in high impact factor journals is seen (incorrectly) as a proxy for quality, relevance and impact (dissembling this narrative will require evidence). Finally, this study will review the existing literature for an explanation of why we use these measures in the first place (plus an overview of who uses them and how), and review other proposed means of measuring impacts (existing tools, new tools, etc.). One final approach that may also be explored as part of this paper, depending on how far along the development of a proposed product has progressed (see "open impact factor + open index") is a new "open impact factor" measure (built on the new math but using a global index) that everyone can have/use and that doesn't discriminate against small/new publishers. Currently, only journals indexed by Clarivate (representing a narrow and elite set of journals) can have an actual impact factor calculated; everyone else needs to use a fake impact factor (like the Global Impact Factor) or invent one out of thin air. Creating an open impact factor will first require creating a global index, which is described in more detail in the open impact factor + open index product proposal.

- **EMBARGOES**: How necessary are embargoes? Publishers insist that a 6-12 month delay is necessary between publication and free public access in order to protect subscription revenues. Critics contend that this time could be shortened—that there are other ways to protect revenue streams that don't involve long paywalls. To-date, the only estimates of ideal embargo length have come from citation half-life studies. In order to generate more "real" data on this

matter that directly answers the question of how long is too long (instead of inferring this from half-lives), we will conduct a blind with the cooperation of publishers (Elsevier volunteered to participate in this study in 2016; we will revisit this offer and see if we can also include other publishers). This study will reduce or eliminate embargoes for a select number of publications and will monitor this impact of this action on revenues. If the impact is negligible, the evidence may suggest that embargoes can be shortened (or that revenue loss can be offset through other value-added access means—e.g., increasing access to the article but not the dataset, which will lead to more purchases of the dataset). The need for embargoes remains a major sticking point in open debates. Figuring out how to make progress on this issue is important to the future of open.

- **IMPACTS**: Not to be confused with "impact factor," understanding the actual impacts of open in research, education and society is vitally important. This is more of a meta study than anything, but it's needed to better "sell" the advantages of open (or to better understand why open is not selling and what we really need in open—more standardization of data, for instance). The OA citation advantage is the most visible attempt so far to quantify open impact, but studies trying to measure even this one statistic have reached different conclusions to-date. Eric Archambault's most recent study (Science-Metrix 2018) is the most authoritative, but even this study didn't look at the full spectrum of open products, just "gratis" (which crosses several categories of open). What we need to know is much more granular: what kinds of green open are the most effective (for instance, the green in institutional repositories, or on preprint servers, or where?), how well is gold received by researcher (and what type), bronze, public access, and so on? In other words, exactly what kind of open is needed to improve visibility and reuse? What kind of open works best and why (what factors are most important—readability, findability, reusability, all of these, or none of the above)? What measures other than citation might we use to triangulate on actual impact (since citations can be influenced by press coverage, topic salience, etc.). What correlates can we note between open and research uptake, R&D investment, and more? The entire corpus of open work to-date has taken it as an article of faith that all open is created equal and that open itself—vaguely defined as it is—is meritorious. We need to get a clearer idea of what we're working to achieve and why, beginning with understanding how the current constellation of open outcomes are being received in the marketplace. (Possible OSI research leads: Rob Johnson, Caroline Wagner, Eric Olson; Rob's possible time frame for working on this is June-Aug 2020)

- **PUBLISHER PROFIT MARGINS:** A major point of contention in this space is how much profit Elsevier makes. Critics say 37 percent. The company (in correspondence with the OSI list) says much less—that Elsevier's income and expenses are entangled with those of its parent company RELX and that revenues come from many sources not related to academic publishing. A clearer picture is simple enough to arrive at by hiring auditors to examine the books (not just of Elsevier but other major publishers as well) and issue an authoritative analysis, and also by reviewing the scholarship on how to properly interpret profit margins within and across industries. We will also review the landscape of funding and costs for universities to see how publishing fits into all of this. Charges of profit-mongering and double-dipping have fueled attacks on commercial publishers or at least 15 years now and these attacks have been used as an excuse to keep publishers from participating equally in global conversations about the future of open. To the extent we can help shed more understanding on these numbers, it will help provide a firmer foundation of transparency and realistic expectations for open reforms. In order to develop a fuller understanding of the underlying tensions in this debate—it's largely just a push and pull between libraries and publishers, with each accusing the other of financial misdeeds— we may also find merit in expanding this study to include a look library finances as well. The publishers with whom we have spoken are willing to participate in this study insofar as providing requested data.

- **CONNECTEDNESS/STANDARDS/ROADMAP**: How related are different concepts and applications of open (across coding, books, journals, etc.), and where can we merge these concepts, applications and even open efforts? As we (not just OSI, but the United Nations, scholarly societies and others) begin developing new roadmaps for the future of open, it behooves all of us to collaborate not just within scholarly publishing, but between journal publishing, book publishing, data science, and so on. OSI is actively pursuing partnerships in the roadmap effort on several fronts but needs to have a roadmap of its own showing who is working on what, what concepts overlap, what concepts differ, and how this landscape of interests and perspectives fits together. From this work, it should be possible to create a new global conversation around global open standards and a global open roadmap built on common ground and connectedness and that applies broadly to all fields and all open efforts. From this position, we can establish policies that are flexible and adaptable and that all pull in the same direction toward more open. A study like this hasn't been conducted before—this would be a first attempt to define the full landscape of open.

- **NEEDS**: Tying in closely to our impact study, the scholarly communication community also needs a study that looks at how much open is needed by field (for instance, is CC-BY licensing always necessary everywhere)? As noted in the impact study description, open efforts have long proceeded from the assumption that we know what works and what the market needs, but in fact we have no idea. This study would first survey existing literature to get a fuller picture of what we already know with regard to researcher wants (primarily various author surveys conducted over the years by publishers and universities). Information gaps would then be filled via new, global surveys, facilitated with the assistance of Editage/CACTUS and others in OSI who have volunteered to help. Getting a broad sense of this demand across regions and institutions, as well as across disciplines and faculty types (as is usually done) is critical insofar as trying to ascertain global needs and perspectives and not just Northern/Western needs. Getting a better sense of what kind of open we should be working toward is also critical. The impact study will look at this from a market perspective, assessing what's being used. The needs study will look at this from an aspirational perspective—what needs are present that are not being met? Do current solutions align with marketplace options? Is there alignment between what researchers are asking for and what the marketplace looks like?

