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Funders 2.0: How Leading Funders Are Changing the Scholarly Research Ecosystem

Company Analysis

April 17, 2018

WHO'S INSIDE

American Chemical Society

Bill & Melinda Gates Foundation

Clarivate Analytics

Elsevier

European Commission

F1000

Hindawi

Informa

Max Planck Society

Public Library of Science (PLoS)

Springer Nature

ŰberResearch

Wellcome Trust

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Why This Topic

Funders are a foundational element of the scholarly research and communication landscape. Without their budgets, research dries up and the ecosystem shrivels. The role of the research funder within the scholarly communications ecosystem is evolving, however. Some leading funders are actively looking to expand beyond their traditional roles, becoming more vocal and potentially disruptive stakeholders in this space.

Several major funders started strengthening their mandates and enforcing specific requirements related to Open Access (OA) and open data, especially over the past couple of years. Some are more actively involved in discussions around peer review, while others are looking at new means of monitoring, tracking, and measuring impact. Still others are increasingly encouraging the inclusion of interim research materials and non-journal article research outputs as part of the research record. Growing numbers of funders are launching their own open research publishing platforms, and several high-profile investments and acquisitions have occurred in this space.

This report examines how the role of funders is evolving beyond their traditional position in the scholarly research ecosystem as they drive change, innovation, and disruption, broadening their impact through policies, mandates, and focus on particular areas of research. We examine the recent activities of five major funders — the European Commission, the Bill & Melinda Gates Foundation, the Max Planck Society for the Advancement of Science (MPG), the National Institutes of Health (NIH) and the Wellcome Trust — highlighting the implications of their individual actions when viewed as a whole. We also examine the impact on other industry stakeholders, particularly information and service vendors, looking at how they are reacting to these changes, and recommend steps for both funders and vendors as they address this new reality.

Methodology

Outsell drew on primarily qualitative research to build this report. Outsell conducted interviews from October to December 2017 with both funders and information service providers. On the funder side, interviewees included representatives from the European Commission, the *Bill & Melinda Gates Foundation*, the *Max Planck Society* and the *Wellcome Trust* (Outsell's "Funder 5"). On the information service provider side, we spoke to a group of organizations that included the *American Chemical Society*, *Clarivate Analytics*, the *COKO Foundation*, *Elsevier*, *F1000*, *Hindawi*, *Informa*, *Public Library of Science* (PLoS), *Springer Nature*, and *ŰberResearch*.

Outsell also leveraged both its own proprietary information resources — including our database of more than 8,000 cross-industry firms that create, aggregate, manipulate, and distribute information — and publicly available online information resources.

We further supported the research through our deep understanding of information-centric disruptive forces, daily interaction with executives in the information industry, and product and service analysis that Outsell conducts as part of its advisory services.

Market Overview

The funder landscape is fragmented and complex. For the purposes of this report, we focus on those funders operating within the science and technology sectors, including medicine. Public funders may operate at the federal, national, or regional levels, whilst private funders include corporations, family-funded organizations, charities, and other philanthropic institutions. The funders may have a broad or laser-focused raison d'etre or mission; they may be actively looking to disrupt a marketplace, or may be doing so indirectly; they may have recently founded the company, or established themselves for a century or more. Every sector and discipline are covered, and funding approaches may be focused on individuals or project-based with single or multiple entities involved. Projects may be short or long term in duration. Budgets vary enormously too, as do available sources for funding. Some highly influential "funders" may not even be funders in the traditional sense (e.g., the Max Planck Society).

All of these differences account for a landscape of organizations that, to a significant extent, operate as individuals. Synergies and shared goals exist, of course, and the funding cycle itself largely follows a similar template (see below). However, the diversity of players — the latest release of Crossref's Funder Registry from October 2017 includes 15,722 funders, of which 15,441 are currently active — means that this is a difficult "market" to consider as a whole, beyond it being defined as a set of organizations meeting the Collins English Dictionary definition of a funder: "a provider of funds".

Global R&D Funding Trends

Publicly available R&D trend data provides useful context for the funder market, given that the two significantly overlap. Estimates put global R&D growth at approximately 3.5% between 2015 and 2016, driven by spending in Asian countries, particularly China.

The Funding Market Landscape

Data specific to funding is not easy to acquire and is typically not as complete as publicly available information on annual R&D activity. Research from drug or biotech companies, for example, is not necessarily publicly documented or aggregated. Equally, data from Chinese funders — which are assumed to be some of the largest in the world — is generally not well documented. Anecdotally, Outsell understands that, given the explosion of research from China, not all of what is funded in China is even documented, let alone made openly available.

Where broader market data is available (see Table 1) it indicates that regional and national funders are the largest in terms of funding dollars. These organizations provide the majority of funding worldwide, and do so ultimately through state taxes. Many other medium-sized and small funders are charity funders, rather than state organizations, relying on donations or legacy investments. Generally, the smaller the funder, the more specific it is in the area of research it funds. The number of small and mid-sized research charities varies hugely between countries: there are many of them in the UK and the USA, for example, but very few in Germany.

Projects funded by the European Commission have the largest average value, whilst the NIH is the largest funder based on funding allocated to new projects in 2016. The Japan Society for Promotion of Science funded the largest number of new projects in 2016. The total funding budget for Outsell's Funder 5 was approximately $53 billion in 2017.

Table 1: Top 10 Funders, by Average New Project Value, 2016 (USD)

Funder	Average New Project Value (2016)	Total Funding Allocated to New Projects (Billions, 2016)	Number of Projects
European Commission	$1,908,397	$7.5	3,930
European Research Council	$1,759,531	$1.8	1,023
Innovate UK	$935,308	$1.2	1,283
NIH (group of funders)	$740,741	$10.7	14,445
EPSRC (UK)	$693,802	$1.5	2,162
Wellcome Trust	$548,620	$0.835	1,522
Research Council Norway	$539,216	$1.1	2,040
RCUK (UK Research Councils group of Funders, not including Innovate UK)	$495,726	$2.9	5,850
NSF USA	$416,025	$5.4	12,980
Japan Society for Promotion of Science	$70,767	$2.2	31,088

Source: Outsell analysis, ŰberResearch, Nov. 2017

Funding in the biomedical science sector is higher overall than in any other area of research. Sciences and engineering are generally responsible for the majority of international research funding, although the picture differs from one funder to another, of course.

Looking at research categories with the highest average spend for new projects in 2016, Artificial Intelligence and Image Processing is hugely dominant. New projects in this category received average funding of $5.1 million in 2016. In contrast, the average funding for projects across the Public Health and Health Services, Clinical Sciences, Neurosciences, Genetics, and Biochemistry and Cell Biology categories was $2.8 million.

Table 2: Average Funding Per New Project by Top Research Categories, 2016 (USD)

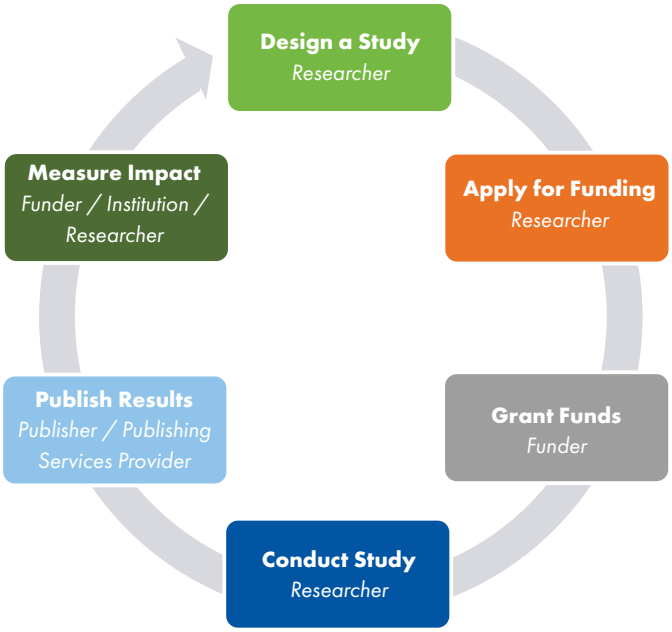
Research Category	Average Funding Per New Project	Funding Allocated to New Projects (Billions)	Number of New Projects
Artificial Intelligence and Image Processing	$5,105,402	$31.0	6,072
Information Systems	$784,413	$3.1	3,952
Public Health and Health Services	$708,151	$4.7	6,637
Clinical Sciences	$605,934	$2.8	4,786
Neurosciences	$540,249	$3.0	5,553
Genetics	$501,771	$3.4	6,776
Materials Engineering	$481,168	$2.9	6,027
Biochemistry and Cell Biology	$428,148	$3.9	9,109

Source: Outsell analysis, ŰberResearch, Nov. 2017

The Funding Continuum

The funding continuum (Figure 1) highlighted by Outsell in our previous report on the funder space remains constant (see The Impact of Research Funders on Scholarly Communication, 7 August 2015). However, the speed of technology and innovation means that the systems and processes meant to serve stakeholders are in a state of flux. Consistent themes appear in each phase of the continuum, with researchers, institutions, information service providers, and funders all looking to more effectively evaluate, track, and measure the outcomes of each phase through data and analytics, new impact metrics, OA, and the development of standards.

Figure 1: The Scholarly Communication Funding Continuum



Source: Outsell Analysis

Key Questions for Funders

As one of Outsell's interviewees noted, in the past, funders were there to "get rid of money". Now they are shifting their perspective to ensure that they support the right projects, directing funds and activities in alignment with the policies they want to implement and the ultimate goals they want to achieve. In thinking more about what they should be funding, the funder perspective — and therefore, the entire ecosystem — has become more data-driven and focused on evaluation throughout the funding lifecycle. Outsell's report highlights how the funding market is changing and maturing, what it looks like now and what it may look like in the future, how five of the major funders (the "Funder 5") are evolving, the implications of those changes on other funders and market stakeholders, and the actions they all need to take to succeed in this evolving landscape.

We hear funders asking themselves the following questions, focusing on their overarching mission, their impact, and their internal infrastructure and processes.

Mission

- What should we be funding?
- Is what we are funding "good science"?
- How can we be effective?

Impact

- How do we know whether we are being impactful? What is the broader definition of impact we are now looking at? How do we monitor and track that multiple times, over time? What indicators do we need to be tracking?
- Do traditional means of assessment support our activities?
- How do we demonstrate the quality of the research we are funding?

Infrastructure and Processes

- How do we discriminate between proposals?
- What could we be doing better?
- How can we get research out faster?
- Where do we need review to happen? Does pre-publication peer review still work for us?
- What technology infrastructure do we need in place?

For some funders, there's a natural extension to these questions:

- Is the current publishing and communication ecosystem the best way to do this?

The Funder 5

We picked the Funder 5 as our focus for this report because they behave in ways that Outsell views as more impactful on the scholarly research and communication ecosystem than others. The balance and relationships between funders and vendors in the ecosystem is changing, and these are major proponents and representative examples of that change. In the course of our research, it became clear that the Funder 5 are also considered to be the most impactful by the information service providers we interviewed for this report. We focus particularly (though not exclusively) on their activities around OA and open data, and the path towards open research and open science. At the same time, we note other activities as they relate to other key scholarly research and communication trends around impact, metrics, the changing role of the researcher and the institution, technology, and standardization.

Key Announcements Timeline

The following timeline highlights what Outsell considers to be the key announcements made by the Funder 5, focused on OA, open data, and (broadly) other open science-related initiatives. We include this to demonstrate both the longevity of their actions in these areas, as well as their ongoing leadership in this space.

Figure 2: Timeline of Key Announcements from the Funder 5 (2003 – 2017)

2003	• The **Max Planck Society** hosts the Berlin Conference and initiates the Berlin Declaration on OA. • The **NIH** Data Sharing policy becomes effective.
2004	• The **NIH** Public Access Policy for publications is drafted.
2006	• The **Wellcome Trust** OA Policy launches.
2008	• The **NIH** Public Access Policy for publications is mandated.
2011	• eLife is founded by the **Max Planck Society**, the **Wellcome Trust** and the Howard Hughes Medical Institute.
2012	• The **Wellcome Trust** announces a strengthened OA Policy, with sanctions.
2013	• The **NIH** Public Access Policy for publications is strengthened with enforcement and sanctions.
2014	• The **Bill & Melinda Gates Foundation** announces its OA Policy. • The **European Commission** requires that all scientific, peer-reviewed publications arising from Horizon2020 research are made OA.
2015	• The **Max Planck Society** publishes a white paper on the financial viability of OA.
2016	• The **Max Planck Society** launches the OA2020 campaign. • The **Gates Foundation** launches the CHRONOS submission system. • The **Wellcome Trust** launches the Wellcome Open Research Platform. • **NIH** releases the Relative Citation Ratio alternative metric indicator.
2017	• The **Gates Foundation** launches the Gates Open Research Platform. • The **Wellcome Trust** updates its policy on managing and sharing research data, software, and research materials. • The **European Commission** begins its Open Research Data pilot for all future Horizon 2020 projects. • The **European Commission** Roadmap for the development of the European Open Science Cloud published. • **NIH** announces that researchers can cite academic preprints and other interim research products in NIH grant applications.
2018	• The **European Commission** research publishing platform is due to launch.

Source: Outsell

The Funder 5: At-a-Glance Comparison

The following table summarizes key data about the Funder 5.