- **PUBLISHING IN RPT**: Publish or perish has been the norm in academia for decades now. This dynamic is not abating; indeed, it's accelerating (Plume 2014). Around the world, we see a wide variety of influences that are causing the number of research articles to stay high, including requiring publishing for a PhD (India), awarding cash bonuses for publishing in high-impact journals (in China; Montgomery 2018), having journal articles ghost-written for you to improve resumes (Russia), and everywhere, having more opportunities available to publish (faster, at lower cost, as part of large multi-author teams, as part of grant requirements—regardless of whether study findings are complete or meritorious, as salami-sliced articles, as a consequence of increased specialization, and more. Concurrent with this avalanche of paper, there is also increasing sloppiness in the system wherein tenure committees aren't necessarily valuing the quality of publications—that is, publishing in predatory journals may not always be noticed or questioned (Shamseer 2016). OSI has debated this issue at length and there aren't any good answers. Do we expand the scope of what "counts" in publishing to include blog posts, videos, press interviews and more? Do we lower the bar and allow preprints to count for more? Do we create professional standards such that publishing in an non-indexed journal (see tech project on indexing) is disallowed. Or even more aggressively, do we create standards that say publishing in such journals is unethical? OSI isn't the only group that has debated this issue. What is needed is a landscape analysis of RPT practices worldwide with regard to publishing. From this analysis, we will develop a set of best practices recommendations for UNESCO and national departments of education. Once we lower the pressure to publish in academia, it will become

easier to rationally discuss and implement solutions aimed at improving the quality and quantity of research publishing. Until then, and without addressing this systemic issue, reform measures will simply be reactive.

- **PEER REVIEW**: Peer review is what separates vetted science from non-vetted science. It's a critical part of the current scholarly publishing ecosystem. Peer review is also unpaid labor and an incredible burden to many in academia. To this end, different methods of peer review are evolving and being tested—for instance, post-publication peer review, which allows articles to be quickly shared and then refined via broad feedback in real time online. Peer review is also being faked—deceptive journals promise peer review but deliver only a cursory editorial review instead, if that. OSI has debated this issue at length and is well-positioned to author a landscape analysis of the current state of peer review, along with best practices recommendations for UNESCO and national departments of education. Without figuring out the right way forward for peer review, our open efforts will flounder—we can't create more open without ensuring the scientific integrity of these articles. We also need to develop and share best practices with the global community in an authoritative way, which this landscape analysis will facilitate. This effort will be focused on settling the highest priority concerns in peer review (Tennant 2019): what is peer review anyway, what value does it add, how do we define expertise, how do we protect diversity and more. These questions will be answered through broad stakeholder polling and consensus. This study will be part fact-finding, part survey, part consensus cultivating, and will involve meetings, email discussions, proposal drafts floated to institution heads, and collaboration with standards agencies like NISO and editorial agencies like WAME (which all participate in OSI).

- **GLOBAL FLIP**: California's library system, cOAlition S, MPDL's OA2020 Initiative, and other influencers in global scholarly communication system all believe quite firmly that a global "flip" to open is economically feasible, wherein closed subscription publications convert to APC-funded open publications. This belief is grounded at least in part in a 2015 study from the Max Plank Digital (Schimmer 2015) suggesting that the world has enough capacity to make this flip possible and that costs will come down as a result of APC competition. These data have never been examined closely in another research piece (they have been challenged in numerous blog posts since then) but they need to be so the global community can assess this strategy more objectively. Mounting evidence suggests that authors do not comparison shop for APCs (Tenopir 2017), so there is no downward pressure on prices. What we have instead are escalating prices, and a shifting of the cost burden from institutions to authors, all of which is only widening the gap between haves and have-nots. Are APCs the way to go? Maybe, maybe not. The fact is we don't know. More research is needed. This study will go back to square one and re-examine the data and assumptions of the original global flip study, updating data points and re-examining assumptions such as price competition based on new studies. It will then look at the variety of pricing models that have emerged in the global publishing system over the last 10 years (such as PAR) and estimate what may actually be possible—that is, estimate what the market may actually be looking for and what reforms may be achievable. Based on this analysis, this study will search for the "sweet spot"—maybe, for instance a global flip to PAR in 10 years bracketed on the high and low end by layers of subscriptions and preprints, or whatever the case may be. This analysis is important insofar as trying to visualize the end-zone for reforms. We know what problems exist and what changes need to be made. What we don't know is where the market is headed. Having a better idea of this will allow the global community to start pulling in the same direction and improve collaboration on measures that aim for the same goal.

- **GLOBAL RESEARCH PUBLISHING STANDARDS**: Figuring out how much deceptive/predatory publishing exists, what it looks like, who is using it and why (see previous study proposal

on deceptive/predatory) is just part of the effort to improve global research publishing. Another critical part is to figure out what research publishing standards we need. Several organizations in scholarly communication have discussed best practices over the years (most notably editorial and umbrella groups like NISO, WAME, COPE, and OASPA), but these discussions have stopped short of creating and issuing internationally-backed recommendations for publishing standards and the methods for enforcing these standards. This study will first gather together best practices recommendations that have been discussed to-date, update these with input from the organizations represented in OSI (which includes editorial and umbrella groups plus over 200 other organizations), and then evaluate realistic measures for creating and enforcing standards for the global research publishing community which will be observed not just by publishers but by others as well—most notably funders and universities. The goal of these standards will not be to erect barriers to publishing, but to map out the boundaries of what we mean by "open," "publishing," "peer review," and other terms that lack a clear definition. These standards will also define the minimum expectations we should have for publisher competency so that the global research publishing enterprise as utilized by universities in particular is consistent and well-defined. Since this study will rely on findings from several other OSI studies, it will need to wait until these other studies are complete before beginning. Creating thoughtful, fact-based, widely-adopted standards for global research publishing is critical to ensuring that research publishing grows in a way that represents the needs of researchers and not just market forces (e.g., less deceptive publishing, less pressure to publish in journals, etc.).

- **REPLICATING THE SCIELO MODEL:** SciELO is one of the most unique organizations in the world of scholarly communication. It is a soup-to-nuts provider of everything from publisher training to editorial services to data management and repository management, serving as a pioneering open access network and hub for dozens of journals across Latin and South America. It is a model for how the publishing industry should evolve in the global south to ensure improved focus and better access. We will undertake a study to determine the feasibility of expanding SciELO from Latin and South America to CAMENA (Central Asia, the Middle East and North Africa), Sub-Saharan Africa, and SE Asia. Is there a need in these regions? Interest? Potential financial support? Should these new SciELO's operate independently or in cooperation with one another? Based on the outcome of our study, we will then approach UNESCO and other possible funders and partners with financing and development proposals (note: an initial version of this plan was raised last year at SciELO-20 with the heads of SciELO and its parent body FAPSEP, as well as UNESCO).

- **IMPROVING SCHOLARLY PUBLISHING RESEARCH:** The majority of research into scholarly publishing-related issues and reforms isn't adequate. This is an impossible statement to corroborate—it's an observation based on the volumes of research the OSI group has reviewed over the past four years. Too much of this research exhibits a fundamental misunderstanding of the nuances in this field. In an effort to promote better research, we will research and publish a paper that describes the conditions researchers need to keep in mind when doing open research. For instance, when researching predatory journals, Beall's List should not be used as a starting point since this list is not transparent and is no longer supported (i.e., the criteria for inclusion on this list were always taken on faith—Beall never made these criteria public—which is not how science should be done). Also, we cannot assume "open" means the same thing as open access. Too much research tracks "open" without understanding that it exists in many variations, and gold/green CC-BY open is just one such variation. Also, we cannot treat databases like Scopus are being representative of all journals. This database is, in fact, narrow and highly selective. There are many more observations about scholarly publishing research we've noted over the years; publishing this as guidance will help improve the quality of future research work in this area.