Table 3: The Funder 5, At-a-Glance Key Facts Comparison

	The European Commission	The Bill & Melinda Gates Foundation	The Max Planck Society (MPG)	The National Institutes of Health (NIH)	The Wellcome Trust
Mission	Horizon 2020 focuses on securing Europe's global competitiveness by driving economic growth, creating jobs, and coupling research and innovation. It highlights three key approaches — excellent science, industrial leadership, and tackling societal challenges — to support these goals.	The Foundation's fundamental belief is that every life has equal value. Its mission is to help all people lead healthy and productive lives.	MPG is dedicated to the advancement of science through basic research. It focuses on research fields that are particularly innovative or especially demanding in terms of funding or time requirements.	NIH's mission is to seek fundamental knowledge about the nature and behaviour of living systems, and the application of that knowledge to enhance health, lengthen life, and reduce illness and disability.	Wellcome exists to "improve health for everyone by helping great ideas to thrive".
Focus	Since 2015, the Commission's key areas of focus are the "Three Os": Open Science, Open Innovation and Open to the World.	Four global programme streams: Global Development, Global Health, Global Policy & Advocacy, and the United States Programme.	A broad-based focus on basic research across the natural sciences, life sciences, social sciences, and humanities.	Biomedical research, specifically: 1. The causes, diagnosis, prevention, and cure of human diseases. 2. Human growth and development processes. 3. Understanding the biological effects of environmental contaminants.	A broad-based focus across discovery science, medical innovation, and the humanities and social sciences. Funding divisions focus on Science, Innovations, and Culture & Society.

	The European Commission	The Bill & Melinda Gates Foundation	The Max Planck Society (MPG)	The National Institutes of Health (NIH)	The Wellcome Trust
Focus (Cont.)			4. Mental, addictive, and physical disorders. 5. Enabling the collection, dissemination, and exchange of information in medicine and health.		
Funding Source(s)	Publicly funded by the European Union. The budget for EC Funding Programmes is allocated every seven years at a fixed amount. The next Funding Programme starts in 2020.	Family-funded by the Foundation trustees: Bill & Melinda Gates and Warren Buffett.	Predominantly (~87%) public sector funding from the German federal government and state governments (50:50). Additional third-party funding from the European Union and grants from private individuals.	Publicly funded through Congress.	Income from its investment portfolio (worth £20.9 billion as of September 2016).
Total Investment Fund Since Beginning	Horizon 2020 was allocated €80 billion for the duration of the Programme.	$41.3 billion (through Q4 2016)	n/a	n/a	n/a
2017 Investment Fund	The final round of funding for Horizon 2020, running from 2018-2020, is €30 billion.	$4.6 billion (2016)	€1.3 billion, distributed across the 83 institutes and research facilities of the Society.	The NIH was allocated a budget of $33.136 billion for 2017.	£1 billion.
Projected 2018 Investment Fund	See above.	Approximately 10% of the endowment is available for funding each year.	As part of the Joint Initiative for Research and Innovation III, MPG will receive annual budget increases of 3% from 2016 to 2020.	Allocated a budget of $35.2 billion by Congress for 2018.	Wellcome has committed to spend approximately £1 billion on research each year from 2016 to 2020.

	The European Commission	The Bill & Melinda Gates Foundation	The Max Planck Society (MPG)	The National Institutes of Health (NIH)	The Wellcome Trust
Funding Breakdown by Area of Focus	€28.7 billion for the societal challenges element of the Programme, €24.3 billion for excellent science, and €16.4 billion for industrial leadership. The remainder was allocated to the European Institute for Innovation and Technology, Euratom, and other projects.	n/a	n/a	In 2016, the top five Institutes in terms of funding allocation were the National Institute of Allergy and Infectious Disease, the National Heart, Lung and Blood Institute, the National Cancer Institute, the National Institute of Arthritis and Musculoskeletal and Skin Diseases, and the National Institute of Diabetes and Digestive and Kidney Diseases.	The majority of current spend is in the UK, but Wellcome is looking to become more focused on global issues.
Funding Approach	A combination of individual and consortia-based grants: a classic national funder approach.	A grantee and partnership-based approach, depending on particular sectors and strategies.	A fellowship and project-based approach that looks to identify outstanding individuals in their fields of science and give them maximum freedom and the best conditions to further their work.	A range of grant funding types, including research grants, career development awards, research training and fellowships, and centre grants.	Wellcome primarily funds individuals, but it also funds centres. Its flagship institution is The Wellcome Trust Sanger Institute, which is focused on leading collaborations worldwide in genomic discovery and understanding.
Number of Employees	1,431 staff at the Research & Innovation Directorate General of the European Commission, within which Horizon 2020 is positioned.	1,453.	22,995, staff including scholarship holders and visiting scientists (December 2016).	20,262.	500-600 staff based in London.

	The European Commission	The Bill & Melinda Gates Foundation	The Max Planck Society (MPG)	The National Institutes of Health (NIH)	The Wellcome Trust
Funding Cycle	Project-specific, but follows a typical phased approach around the application process and budgeting, contractual phase, and managing and finalizing the project.	Project-specific.	Project-specific.	Grants typically follow a four phase cycle: Apply for Grant Funding, Application Referral and Review, Pre-Award and Award Process, and Post-Award Monitoring and Reporting.	Each of Wellcome's 70 funding schemes runs on its own funding cycle.
Funding Cycle Timelines	Project-specific.	Project-specific; may take up to a year.	Project-specific.	The typical timeline from application submission to grant award is 7-10 months.	See above.

Source: Outsell Analysis, December 2017

Funder Profiles

The European Commission

Mission

Horizon 2020 is the European Union's framework programme that includes all funding for research and innovation. It is its largest ever research and innovation programme, with just under €80 billion of funding allocated over seven years (2014-2020). It falls under the remit of the Research & Innovation Directorate General of the European Commission (the Commission). With the political backing of European leadership and members of the European Parliament, it is seen as a means to drive economic growth and create jobs. Horizon 2020 emphasizes three key areas of focus: excellent science, industrial leadership, and tackling societal challenges. Its goal is to "ensure Europe produces world-class science, removes barriers to innovation, and makes it easier for the public and private sectors to work together in delivering innovation".

Since 2015, Horizon2020 has had three overarching goals, known as the "Three Os":

- **Open Innovation:** To open up the innovation process to all active players, so that knowledge can circulate more freely and be transformed into products and services, creating new markets and fostering a strong entrepreneurial culture.

Open Science: Ten percent of the budget is channelled to direct or indirect support for open science. It involves four key approaches: actions addressing specific aspects of open science; the development of the European Open Science Cloud; open-data-driven science and explicit references to the use/experimentation of open science approaches, such as knowledge or data sharing; and the spreading of best practices through networks, platforms or hubs. Additionally, the Commission will set up a platform in 2018 for Horizon 2020 grantees (and beyond) to publish via OA from 2018.

- **Open to the World:** Dedicated to international cooperation in areas of mutual benefit, this programme looks to reinforce existing flagship initiatives and set up new ones of significant scale and scope. Examples include the EU-Africa Research and Innovation Partnership, and Nutrition Security and Sustainable Agriculture.

Funding

The funding for Horizon 2020 is a fixed amount provided by the European Union for the duration of the framework program. The budget for Horizon 2020 allocated €28.7 billion for the societal challenges element of the program, €24.3 billion for excellent science, and €16.4 billion for industrial leadership. The remainder was allocated to the European Institute for Innovation and Technology, Euratom and other projects. Horizon 2020 funding is open to European Union member and associated countries: at least one legal entity in a project team must come from one of those countries. The final round of funding for Horizon 2020 runs between 2018 and 2020 with a total allocated budget of €30 billion.

Grant Strategy and Funding Approval Process

Horizon 2020 offers a combination of individual and consortia-based grants, running on a "classic national funder approach". Whilst individual projects follow their own specific lifecycles, Horizon 2020 projects follow a typical three-phased approach:

- **Call Management:** This includes publication and opening of the Call, registration (submission of registration by interested parties) and submission (submission of proposals).

- **Evaluation:** All proposals are evaluated, with a maximum timeframe of five months before organizations are informed whether or not they succeeded. Successful proposals go through a Grant Agreement Preparation phase, with the maximum total Time to Grant period (from when the Call closes) of eight months.

- **Project Duration.**

Additional grant management activities include potential amendments (requested by either the project team or the EU), continuous reporting and deliverables, and checks and reviews by experts and project monitors.

As a public funder, the Commission does not see commercialization as part of its role; rather, it aims to enable and improve research by supporting open science. It can't be seen interfering in the market, and the launch of its own publishing platform in 2018, for example, is not intended to commercialize research, but rather to support the promotion of OA.

Driving Change

Here we focus on the Horizon 2020 open science goal. Describing it as accelerating work already done before, the European Commission positions open science as enabling a better return on investment. If publications and data are openly available, you can increase the output of investment by enabling faster speed of discovery, increasing the transparency of research, and enabling researchers to build on established science.

Ultimately, the Commission's view is that most research in Europe is publicly funded and should be publicly available. It sees open science as a "systemic transition" of the science system, impacting the whole research cycle and all its stakeholders by affecting the way research is performed, knowledge is shared/diffused and preserved, research projects and results are evaluated, research is funded, researchers are rewarded, and future researchers are trained.

The open science goal includes eight priorities developed through Europe-wide consultation, including four "hard" priorities where the Commission looks to take the lead through mandates, and four "soft" priorities where it looks to "encourage and recommend":

Hard Priorities:

- **OA:** All peer review scientific publications are freely accessible.
- **Open Data:** FAIR data sharing — ensuring that data is Findable, Accessible, Interoperable, and Reusable — is the default for funding scientific research.
- **Science Cloud:** All EU researchers are able to deposit, access, and analyse European scientific data through the open science cloud.
- **Altmetrics:** The use of alternative metrics to complement conventional indicators for research quality and impact, such as the Journal Impact Factor and citations.

Soft Priorities:

- **Rewards:** The European research career evaluation system fully acknowledges open science activities.
- **Research Integrity:** All publicly funded research in the EU adheres to commonly agreed Open Science Standards of Research Integrity.
- **Education and Skills:** Provide all young scientists in Europe with the necessary skills and support to apply open science research routines and practices.
- **Citizen Science:** Enable the public to take a greater role in science. The Commission sees this as both an aim, and an enabler, of open science.

The Commission's goal is for Europe to be fully OA, with mandatory open data by 2020, and a fully functioning open data cloud operational by 2028 (with rollout starting in 2018). Its ambition covers all European Union member and associated countries, and all disciplines in science and the humanities and social sciences (HSS).

The Commission also looks to lead by example:

- **OA and Open Research Data:** OA has been mandatory for publications since the start of Horizon 2020. Open data has been mandatory since September 2017, with the launch of the Open Research Data Pilot, which requires grantees to deposit research data, preferably in a research data depository. The types of data covered by the Pilot include underlying data and any other data, such as curated data not directly attributable to a publication, or raw data, as well as the associated metadata. A Data Management Plan is also required.

  Appreciating that not all data can be open, however, the Commission's position is that data should be "as open as possible, as closed as necessary". As much as possible, projects must also take measures to enable third parties to "access, mine, exploit, reproduce and disseminate" the data, for example, by attaching a CC-BY license to it. Open research data will be monitored throughout Horizon 2020 with a view to further developing the Commission's policy on open science in this regard. Based on data management plans submitted thus far, the Commission sees the need for additional guidance around data management, data preservation, IPR and data standards in particular.

- **Open Research Europe publishing platform:** In November 2017, the Commission launched its RFP for the creation of an Open Research Europe (ORE) publishing platform, with a view to granting the contract in 2018. ORE will be an online platform allowing the rapid, OA publication of peer review articles and preprints related to Horizon 2020, containing mechanisms for open, collaborative and public peer review, as well as alternative metrics. It will be free to use for Horizon 2020 grantees as a complementary service, rather than a compulsory one.

- **European Open Science Cloud:** In April 2016, Commissioner Carlos Moedas stated: "Europe's final transition must be one from fragmented data sets to an integrated European Open Science Cloud. By 2020, we want all European researchers to be able to deposit, access and analyse European scientific data through a European Open Science Cloud". The goal is a trusted, open environment for storing, sharing, and reusing scientific data and results, and supporting open science practices. The Commission is currently working with member states on the definition of governance and financing for the initiative, with a first draft of the EOSC Roadmap due shortly. In the meantime, the EOSC Declaration, published on 26 October 2017, enabled all scientific stakeholders to sign up and confirm their endorsement and commitment to the realization of the EOSC by 2020. The Declaration includes 33 high-level statements meant to capture common understanding of the required data culture, research data services and architecture, and governance and funding needed to make the EOSC a reality by 2020. At the time of writing, 40 scientific stakeholders are signatories to the Declaration. Additionally, 31 of the signatories also committed to one or more actions to implement the principles of the EOSC Declaration.

2018 and Beyond

Commissioner Moedas has stated that Framework Programme 9 (FP9), the follow up to Horizon 2020, will "embody open science and have it at its core". It is clear that the priorities outlined above will continue to be key into FP9 and beyond, in order to fulfil the Commission's aims around open science.

The Commission is also looking to reinforce monitoring and incentives around OA for publications to help achieve its aims related to open science, and sees education is a key element of that effort. It will also launch the European Open Science Monitor in 2018, bringing together issues related to open science, broken down across geography, sector, and discipline. It also intends to mainstream FAIR data principles across Horizon 2020 and FP9, develop tools to help further develop policy, and commission expert groups on FAIR data and the future of scholarly communication.

In Outsell's Opinion

The ability of the European Commission to impact the scholarly communication marketplace is huge, given the size of its budget. With its focus and ambitions around open science, the Horizon 2020 framework has been particularly influential, and the Commission acknowledges the impact that it has on the market through its policies and mandates in that regard.