- **OTHER**: The OSI group is constantly talking. It's quite likely that other study ideas will be raised. If some of these ideas are meritorious, they will be added to this grant proposal with permission and pursued if possible.

INFRASTRUCTURE

OSI will also begin developing tech products and solutions that fill key needs in the scholarly communication ecosystem where a lack of government and/or private sector action has hindered the progress of open reforms. As with OSI studies, these products and solutions will be "leveraged" through OSI, not outsourced. That is, OSI will design and oversee development in-house, and NSF funds will be used for certain programming and other work that cannot be handled in-house. The OSI team will identify and hire personnel as needed (some may end up being OSI participants already) who can conduct this work as needed, but the final design decisions and assessments will be done in-house by OSI participants. All of these products and solutions will fully deploy before 2025. Grant funds (if available) will be used to maintain these products and solutions over grant periods, but all solutions will become self-supporting through various combinations of advertising, sponsor fees, and member fees for content providers (none of these products/solutions will have user fees for basic access, although premium access models may emerge as a means of support). The products/solutions OSI will consider building are:

- **APC DISCOUNT/SUBSIDY DATABASE**: There are no databases of article processing charges (APCs) or subscription discounts or subsidies. Researchers looking for charges, discounts or subsidies need to search for these one at a time. Research4Life leaders (who are part of OSI) have noted that building such resources would be immensely helpful to authors, particularly those from the global south where discounts and subsidies are most needed, and also where price comparisons are more needed. OSI researchers will collect and input initial APC and discount/subsidy data over a period of six months, after which point publishers and discount/subsidy providers will be given instructions on how to keep their data current. This data from this system will feed into other systems we develop (see, for instance, the Yelp product).

- **OPEN IMPACT FACTOR + OPEN INDEXES:** Our uneven progress toward open is having unintended consequences. Among these consequences are the unavailability of legitimate impact factors for all journals (because not all journals are indexed), uncertainty about the number and growth of so-called deceptive/predatory journals (see deceptive/predatory study proposal), and the growing incidence of citations from non-indexed journals. Regarding this first problem, because the need exists for thousands of journals to get some sort of legitimate impact factor (whether this uses the same math as the current impact factor is a separate question—see the impact factor study, which will precede the development of this tool), because most journals will never earn a legitimate impact factor through Clarivate (since these journals don't pass rigorous tests for index inclusion), and because the alternatives (such as "global impact factor" or "universal impact factor") aren't legitimate, there is a need in the marketplace for new solutions that are legitimate. OSI has discussed developing three possible solutions to these challenges: (1) Creating an open impact factor measure (described below), (2) creating an all-inclusive open index, and (3) creating an index of indexes. All three products/services have unique audiences and all three will be developed/piloted together. The first solution—the open impact factor—simply decouples Garfield's impact factor calculation from the private management and ownership of it by Clarivate—decoupling the algorithm from the data source so we can have as many lowercase "impact factors" with as many algorithms as we want. (Clarivate has trademarked "impact factor" and "journal impact factor" in the US but does not own the mathematical concept. This move is not wresting control of the impact factor away from Clarivate since the product they provide has substantial independent merit. Rather, it is simply providing legitimate alternatives to the "universal impact factor" and "global impact factor" for journals

that do not qualify for a Clarivate-issued impact factor.) To do this will first require a developing a global index of journals, which is proposed solution number two. Current indexes are limited in scope and focus primarily on English-centered indexes. In order to improve the identification of deceptive journals it is necessary that we have a universal indexing system that overcomes the natural or operational exclusion of current indexes. Today such indexing is provided only by Google Scholar. Idea number three is to create an automated journal whitelist look-up, whereby a program will make an API call to a look up and return a list of whitelists on which a given journal appears (with cooperation from Cabell's, this call could also include blacklists). This system will return a finding like: "Journal X is indexed by WoS, JCR, Scopus, DOAJ, and MEDLINE." The lookup will also include subject lists (like EconLit, PsycINFO, MLA, and so forth) as well as regional titles. This system will be used to help dissuade citing non-indexed and possibly suspect work. Journals will be encouraged to adopt an editorial policy whereby if a referenced journal does not appear on a whitelist, then authors must justify the citation. This approach does not require much in the way of new infrastructure or the creation of new lists. It will, however, require various whitelist publishers to agree to allow such an API look-up (akin to Indeed or Monster scraping various job boards to provide one meta job board). The look-up would not contain any additional information from the white lists—only an indication of whether a journal appears on it.

- **APC PRICE COMPARISON TOOL**: As noted earlier, several recent studies have confirmed (Tenopir 2017) that scholars do not shop around for the best prices on APCs. And yet price shopping is behavior is assumed to exist and is fundamentally important to the success of the University of California's position with regard to cancelling access to Elsevier journals and hoping that alternative publishing options will not only take hold but save the system money (as enunciated by the UC's lead negotiator Jeff Mackie-Mason; see Mackie-Mason 2016), and also to the MPDL's OA2020 effort (which underpins the EU's Plan S initiative). APC price shopping may not exist yet simply because there is no tool to help facilitate this (to be clear, price is a factor, but surveys have shown that authors care more about quality and impact than price; the argument here is that if it was easier to compare prices, then maybe price would factor more in decisions). Although many in OSI are opposed to the carelessness of Plan S, we are not opposed to the idea of helping contain costs in publishing; developing an APC price comparator tool would therefore be of great service to the global scholarly communication community. No such tool currently exists. The development and deployment of this tool would need to proceed with care. While providing price information is valuable, we don't want to help promote fake journals either. Therefore, with help from Cabell's, DOAJ, SSP, and other relevant organizations in OSI, we will begin by creating a self-populating database of APCs from currently indexed journals only (seeded with initial data as available, at which point publishers will be emailed and instructed how to self-update information). Non-indexed journals with egregiously bad behavior (plagiarism, fake peer review, etc.) will not be listed in this database; non-indexed journals with smaller question marks (new, no street address, broad subject coverage, regional interest, etc.) may be listed with asterisks (indicating that authors should seek input from their library officials before publishing in it).