In Outsell's opinion, the Commission's impact and influence will continue to grow in this area as it looks to drive the agenda forward with its open data, open research platform and the European Open Science Cloud initiatives. Whilst the launch of the Wellcome Trust and Gates Foundation open research platforms were undoubtedly influential, it is likely that it will be the launch of an open research platform by the Commission that will truly open the floodgates here.

These initiatives are still in the early stages, however — particularly the European Open Science Cloud — and the Commission's ability to deliver there is yet to be proven. Sensitive to its role as a public funder, the Commission relies in many ways on the actions of the market to implement and "make real" the implementation of its policies. Stakeholder dialogue, consensus, and collaboration will be crucial to the success of its stated ambitions around open science going forward. This is particularly the case given the Commission's view that the whole lifecycle of research could be made open in real time, with data and research able to be used throughout the whole process within 10 years, given the current speed of technology and innovation.

The Bill & Melinda Gates Foundation

Mission

Founded in 2000, the fundamental belief of the Bill & Melinda Gates Foundation (Gates) is that every life has equal value. Its mission is to help all people lead healthy and productive lives, primarily with a focus on health, education, and libraries. All Gates activities worldwide align with these core beliefs. It has no goal related to the commercialization of its investments.

Funding

Gates is a philanthropic, family-funded Funder, funded entirely by Bill and Melinda Gates and Warren Buffett. It operates as a two-entity structure: the Bill & Melinda Gates Foundation, and the Bill & Melinda Gates Foundation Trust. Both are tax-exempt, private foundations, structured as charitable trusts. The Foundation is the grant-making entity focused on here whilst the Trust holds the donated investment assets from Bill & Melinda Gates and receives contributions from Warren Buffett. It manages the investment assets and transfers proceeds to the Foundation as necessary to achieve the Foundation's goals.

As of December 31, 2016, the Foundation Trust Endowment was $40.3 billion. The Foundation has made $41.3 billion in total grant payments since inception. In 2016, it provided direct grantee support of $4.6 billion, up from $4.2 billion in 2015. Levels fluctuate slightly year-on-year depending on the size of the endowment.

Grant Strategy and Funding Approval Process

Gates makes grants across four global programmes, each of which is divided into programme strategies (of which there are a total of around 27):

- **Global Development Programme:** Focused on work in developing countries on agricultural development, family health, vaccine delivery, financial services for the poor, emergency relief, and access to computers and the internet.

- **Global Health Programme:** Addresses health problems significantly impacting developing countries through innovative, ambitious, and scalable solutions. Areas of focus include discovery and translational sciences, enteric and diarrheal diseases, HIV, malaria, neglected tropical diseases, pneumonia, and tuberculosis.

- **Global Policy and Advocacy:** Oversees the Foundation's work to build strategic relationships with governments, private philanthropists, media organizations, public policy experts, and other key partners that are critical to the success of the Foundation's mission.

- **United States Programme:** Focuses on the Foundation's work on education, libraries, and access to the internet, emergency relief in the US, and community grants and local efforts in the US Pacific Northwest.

Each division develops specific goals and strategies before allocating resources and granting funding. Each continually collects and shares findings, assimilating lessons learned and adjusting strategies as needed to achieve goals. Each strategy is reviewed annually, with ongoing dialogue with grantees and partners occurring across the strategy lifecycle. All grants and contracts are developed using a standard four-phase process — Concept Development, Pre-Proposal, Investment Development, and Management and Close — with the duration of each phase dependent on the individual project, its complexity, and the capacity and location of the potential partner.

Throughout the grant-making process, Gates works with its partners to define the overall results that it hopes to

achieve and the data required to measure those results. It focuses on critical (project-dependent) measurement metrics of progress that enable continued learning, adjustment, and alignment. Gates also has an Evaluation Policy to enable the generation of quality evaluation evidence. Again, the evaluation measures differ by project type, but are integral to each project.

All projects are managed through a proprietary workflow solution, Unison. As a funder, Gates' finds that the small market means that there is a lack of suitable tools, so it built its own system around ten years ago.

Driving Change

The Gates Foundation's support of OA is fundamentally linked to the belief that sharing information accelerates its impact. It is mission-driven: "barrier-free access to foundation-funded research advances innovation and helps create a world where everyone has the opportunity to lead a healthy and productive life".

Its OA Policy was announced in November 2014, implemented to optimize the impact of the research it funds, and to minimize operational impact on staff, researchers, and publishers. Effective for all new agreements as of January 1 2015, it included a two-year transition period for policy compliancy, with all publications required to publish on its OA terms as of 1 January 2017.

The policy contains five key elements:

- **Discoverable and Accessible Online:** Publications are to be deposited in a specified repository with proper tagging of metadata.
- **OA Terms:** All publications are to be published under the CC BY 4.0 license or equivalent.
- **No Embargo:** All publications are to be made available immediately upon publication with no embargo period.
- **Underlying Data:** All data underlying the published research is required to be immediately accessible and open.
- **Reasonable Fees:** The Foundation will pay reasonable fees to publish by the terms of the policy, from a centralized budget created to pay OA fees.

Between 2,000 and 2,500 articles are generated by Gates Foundation research each year. It is widely regarded as having one of the most stringent policies in the field, and it allows no exceptions. That currently means the exclusion of some high-profile journals — such as Nature and some Nature-branded research journals — because they do not comply with all aspects of the policy.

In August 2016, Gates launched Chronos, a co-developed, web-based platform for Gates-funded researchers, designed to simplify and manage the publication process, and enable it to track its peer-reviewed published

research. All articles must be submitted through Chronos, which includes payment management, compliancy checks, data management, and reporting functions. Currently only available to Gates grantees and employees, Chronos is likely to be made available to other funders and institutions in 2018.

In what it sees as a natural extension to its OA policy, Gates launched the Gates Open Research platform in autumn 2017. Working with F1000, Gates Open Research publishes scholarly research outputs reporting any basic scientific, translational, applied, and clinical research funded by Gates. All research, including clinical trials, systematic reviews, software tools, and method articles, can be published via the platform, including confirmatory and negative results.

In keeping with the F1000 approach, invited peer review takes place openly after publication, with authors ensuring that the article is peer-reviewed by independent experts in a timely manner. Articles that pass peer review are indexed in PubMed and elsewhere. All articles published on the platform are published under a CC-BY license, and authors are required to provide detailed descriptions of methods as well as providing full access to underlying data sources. All submissions to Gates Open Research are made via Chronos, and all publishing costs are covered directly by the Foundation.

2018 and Beyond

Having been very focused on transitioning to its OA policy over the past couple of years, Gates is now focused on getting the open data piece right by creating an environment that makes it easy for researchers to create structured, discoverable, and shareable datasets. Initial focus is on progressing past underlying data guidelines, storage, and discoverability. It sees clear alignment here with its core beliefs and mission via "unprecedented potential for data and information to transform life in the 21st century". For example: "If we have extensive and freely available datasets, medical researchers are much better positioned to identify underlying causes of preterm birth and effective treatments for them". Ultimately, it sees this as part of a bigger shift that started with OA, is moving towards open data and, ultimately, to open research and open science, through ease of access and discoverability, transparency, and dissemination of scientific knowledge.