- **YELP SITE FOR SCHOLARLY PUBLISHING**: OSI will build a few tools that have wide "category-killer" appeal and real paradigm-shifting potential for scholarly communication. A Yelp site for publishers is one such tool (an All-Scholarship Repository is another). Both of these tools will have significant overlap with other tools we build and that exist on the market today—that is, they will incorporate some of the same data, but they will have broader audiences and fill more needs at once. The core purpose of the Yelp site for scholarly publishing is to provide an easy-to-use, familiar-looking interface where customers (authors, editors, reviewers, funders and more) can rate scholarly publishers (not just commercial journals but university presses, scholarly society journals and more) and where publishers can provide important contact and product information—a link to their website, a summary of their products and services,

links and credentialing badges that verify data such as indexing and impact factors, and much more. Customers will be able to search this database for publishers in their field, price range, region and more—like the actual Yelp site, searches can be filtered in a wide variety of ways. Customers will also be able to provide reviews regarding their experiences with publishers, which will help round out the data provided by Cabell's blacklist and other information sources. For instance, customers might report that their peer review experience with a particular black-listed publisher was perfectly acceptable, or conversely, that it was entirely inadequate with a highly-ranked publisher. The reviews that get posted on this website will take a few years to become accurate. At first they will be dominated by people who are either trying to mask bad products or punish good ones, but over time we suspect that this will become the go-to resource for all authors looking to publish their research and funders looking to identify reliable open access publishing options. As such, it will be heavily trafficked (at least relative to other products in the scholarly communication space) and a good revenue-generator. Ad revenue will help support the upkeep and sustainability of this product, with excess revenues accruing to OSI toward the development of OSI's other products (and studies); sponsorship support will also be important. This will be a complicated product to develop, launch and fine-tune, and very labor intensive as well. If we are able to begin product development in early 2020, it will take six months to work out the architecture, six more to populate with starter data, and six months after that to beta test and refine—a total of 18 months before the first iteration of this site is up and running. Due to its complexity, the vast majority of this product will be hired out—very little of the programming work will be conducted in-house.

- **ALL SCHOLARSHIP REPOSITORY:** The All-Scholarship Repository (ASR) is the ultimate game changer in scholarly communication. Rather than continuing to rely on (and expand) our global network of institutional and national repositories, and then exert herculean and ultimately inadequate efforts to connect the meta data in these repositories (which ends up only providing a glimpse into the contents of each repository, not full access to the contents themselves—at least at the moment), ASR jumps over this step and instead creates a single warehouse for all scholarly research content. The advantages of this global preprint server concept are multifaceted: full-text searches across all articles, the potential for widescale database standardization and integration, the potential for vastly expanded cross-discipline integration, the potential to implement widescale online peer review solutions, real-time and transparent impact measurement (via downloads, views, comments and reader scores), instant open for all content, and more. ASR, in essence, solves a hundred pressing issues in scholarly communication in one fell swoop. It's a leap, though, and will require widespread buy-in in order to succeed, including from publishers whose content is needed for this system. Where would publishers end up with this system? The same as now, publishers would identify the best and most promising research and publish these articles in their journals. They would also put their own interface on the ASR (a public resource) and curate contents as they see fit, adding value by analyzing trends, highlighting significant new discoveries in fields of interest, and more. The only difference would be that the preprint world would be "unshackled" from the print world, and would be free to grow at its own pace and direction. This may eventually mean fewer print journals and more reliance on the ASR, but a possible decline in publisher subscription revenues would be offset by an increase in value added revenues. In terms of architecture, ASR would be single database with many spokes—many independent owner/operator channels through which data can be added and outputs can be customized. The Digital Public Library of America is the best example of how this system would operate. The central ASR database would be replicated and archived continuously; it would also be cloned by owner/operators. A fuller description of the ASR concept and operation is available in the appendix of OSI's February 2015 report (OSIWG 2015). The time frame for developing and launching ASR is longer than for our Yelp site since we will need about a year to discuss and arrange collaborations with major pre-print and government servers about data scraping and integration (we aren't expecting that ASR will replace

any existing services until it is very populated, although the prospect of replacement will be promoted; US government agencies in particular, if directed by OSTP, might be keen to explore repository replacement instead of long-term and costly upkeep and modernization). If funding for ASR is secured by early 2020, our goal is to have an initial version of this repository running by end-2022. Like the Yelp site, this site will have revenue generating potential, but on a much more massive scale—not only advertising and sponsor revenue channels, but also percentage revenue arrangements with publishers who provide data for the site and resell data from the site. Excess revenues will be directed to OSI to ensure the continued full funding of OSI operations, in accord with the NSF's guidelines on this matter.

- **PREDATORY PUBLISHER BLACKLIST**: In collaboration with other organizations in this space OSI will create a free, publicly available list of the largest, most prolific predatory publishers. Curating and maintaining the full list is a labor-intensive endeavor and will remain a retail product of Cabell's, but the OSI list will serve as an initial "quick check" for potential authors, highlighting the most egregious and prolific predatory journals who account for the most of this kind of output and/or the most blatantly fake outputs (like OMICS). This site will also provide background information on predatory publishing, links to resources like Think-Check-Submit and Cabell's (for the full list of predatory publishers), and case studies on why this kind of publishing should be avoided (due to risks it poses to careers and science). There is no other resource like this on the market.

- **ITUNES SINGLE ARTICLE DOWNLOAD:** The idea of having an iTunes-type of tool for single-article downloads has been kicked around for years in publishing but never pursued. Various experts have dismissed it out-of-hand for various reasons, with criticisms like we shouldn't have to pay anything for these articles, and customers won't pay when they can find them for free with a little digging (interlibrary loans, etc.). These criticisms have never been tested though. Our hypothesis is that, in fact, creating a model where consumers can legally access the latest work (or close to it—maybe downloads from this system would be embargoed only briefly but not for as long as free articles) would be extremely well received by both publishers and the marketplace, creating new revenue pathways for publishers and cheaper access for customers. As with some of the other tech solutions we're proposing, this one may end up being a "module" of the ASR, so it will be developed with this in mind. That is, eventually the ASR may feature access to various categories of articles and products—free, cheap, PPV and subscription, for instance—and inasmuch, the architecture of this iTunes site should integrate seamlessly with the ASR. Ultimately, we view the iTunes site as a transitional tool—as a way to allow publishers to daylight a hundred years of backlisted articles now but in such a way as to still generate revenues from these assets. Careful modeling will need to take place first to determine price points, catalog, frontlist integration and more. Over time, as the ASR becomes richer and more populated, it may become more advantageous to de-monetize more and more of this backlist. Like the ASR and Yelp sites, the iTunes site will have significant revenues accruing from ads and sponsors. It will also accrue revenues from percentage sales. As with ASR, excess revenues from this site will be directed to OSI. Development and deployment will be on the same schedule as the ASR site, with full operation by end-2022.

EXISTING WORK/PRIORITIES

In addition to studies and tech products, OSI's existing work/priorities will also be supported by this grant. This includes:

- **CONSOLIDATION AND IMPLEMENTATION OF OSI RECOMMENDATIONS:** OSI has accumulated a wealth of knowledge over its four years of operation. We are in the early stages of publishing materials that consolidate this knowledge into issue briefs and policy perspectives. A few of these have been published to-date; many more are planned (around 50 have been

identified), to be written by OSI participants. In terms of priorities, the next most needed publication is OSI's "Plan A" for open—a summary paper that captures the general sense of the OSI group with regard to what steps the global community should take next in order to ensure the rapid, collaborative and sustainable development of global open science. We expect this Plan A document to be issued by year-end 2019. Plan A will, in essence, be OSI's roadmap for the future of open science. A number of different stakeholder groups (including IGO's, led by UNESCO; scholarly societies, led by the NAS; the AAU, representing university provosts; and others) also realize that broad, collaborative action is needed now. What we are seeing as a result are parallel, high-level efforts happening around the world to create a new roadmap for the future of open. However, there is no convergence of activity and no central point. OSI will fill this role and communicate this convergence perspective in Plan A—as an observatory to keep these similar and important efforts connected, aware of each other's existence and activities, and coordinated so actions and policies can have more impact. We need this central hub to ensure that we can have reasonable, sustainable, global, inclusive action—a group to inform, coordinate and share policies that will lay the groundwork for the future of open research/data and open science in particular.

- **ANNUAL GLOBAL SURVEY OF STATE OF OPEN:** How is open changing? The fact is we just don't know. Studies measuring open aren't conducted at regular intervals and don't use the same methodology. In order to measure global progress toward open, we need a baseline and consistent, comprehensive, global measurements. Several OSI participants have volunteered to help develop this product and implement it. The Center for Open Science is once such partner; Editage/CATCUS is another (who will help translate this and disseminate it to global audiences). This annual survey will be an important tool in helping us better understand current needs and perspectives, understand where we need to focus our open efforts, and track our progress toward achieving our objectives.

- **EDUCATION/OUTREACH:**

    - One of OSI's goals is to help countries understand open and understand how this issue (and current global proposals) impacts their equity, education and development goals. Our issue briefs (which UNESCO has promised to help co-brand and promote) are one tool in our education arsenal. Our studies and tech products are other tools. In addition to these, we will improve/enrich the OSI website with the goal of making it more of a hub/resource for open and a more useful teaching tool.

    - There are many ways to learn about open, far fewer ways to collaborate on global actions to improve open that aren't biased toward set end-points (e.g., "let's do a global flip," or "let's remove publishers from the process"). There are a great many groups looking for constructive ways to engage in realistic measures. An important approach OSI will cultivate beginning in 2020 is to bring organizations together to help pick the low hanging fruit—to create a global environment of cooperation for solving the most urgent problems together and in doing so build a track record of success. We don't need a Plan S that changes everything for everyone tomorrow without regard for the consequences. We do need a Plan A that describes what needs to be addressed and describes realistic and sustainable ways to begin tackling these issues together in ways that are easy and make sense for everyone, and importantly, that have incentives aligned such that partners will be joining in this effort out of self-interest and not due to threat or obligation.

    - **EVENTS**: OSI has hosted two full-group meetings to-date (in 2016 and 2017), one executive team meeting (in 2018), and helped sponsor several other meetings in this space (such as SciELO-20 in 2018). We will need to hold and sponsor a number of

other meetings in the coming years. There is no better way to get solid input from a diverse range of participants than to hold meetings. Email works okay to continue the conversation, but there is simply no substitute for breaking down walls and making progress than in-person meetings. OSI participants will also participate as speakers and panelists in other global meetings, communicating OSI's lessons of experience and also forging partnerships with universities, publishers, research institutions, governments, funders, societies and policy groups interested in moving forward with workable, global solutions to open research. By November of 2019, OSI will have marked four such efforts: (1) A presentation about OSI on the opening panel of the SciELO 20th Anniversary conference; (2) A presentation about OSI in the keynote portion of this year's Charleston conference, and (3) Inclusion of OSI and key OSI outputs (such as the DARTS open spectrum) in the 50th Anniversary addition of the STM Report, a key resource for the scholarly publishing community; and (4) Inclusion of OSI in a debate at the 2019 Falling Walls conference about the future direction of open science.

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Unpaywall (https://unpaywall.org/)

Annex 5: Publishing STM Research

OSI

SCHOLARLY COMMUNICATION INFOGRAPHIC 2.0

PUBLISHING STM RESEARCH

UNDERSTANDING THE DIFFERENT NEEDS, OPTIONS AND OUTCOMES

RESEARCHER NEEDS

The publishing needs and goals of university-based STM researchers vary widely.*

RAPID

Rapid publishing is the norm in some fields. In other fields, researchers might publish quickly in order o share urgent medical research, establish discovery, or get feedback.

REQUIRED

Publishing is required for all research grants. In most cases, publishing is basically about creating an official record of the research in the best available venue.

IMPACT

Every researcher wants their work to have high impact and be read by other researchers in their field. Therefore, getting published in the best possible journals is a common goal.

VISIBILITY

Researchers want their work to be visible. The perceived prestige of certain journals can therefore be a factor in deciding where to publish.***

OPTIONS & OUTCOMES

Currently, 3.5 million research articles are published annually in over 50,000 journals, plus many preprint servers.

	DECEPTIVE JOURNALS	PREPRINT SERVERS	REGIONAL JOURNALS	SPECIALTY JOURNALS	PRESTIGE JOURNALS
	Publish anything quickly for a fee. Most are fakes and have no peer review or quality processes; many later disappear.	Mostly research articles posted online to generate feedback before submitting to a journal, or to claim discovery.**	Small, affordable, focusing mostly on topics of regional importance, often in local languages. Quality varies widely.	International, selective, conduct peer review, have rigorous quality processes, widely read and cited, good visibility.	Multiple fields, novel findings, followed by major media. Prestigious for researchers, funders, and institutions.
Articles published ①	**9% of total?**	**3% of total**	**12% of total?**	**75% of total**	**<1% of total**
Accessibility ⑤	Open access	Open access	Mostly open access	50% open access	90% subscription
Language	English + local	English + local	English + local	Mostly English	English
Speed ②	< 1 month	Immediate	Varies	3-9 months	6-9 months
Rejections ③	None	None	About 10-30%	60-65%	Up to 90%
Peer review ④	None	Generally none	Varies	Quality	Quality
Cost ⑤	Low	Free	Free to moderate	Varies	Expensive
Research impact ⑥	None	Varies	Mostly regional	High	High
Career impact	Varies	Varies	Varies	Good	High
Quality	Poor	Varies	Varies	High	High
Discoverability ⑦	Varies	Varies	Regional indexes	All major indexes	All indexes + media

SUBMIT, REJECT, REPEAT

* These needs and goals vary by career stage, research field, topic, funder expectations, and more. Non-university STM researchers don't rely as much on journal publishing, using white papers and other less accessible publishing modes instead (conferences are a common communication tool used by both of these groups). Humanities research is published mostly in book format, not journals.

** Preprints can be a publishing end-state in some fields (most notably physics and astronomy, which have relied on the arXiv preprint server since 1991). In general, preprints comprise a very wide range of articles in terms of subject matter and quality.