In Outsell's Opinion

The Bill & Melinda Gates Foundation is a supremely mission-focused organization and one to be hugely admired. Its ambitions are vast and its drive to achieve them is all-encompassing. This mission-driven zeal is at the centre of everything it does, and it takes no prisoners in working towards the fulfilment of its mission. The Foundation's impact on scholarly research stems from that, rather than a specific agenda to disrupt the market per se. Whilst not the first to act in terms of OA, its positioning and future plans there highlight its drive to use its resources and profile to advance causes that reinforce its beliefs and help achieve its ultimate goals. Whilst not a scholarly communication ecosystem native, it recognizes its role as part of the ecosystem, is increasingly embracing that, and comes at discussions in the spirit of partnership. Others will always follow where the Gates Foundation goes, and as a global brand, that alone makes it a hugely impactful force.

The Max Planck Society for the Advancement of Science

Mission

Founded in 1948, the Max Planck Society for the Advancement of Science (MPG) is focused on researching and understanding basic findings. A non-profit organization, it is not a funder in the traditional sense, but rather a research-performing organization.

MPG has a broad scientific focus, conducting basic research across the natural sciences, biosciences, humanities, and social sciences; of the major disciplines, it considers only clinical medicine and applied engineering less relevant to its mission. The Society is dedicated to achieving a high level of excellence within the "scientific investigation of particularly relevant and promising areas. Above all, it seeks to address new areas of research, including those outside or between established disciplines, quickly and with the required effort". Typically, once a field of study has become routine at the university level, MPG will move on to another endeavour.

A key tenet of MPG's philosophy is identifying outstanding individuals in scientific fields and providing them with the maximum freedom and best conditions to further their science. MPG institute directors are some of the pre-eminent scientists worldwide, with the largest institutes having 8 to 10 directors leading and driving research activities. The focus on changing, developing, and evolving the status quo in ways which are meaningful for the future underpins many of the driving elements of the Society, including its dedication to OA.

Funding

Funding for MPG comes primarily from the German federal and state governments (€1.3 billion in 2017). This funding is distributed across the 83 Max Planck institutes and research facilities to finance research. MPG organizational structures support the institutes, but it is their role to "conduct scientific research freely and autonomously".

Commercialization of research investments is not a goal of MPG, although it does happen. The Society has a patent office and provides support to researchers to monetize their research where there is the opportunity to do so. However, this is a relatively marginal activity, particularly given that MPG research is typically focused on the early stages of research in new areas.

Grant Strategy and Funding Approval Process

Many people are involved in the process, with final decisions taken by the president, albeit in consort with a number of committees and evaluations. Vice presidents are responsible for particular subject areas, with the evaluation committees working under them to evaluate proposals, make recommendations, and develop assessment reports on an ongoing basis. MPG describes the process as bureaucratic — although it is faster and simpler than with external funders such as the European Commission — and tries to keep it as lean as possible. It is careful to provide strong administrative support as well.

In keeping with its dedication to excellence, and to demonstrate and maintain its premier reputation, all institutes are rigorously monitored and assessed. Evaluated on a biannual basis, they undergo thorough analysis of research performance, with project discontinuation and withdrawal of additional funding at stake.

Driving Change

The Max Planck Society has a long history as a driver of open access, since hosting the first Berlin Conference and initiating the "Berlin Declaration on OA to Knowledge in the Sciences and Humanities" in October 2003. The Declaration continues to receive fresh support and has been signed by 550+ institutions and organizations worldwide. MPG is a dedicated OA publisher, active in Green OA (with an institutional repository since 2002) and has a strong focus on Gold OA (supporting APC charges and with various publisher agreements set up since 2003). In 2011, in partnership with the Howard Hughes Medical Institute and the Wellcome Trust, it founded eLife, the open-access journal focused on publishing "promising research in the life and biomedical sciences", and continues to provide the project with financial support and strategic guidance.

The key element of MPG's commitment to OA is its recognition and deep belief that it is a core requirement in advancing the research process in a digital scholarly communications environment. For MPG, the cost argument is not a key driver; it is a concern, but it doesn't come first. Rather, it sees this as being about enabling the exploitation of the internet's potential. From the Society's perspective, the current paywall system is outdated and dysfunctional in an era where one needs free use of research for text and data mining purposes, and for the effective deployment of software, analytics, research, and workbench tools.

MPG perceives itself as a leader in this space, with a strong convening power around OA. It is trying to show the way forward, hence the launch of its OA2020 campaign. OA2020 is a global alliance committed to accelerating the transition to OA, replacing the subscription business model with new models that "ensure outputs are open and re-usable and that the costs behind their dissemination are transparent and economically sustainable." It recognizes and endorses various means of implementing OA — including the development of new OA publishing platforms, archives, and repositories — but believes that "to gain the full benefits of OA and enable a smooth, swift and scholarly oriented transition, the existing corpus of scholarly journals should be converted from subscription to OA". It sees the institutional focus on buying content, rather than looking to repurpose the same budget to pay for publisher services, as a key barrier to widespread transformation. In the Society's view, libraries need to replicate the kind of transformation seen at vendors such as Elsevier (which has moved from a publisher to a data and analytics provider) and position themselves as the intermediaries between vendors and researchers, supporting researcher need to access content and data across traditional boundaries and siloes (hence the need for OA).

Signatories to the OA2020's Expression of Interest document now include more than 100 institutions. This includes key institutions from China: the National Science and Technology Library, the National Science Library, and the Chinese Academy of Sciences. Whilst MPG continues to question whether progress is fast enough, it hopes to be able to pave the way in demonstrating the ability to shift the money flow from the reading/access end of the publishing lifecycle to the publication and services end. It is optimistic that OA2020 is receiving a lot of attention and hopes that it will demonstrate that it is possible to keep the money within the system — albeit for services rather than content — reassuring and continuing to work with publishers in that regard. It doesn't expect to see wide-scale OA by 2020, but assuming that the institutional mind-set can change and that it is able to demonstrate that transformation is possible, MPG thinks that the market will reach a point of no return within the next five years.

2018 and Beyond

MPG's roadmap for its transition to OA is highly visible, and is linked, unsurprisingly, to OA2020. More than

80% of its total article output is published in journals from 20 key publishers, five of which are already pure OA publishers. MPG's stated aim is to "divest with maximum consequence from subscriptions" with the intention that by 2020 "none of our 20 key publishers continue to operate on a regular subscription scheme". In negotiating with publishers, MPG focuses on two options:

- Engaging in a transformative arrangement (e.g., offsetting) with OA rights based on fair conditions.
- Either discontinuing MPG subscriptions completely or reducing them to a bare minimum.