*** Whether this should be the case is a different matter. At present, this high visibility can benefit early career researchers who are seeking promotion and tenure, or researchers who are seeking grant funding. This visibility incentive ends up influencing publishing choices and outcomes. Efforts like DORA (https://sfdora.org) are trying to reform this emphasis on perceptions of "prestige" in journals, and focus instead on the significance of research articles themselves.

① There are no definitive estimates of how much research is being published in each category. The estimates here assume that 3.5 million articles per year are being published (see https://bit.ly/3r0a794); that 3% of these are preprints (see https://doi.org/10.1371/journal.pgen.1008565); that 700,00 articles annually are coming from regional and deceptive journals together (extrapolated from the 2015 estimate of 420,000 at https://doi.org/10.1186/s12916-015-0469-2; since this time, these categories of publishing have continued to grow, with Cabell's currently tracking 14,183 predatory journals); and that the top 100 ranked journals in SJR published 21,143 articles in 2019.

② How quickly articles get published depends in part on how long the review process takes. Generally, high impact journals have review times that average around 4.5 months (see https://go.nature.com/2YBF5rS). Once this hurdle is crossed, publishing speed depends on how quickly publishers can format and otherwise prepare an article for viewing.

③ Across all kinds of journals, the average rejection rate of articles is 60-65% (https://doi.org/10.3145/epi.2019.jul.07). Individual rates vary widely by journal, ranging from 0-90% and higher. The regional rate is an estimate drawn from conversations in OSI. About 20% of papers get rejected before peer review for being out of scope, among other reasons (see https://bit.ly/2YnYoVv). Almost two-thirds of research articles are rejected at least once (see https://bit.ly/2YkPpo2), but most eventually get published somewhere. As noted above, preprints are most often not an "end-state" in publishing (except for a few fields). Two-thirds of preprints posted before 2017 were later published in peer-reviewed journals within 12-18 months (see https://doi.org/10.7554/eLife.45133).

④ Researchers place a high value on peer review as a screening function, and see strong peer review as a signal of quality (see https://bit.ly/3otwKRs). Therefore, peer review is important to many researchers. Generally, specialty and prestige journals provide high quality peer review; even some preprint servers are experimenting with new forms of peer review. Regional journals don't always provide the kind of peer review required by specialty journals; peer review quality here varies widely. All this said, the evidence is unclear whether peer review actually improves research (beyond making articles more readable).

⑤ About half of all new articles are currently being published in open access format (most journals, however, are subscription based). Most often, the publishing costs for open access articles are paid by an author funding mechanism known as APCs, or article publishing charges. In the US and EU, APCs are normally subsidized in whole or part by institutions or governments; in the Global South, these charges are largely paid by researchers. A typical APC for an article in a specialty journal is around US$2,500; prestige journals can charge US$10,000 per article or higher; regional journals normally charge lower APCs (or in some cases, these costs can be subsidized by governments, foundations or institutions), which is more in line with what authors can afford. The cost of accessing subscription journals is normally paid by libraries (authors might pay for miscellaneous publishing charges, like color graphics). Most specialty and prestige journals are still subscription based, although the trend is that more of these are becoming APC-financed instead.

⑥ Research impact can be difficult to measure. The number of citations per article is one metric. Over 90% of the articles in specialty and prestige journals are cited at least once, averaging about 18 citations over their lifetimes. For regional journals, that number is 40%, with and average number of citations per article of 2.6 (see https://bit.ly/3iWZAoQ). Part of the reason for this disparity is that many regional journals have lower readership, different quality standards, and/or a more niche focus (see https://www.aje.com/arc/regional-journals/). Deceptive journals (also known as predatory journals) perform worse. See https://doi.org/10.13021/osi2019.2419 for a fuller discussion of these journals and practices. Downloads are another metric of impact. Articles that are published first as a preprint can eventually get more downloads (and also more citations) than articles without a preprint (https://doi.org/10.7554/eLife.52646).

⑦ A key consideration for researchers is whether their articles will be discoverable after publishing. Google Scholar is the most widely used search tool and tends to locate much research work. Preprints benefit from a variety of other discovery options, as do specialty and prestige journals. Key among these is being indexed, or cataloged by a research journal encyclopedia. Regional journals are mostly cataloged by less well-known indexes, making discovery more difficult (this is a bug in the system, not a feature).

OSI Infographic 3 sources & notes

Most of the data in this infographic was extracted from the UNESCO UIS dataset at http://data.uis.unesco.org. Additional data sources are as noted.

Growth • R&D and researchers: UNESCO UIS data tables. Count only includes personnel classified as researchers, not all include all R&D personnel (such as technicians). • Publication data: US NSB Science & Engineering Indicators, https://ncses.nsf.gov/pubs/nsb20206/publication-output-by-region-country-or-economy • Patent data: OECD data tables, https://stats.oecd.org/Index.aspx?DataSetCode=MSTI_PUB#. Patent reporting for 2017 is incomplete (2016 is last available year).	**People** • R&D and researchers: UNESCO UIS data tables. Count only includes personnel classified as researchers, not all include all R&D personnel (such as technicians).
Funding • UNESCO UIS data tables	**Higher ed** • Figures from UNESCO UIS data tables • Rankings from US News & World Report research university rankings. List and ranking methodology at https://www.usnews.com/education/best-global-universities/rankings • Additional data from https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0202120
Spending • Main data from UNESCO UIS data tables • Data for US from: NSB S&E indicators: https://ncses.nsf.gov/pubs/nsb20203/recent-trends-in-federal-support-for-u-s-r-d#figureCtr920 • Data for Germany from: https://www.datenportal.bmbf.de/portal/en/K1.html • Available worksheets show how US and Germany data was transposed and converted to PPP	**Companies** • Individual company R&D: https://www.visualcapitalist.com/global-leaders-r-d-spending/ • Aggregate global figures: https://ncses.nsf.gov/pubs/nsf20316/
Types • UNESCO UIS database	Links • Source: https://ncses.nsf.gov/pubs/nsb20201/global-science-and-technology-capabilities. See https://www.natureindex.com/news-blog/international-collaborations-growing-exponentially for additional (callout) data

Annex 6: Who Does Research?

OSI

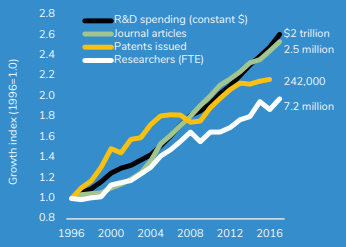
SCHOLARLY COMMUNICATION INFOGRAPHIC 3.1

WHO DOES RESEARCH?

UNDERSTANDING GLOBAL RESEARCH & DEVELOPMENT

GROWTH

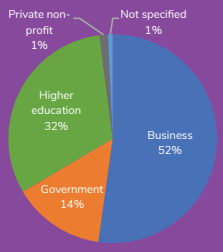
In the two decades from 1996-2017, global research and development (R&D) increased by around 250 percent. Similar increases occurred in the number of researchers, patents, and journal articles published.