It is working on offsetting or other transformative agreements with publishers that include Springer Nature (via Springer Compact), RSC, and Taylor & Francis, with a further two to five new agreements currently being discussed. Further extension of its approach is intended from 2019 onwards, once further licensing agreements are up for renewal.

In Outsell's Opinion

Whilst not a true funder in the traditional sense, the Max Planck Society is a highly respected and premier organization in this space. Its research reputation is stellar, and its influence across the sector is widespread and significant. It is a leader in both research and industry terms and is focused on working with other industry stakeholders to pursue its OA agenda. In its view, OA is the foundation upon which the full benefits of open data, open science, text and data mining, and other tools and services related to research and publication workflow are contingent.

The Society sees the subscription system as the most fundamental barrier to OA, and believes that the lever for change is the money in the system. "We have seen enough mandates for researchers — we need mandates for the money. If institutions are willing to keep up the levels of money in the system, and we can reassure publishers of that, then OA cannot be stopped." Funders and publishers consider MPG to be highly impactful in terms of its actions in this regard, and this is Outsell's opinion as well. In particular, we recognize its deep seated belief in its mission, its drive and efforts to achieve its goals, and its work to develop long-term, pragmatic, and impactful solutions for the benefit of all.

The National Institutes of Health (NIH)

Mission

The National Institutes of Health (NIH) is the US medical research agency and part of the US Department of Health and Human Services. It is one of the largest funders and the largest public funder of biomedical research worldwide. Its overarching mission is to "to seek fundamental knowledge about the nature and behaviour of living systems and the application of that knowledge to enhance health, lengthen life, and reduce illness and disability".

In pursuit of its mission, NIH promotes treatment and prevention to improve health, expands the biomedical knowledge base through funding research and developing the current and future biomedical workforce, and

drives economic growth and productivity. NIH's overarching goals are:

- To foster fundamental creative discoveries, innovative research strategies, and their applications as a basis for ultimately protecting and improving health;

- To develop, maintain, and renew scientific human and physical resources that will ensure the capability of the United States to prevent disease;

- To expand the knowledge base in medical and associated sciences to enhance the US's economic well-being and ensure a continued high return on the public investment in research;

- To exemplify and promote the highest level of scientific integrity, public accountability, and social responsibility in the conduct of science.

Funding

NIH invests more than $30 billion annually to achieve its mission. Congress awarded it a budget of $33.136 billion for 2017.

NIH is made up of 27 different institutes and centres, each of which has a specific research agenda. All but three of them receive funding directly from Congress and administer their own budgets.

Currently, over 80% of NIH's funding is awarded through approximately 50,000 competitive grants. These involve more than 300,000 researchers at 2,500 universities, medical schools, and other research institutions in the US and around the world. In 2016, the top five institutes in terms of allocated of funds from NIH's budget were the National Institute of Allergy and Infectious Disease, the National Heart, Lung and Blood Institute, the National Cancer Institute, the National Institute of Arthritis and Musculoskeletal and Skin Diseases, and the National Institute of Diabetes and Digestive and Kidney Diseases.

Grant Strategy and Funding Approval Process

NIH provides financial support in the form of grants, cooperative agreements, and contracts in support of its mission. It offers a range of grant funding types, including research grants, career development awards, research training and fellowships, and centre grants. Its grant funding process typically follows a templated approach:

- **Apply for Grant Funding:** In the six to eight weeks before submission, researchers prepare to apply, write, and submit their applications.

- **Application Referral and Review:** In the first month after submission, applications compliant with NIH policies are assigned to an NIH institute or centre and to a review group for an evaluation of scientific and technical merit. Applications undergo a rigorous two-stage peer review process in the two to eight months

following submission. The first stage is primarily carried out by non-federal scientists, the second by advisory councils or boards.

- **Pre-Award & Award Process:** Seven to 10 months after submission, high-scoring applicants submit "just-in-time" information, such as relevant certifications. Final administrative reviews are conducted, and Notice of Award documents are sent to successful applicants.

- **Post-Award Monitoring and Reporting:** NIH monitors grants carefully throughout the duration of the award. Active monitoring includes reports and correspondence from the grantee, audits, and site visits.

Driving Change

NIH has long been an advocate of open access, with its Public Access Policy for research publications generated as a result of NIH funding originally drafted in 2004. It was mandated in 2008 and stringently enforced from 2013 onwards, with sanctions applied in cases of noncompliance. The Policy "requires that all investigators funded by the NIH submit or have submitted for them to the National Library of Medicine's PubMed Central an electronic version of their final peer-reviewed manuscripts upon acceptance for publication, to be made publicly available no later than 12 months after the official date of publication." PubMed Central materials are also integrated with large NIH research databases, such as Genbank and PubChem, to help accelerate scientific discovery.

NIH's stance on research data sharing is even more longstanding, with its Policy on Data Sharing effective since 2003. Updated and revised on several occasions since then, there are a number of versions specific to the work of individual institutes and disciplines. In essence, the NIH position is that "data sharing is essential for expedited translation of research results into knowledge, products, and procedures to improve human health" and that "data should be made as widely and freely available as possible while safeguarding the privacy of participants, and protecting confidential and proprietary data." The policy applies to the sharing of final research data for research purposes; basic research, clinical studies, surveys, and other types of research supported by NIH; and unique data that cannot be readily replicated. A data management plan, or a statement of why data sharing is not possible, is required for any grant applications requesting $500,000 or more in direct costs in any single year.

Other recent announcements also highlight NIH's ongoing involvement in the evolving scholarly communications landscape. For example:

- **New metrics:** In August 2016, NIH announced its development of a new article-level citation metric, the Relative Citation Ratio (RCR). RCR provides an improved indicator of the relative citation strength of a given paper, normalized by field and time (publication date). The adoption of the RCR is one of the key areas where information service providers see NIH as being particularly influential.

- **Preprints:** In March 2017, NIH announced that it was now encouraging investigators to use interim research products, such as preprints, to speed dissemination and enhance the rigour of their work. It also announced that it is allowing investigators to cite their interim research products and claim them as products of NIH funding. This plays to a growing focus by the scholarly research community on preprint disciplines,

such as physics, where the depositing of preprints has been de rigeur for many years. Equally, the NIH is also further demonstrating an evolving position around alternative metrics and indicators of impact.

2018 and Beyond

Part of NIH's mission as a public funder is to serve as "an effective and efficient steward of public resources". The need to prioritize in terms of research focus is part of that mandate, requiring constant review and adjustment, flexibility, and ultimately, a focus on what is the best science of the moment. In this, we see a clear need and requirement from NIH for more data analysis and metrics tools as it strengthens its commitment to a transparent, evidence-based process. For example, its desire to increase the transparency of its decision-making process, and harmonize that across its institutes and centres as well, will see more open publication of particular metrics (for example, around funding thresholds). Equally, enhanced portfolio analysis is also part of the strategy to help ensure that NIH investments avoid overlaps and maximize synergies.