1996–2017 GLOBAL R&D GROWTH

PEOPLE

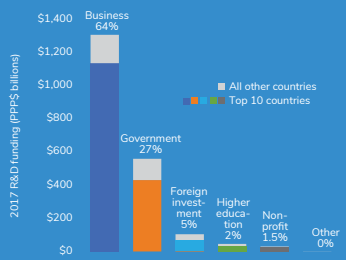
Approximately 7.2 million people (FTE) are employed as researchers (not including many more who work in supporting R&D roles). Most researchers work for businesses. Women are 30% of the R&D workforce.



2017 R&D EMPLOYMENT (FTE)

FUNDING

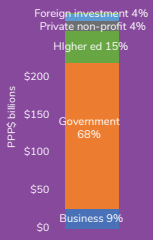
Businesses fund 64% of all R&D globally. Government funding is second highest at 27 percent. Most R&D happens in just a handful of countries (see below). Higher education performs much more R&D than it funds.



GLOBAL 2017 R&D FUNDING ($2 TRILLION IN PPP$)

HIGHER ED

Higher education institutions performed $286 billion of R&D work in 2017. This work is impactful, accounting for almost all research published in journals. Businesses also increasingly outsource their basic research to higher ed.

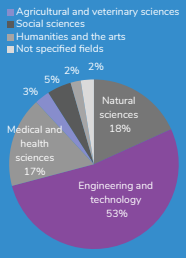


SOURCES OF 2017 GLOBAL R&D SPENDING BY HIGHER ED

		2021 RESEARCH RANK (USNWR GLOBAL)
1	Harvard	
2	MIT	
3	Stanford	
4	U Cal Berkeley	
5	Oxford	
6	Columbia	
7	Cal Tech	
8	U of Washington	
9	Cambridge	
10	Johns Hopkins	
11	Princeton	
12	Yale	
13	UCLA	
14	U of Pennsylvania	
15	UC San Francisco	
16	U of Chicago	
17	U of Mich. Ann Arbor	
18	U of Toronto	
19	U College London	
20	Imperial Coll. London	

SPENDING

Most R&D spending is in engineering and technology. However, countries prioritize their R&D spending differently, and spend widely varying amounts on R&D. The top 10 countries account for 78% of the global total R&D.

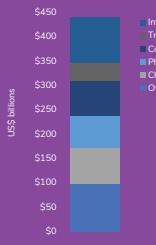


GLOBAL 2017 R&D SPENDING BY SECTOR

	2017 PPP$ BILLIONS	%
US	549	25.0%
China	499	22.8%
Japan	171	7.8%
Germany	132	6.0%
Korea, Rep	91	4.1%
France	65	3.0%
India	64	2.9%
UK	50	2.3%
Russian Fed.	42	1.9%
Brazil	41	1.9%
Other	488	22.3%
GLOBAL TOTAL	2,192	

COMPANIES

Information, auto and pharmaceutical companies are big spenders on R&D. The top 10 companies account for 9% of investment by this sector. Business R&D spending is higher as a percent total R&D in top-10 countries (see left).



2018 (US ONLY) R&D SPENDING BY BUSINESS

	2017 PPP$ BILLIONS	%
Amazon	17.4	1.2%
Volkswagen	15.1	1.1%
Alphabet	14.5	1.0%
Intel	12.8	0.9%
Samsung	12.8	0.9%
Microsoft	12.7	0.9%
Roche	11.7	0.8%
Huawei	11.2	0.8%
Apple	10.8	0.8%
Merck	10.3	0.7%
GLOBAL TOTAL	1,432	

TYPES

R&D is divided into basic research, applied research, and experimental development. Most is experimental development, of which business performs 90 percent. Higher education performs 44% of basic research.

GLOBAL 2017 R&D SPENDING BY TYPE

Basic research discovers and extends knowledge. Applied research does this, too, but with practical applications in mind. Experimental development follows basic and applied research and involves designing these practical applications.

LINKS

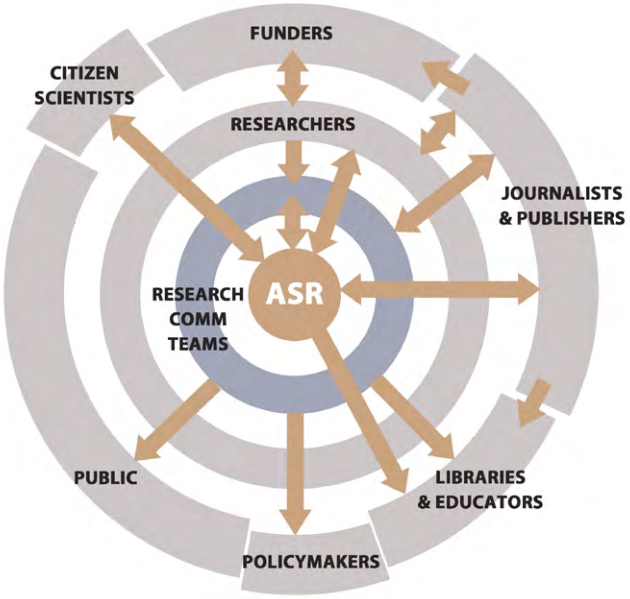
A global ecosystem of stakeholders creates and sustains research, from universities to businesses, governments, publishers, and beyond. The interconnectedness and impact of this work is broad and significant.

2018 JOURNAL ARTICLES

Sources & notes: See next page

Annex 7: The All-Scholarship Repository

About two-thirds of the researchers OSI surveyed in 2022 support the idea of building a single, powerful data repository to hold all the world's research information. This idea may seem far fetched, but according to experts, different version of it have been debated for years. Indeed, this approach was favored the US Office of Science and Technology Policy in 2013 before finally settling on a solution wherein each government agency would build and manage its own data repository (for a fullller discussion, see Annex 1 of Open Science Initiative Working Group 2015, listed in the annex section containing a complete list of OSI publications).



The so-called All Scholarship Repository (ASR) would replace the thousands of government and institutional repositories currently in use with one ultra-high functioning repository, and would also simplify the flow of research information. All research information—not necessarily in research paper format but in all kinds of reporting formats—would be deposited into ASR and picked up from there by publishers, policymakers, and other researchers.

The core database for ASR would be structured like the Digital Public Library of America, where every institution, publisher, discipline, subject and author would be able to design their own user interface drawing from the same common information base. Every institution would be able to adjust content permissions as needed.

In this sort of information ecosystem, new opportunities and challenges would emerge for publishers. More innovation and competition would develop around identifying and developing the best content from the ASR for publication in journals (which would no longer necessarily announce breaking news content), and also developing the most compelling interfaces that provide the most value for audiences. Some public interfaces would certainly be free, but competitive new interfaces and premium content and analyses supported by subscription revenue would also likely emerge. There would be no be barriers to accessing the raw information itself, however. Much like Internet news today, anyone can eventually find most anything, but the most consumed and trusted information is still curated, verified, and comes from reliable sources.

There would be challenges on the data input side as well. In order for ASR to reach its full potential, it would need to be surrounded by a new communications capacity in research institutions (the blue-shaded inner circle in the above figure). Otherwise, the task of publishing data to the ASR and maintaining this resource would be untenable. These research communication teams would bear the primary responsibility for maintaining ASR, and over time they might also eventually perform functions such as standardizing data prior to publishing, connecting research, and liaising with publishers, policymakers, educators and the public, thereby relieving researchers of these communication responsibilities (many of which are new) and also improving participation in and sustainability of these important functions (over time, the ASR team itself will also develop these capacities, especially to assist communication teams with their work).

These permanent research communication teams would be a new profession in science, and could be supported through a new (and modestly smally) overhead charge on research grants. Training for such a position would involve standardizing a new research communication PhD program, where research communicators receive a core education in communication, data curation and research, but specialize by field. With a massive, connected database of research information, other new disciplines and industries will also emerge to connect the dots, like "peering" experts who seek out new connections within and between research, and experts who would take on the heady task of standardizing data within and between fields.

Once ASR becomes fully functional, it would be a deep resource for researchers and publishers. ASR would eliminate a host of bottlenecks in the current scholarly publishing system, and simultaneously address a number of contentious and even seemingly intractable cultural issues, all while keeping existing stakeholders at the table, and also spurring discovery and innovation as researchers from institutions, business, and the public begin digging through and connecting research in ways that have never before been possible.

Annex 8: List of OSI Reports, Briefs and Presentations

Anderson, R. 2019. OSI Issue Brief 3: Deceptive Publishing. Open Scholarship Initiative. doi:10.13021/osi2019.2419

Hampson, G, M DeSart, J Steinhauer, EA Gadd, LJ Hinchliffe, M Vandegrift, C Erdmann, and R Johnson. 2020b (June). OSI Policy Perspective 3: Open science roadmap recommendations to UNESCO. Open Scholarship Initiative. doi: 10.13021/osi2020.2735

Hampson, G, M DeSart, L Kamerlin, R Johnson, H Hanahoe, A Nurnberger and C Graf. 2021. OSI Policy Perspective 4: Open Solutions: Unifying the meaning of open and designing a new global open solutions policy framework. Open Scholarship Initiative. January 2021 edition. doi: 10.13021/osi2020.2930

Hampson, G. 2018. Comment to EPS on proposed rule, "Strengthenig Transparency in Regulatory Science." Open Scholarship Initiative

Hampson, G. 2018. The future of scholarly publishing. Video presentation for the 2016 SciELO conference. https://osiglobal.org/wp-content/uploads/2021/04/SciELO-presentation.pdf

Hampson, G. 2019 (2nd ed.). OSI Policy Perspective 1: Plan S & the quest for global open access. Open Scholarship Initiative. doi: 10.13021/osi2019.2450

Hampson, G. 2019. Finding common ground. Presentation for the SciELO20 conference. https://www.youtube.com/watch?v=-H8mTObdlbs

Hampson, G. 2019. OSI Issue Brief 2 (v. 2): How fast is open growing? Open Scholarship Initiative. http://doi.org/10.13021/osi.v3i0.2368

Hampson, G. 2020 (Nov 12). The future of open science: How we get there from here. Council of Science Editors (CSE) webinar, "Understanding Open Access, Plan S, and Other Global Initiatives in the Current Publishing Ecosystem: An Overview and International Perspective During a Pandemic." https://secureservercdn.net/198.71.233.65/i81.b11.myftpupload.com/wp-content/uploads/2021/04/CSE-presentation-Hampson.pdf?time=1617912104

Hampson, G. 2020 (Sept 30). Opening Science for Building Resilience in the face of Covid-19: Finding the best path forward. UNESCO webinar presentation. https://osiglobal.org/wp-content/uploads/2021/04/Hampson-slides.pdf

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Hampson, G. 2020. OSI Policy Perspective 2: Common ground in the global quest for open research. Open Scholarship Initiative. doi: 10.13021/osi2020.2725

Hampson, G. 2020. Peer review in the COVID era. Slide presentation for Second Virtual Session for the VI Brazilian Meeting on Research Integrity, Science, and Publication Ethics (VI BRISPE). https://osiglobal.org/wp-content/uploads/2021/04/BRISPE-presentation-final-Hampson.pdf

Hampson, G. 2021 (July 29). Diverse Routes to Open Access. 4TH Forum for World STM Journals. China Association for Science and Technology (CAST). Conference presentation. https://drive.google.com/file/d/1xm_tTpTbotWktLsgDkHdW1Wg6sK1m1XQ/view

Hampson, G. 2021 (July 9). Better science communication. MH21 (Materials for Humanity 2021) conference presentation. https://osiglobal.org/wp-content/uploads/2021/11/MH21-Hampson-Better-Science-Communication-final.pdf

Hampson, G. 2021 (Mar 24). Unleashing the Open Renaissance. Computers in Libraries Connect 2021 Conference. https://secureservercdn.net/198.71.233.65/i81.b11.myftpupload.com/wp-content/uploads/2021/04/UNLEASHING-THE-OPEN-RENAISSANCE-final.pdf?time=1617912104

Hampson, G. 2021 (May 7). Creating an Open Renaissance. WSIS 2021 Conference. https://osiglobal.org/wp-content/uploads/2021/05/WSIS-2021-CREATING-AN-OPEN-RENAISSANCE.pdf

Hampson, G. 2021. Competition, Collaboration & Data Sharing in Science: An Overview of Ongoing Challenges. VI BRISPE conference. https://osiglobal.org/wp-content/uploads/2021/11/VI-BRISPE-panel-3-presentation-on-data-sharing-Hampson.pdf

Hampson, G. 2021. Contributions to panel on "Challenges on the road to open," Council of Science Editors 2021 Annual Meeting. https://osiglobal.org/wp-content/uploads/2021/05/5-Challenges-CSE2021.pdf

Hampson, G. 2021. Contributions to UNESCO conference, "Leveraging digital technologies for peace and sustainable development." https://www.youtube.com/watch?v=6xhmjmMz1bQ

Hampson, G. 2021. Our Open Future. Opening address for NISO virtual conference on open research (November 17, 2021). https://osiglobal.org/wp-content/uploads/2021/11/NISO-presentation-Hampson.pdf

Hampson, G. 2023. OSI Policy Perspective 5: Summary of OSI2022 Research Communication Surveys. Open Scholarship Initiative (OSI). doi: 10.13021/osi2023.3552.

Hampson, G. 2023. OSI Policy Perspective 6: Considering evidence-based open access policies. Open Scholarship Initiative (OSI). doi: 10.13021/osi2023.3553

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OSI website. https://osiglobal.org

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OSI. 2015-2020. The OSI listserv. Open Scholarship Initiative

OSI. 2016. OSI2016: Summary report of the inaugural conference of the global Open Scholarship Initiative. Open Scholarship Initiative

OSI. 2016. Preface to the OSI2016 Workgroup Papers. Open Scholarship Initiative

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