Another clear area of focus for NIH going forward is improving the rigour and reproducibility of research. Its stated strategic aim here is to "take the lead in promoting new approaches toward enhancing the rigour of experimental design, analysis and reporting" to "improve the biomedical research community's overall culture and training to encourage best practices for rigorous scientific methods". In this, NIH is clearly positioning itself on the ongoing path towards open research, as it looks to establish principles and guidelines for reporting preclinical research, for example. In the same vein, it is creating training modules and curricula to educate next-generation scientists on approaches to enhance the reproducibility of their research. This will ensure compliance with policies for OA to published literature and data sharing, and improve dissemination of clinical trial results through continuing to expand the studies included in the ClinicalTrials.gov results database.

In Outsell's Opinion

NIH is widely viewed as an early driver of the open access and open data movements. However, in comparison to later OA policies, its Public Access Policy looks like a watered-down version, given its more limited use and reuse requirements. This is perhaps indicative of NIH as a whole with regards to ongoing innovation in the scholarly research communication field: whilst it generally seems on board with the concept of open research, it is more likely to be following than leading the action. This is perhaps a result of geography, given Europe's position in the driving seat around open access, in particular. Equally, NIH is clearly facing uncertainty around its budget and the need to cost-cut going forward under the current administration. The pure size and scale of NIH as a funder ensures that its impact is widely felt across the scholarly communication ecosystem, however, in Outsell's opinion, it has lost its leadership position to other players such as the Wellcome Trust and the European Commission with respect to open research.

The Wellcome Trust

Mission

The Wellcome Trust (Wellcome) is an independent, global charitable foundation, dedicated to improving health. Its mission is:

- To protect, preserve and advance any and all aspects of the health and welfare of humankind, and to advance and promote knowledge and education by engaging in, encouraging, and supporting:
    - Research into any of the biosciences;
    - The discovery, invention, improvement, development, and application of treatments, cures, diagnostics, and other medicinal agents, methods, and processes that may in any way relieve illness, disease, disability, or disorders of whatever nature in human beings or animal or plant life.
- To advance and promote knowledge and education by engaging in, encouraging and supporting:
    - Research into the history of any of the biosciences;
    - The study, understanding and history of any of the biosciences.

Wellcome's overarching philosophy is founded on the belief that "good health makes life better". Its independent charitable status enables it to take a long-term view, with a strategic framework based around advancing ideas, seizing opportunities and driving reform. In keeping with its long-term perspective, Wellcome has identified four key initiatives where its focused, intensive support could help create a step change in a 5-to-10 year period: Vaccines, Drug-Resistant Infections, Strengthening Research Ecosystems in Africa and Asia, and Our Planet, Our Health. More broadly, it is looking to drive reform and promote change through alliances and campaigning in two key areas: Improving Science Education and Diversity and Inclusion.

Funding

Wellcome's funding source is income from its investment portfolio, worth £20.9 billion at the end of 2016. In 2015, it committed to spending £1 billion on funding each year from 2016 to 2020. Its research funding is focused on discovery science, medical innovation, and HSS, with grants available through its funding divisions: Science, Innovations, and Culture and Society. (A fourth division, Strategy, was dissolved in Oct 2016.)

The majority of Wellcome's current spend on research is in the UK, but it is increasingly looking globally and at global issues. The Science funding division is by far the largest, accounting for £750.8 million of the £1.03 billion in funding allocated in 2016. This was followed by the Culture & Society division (£110 million) and then the Innovations division (£91.8 million). The now defunct Strategy division was allocated funding of £80.9 million in 2016.

The value of Wellcome's portfolio has increased significantly (up from £14.5 billion in 2012) giving it some "headroom". To that end, whilst its traditional core fund will continue to be supported on a committed and ongoing basis, it has set up a reserve fund to be allocated to new initiatives, based on community needs (such as the four key, longer-term priorities highlighted above).

Grant Strategy and Funding Approval Process

Wellcome typically funds individuals, but it also funds a number of centres worldwide, such as its flagship Sanger Institute based in Cambridge, UK, a world-leading institute focused on genomic discovery and understanding.

It currently has around 70 funding schemes, each with its own funding cycle. As Wellcome evaluates proposals submitted through its funding schemes, it looks to assess the science behind the proposals and whether the applicant is capable of delivering. Whilst previous publications are still the primary means of assessment, it looks for other evidence of the project team's ability to deliver, as well as requiring various grant policies to be followed throughout the grant management process.

Commercialization of investments is not a target for Wellcome: its primary objective is to fund research to improve health, and it is important to Wellcome that the results of the research it funds be "applied for the public good". An important element of that is creating an environment that "enables and incentivizes researchers to maximize the value of their research outputs, including data, software and materials".

Measuring funding outcomes is again mission-related. Wellcome has a publicly available success framework through which it attempts to measure the impact of funding over time. Each grantee is encouraged to produce an annual report highlighting project progress and any particular challenges. At the end of the grant, the grantee submits an additional report highlighting what arose as a result of the project in terms of publications and other research outputs. Grantees are also required to submit an output sharing plan, which Wellcome is committed to reviewing at the end of the grant phase. Certain policies — such as the Wellcome OA policy — have very strict requirements, with sanctions if they are not adhered to. Wellcome's data sharing policy requires researchers to share their research data, but at this time they are not sanctioned if they do not do so (although Wellcome may move to sanctions further down the line, if there is a need for it).

Driving Change

Open research is a core principle for Wellcome. It wants the research it funds to be open and accessible, and to have the greatest possible impact. Its view is that "transforming human health will take longer if research outputs aren't managed, shared, and used in ways that unleash their full value".

In 2006, Wellcome was the first research funder to introduce a mandatory OA policy requiring all journal articles, book chapters, and monographs presenting the findings of the research it funded to be made freely available. One hundred and fifty global research funders have since done the same. Wellcome strengthened its endorsement of the policy in 2012, with sanctions for researchers if the policy is not complied with. Approximately 80% of all Wellcome-funded research publications are now openly available.

In July 2016, Wellcome announced the launch of its new publishing platform, Wellcome Open Research, which went live in November 2016. The platform was the first to use the F1000 publishing model — adopted since by the Gates Foundation and other funders — enabling researchers to rapidly publish all outputs from their research, including research articles, datasets, case reports, and protocols, as well as null and negative results. Wellcome's stated hope at the time was that not only would other funders follow their lead, but that over time, funder-specific platforms would merge into a single international platform open to all researchers. Whilst this has yet to happen, of course, the launch of the platform built on Wellcome's OA and data sharing positioning, as well as its willingness to "encourage disruptive innovation" in scholarly communication (e.g., supporting eLife).

Key motivations for Wellcome include the following:

- Speeding up the publication process
- Improved transparency across the research publication process
- Support of open, post-publication, peer review
- Making it easier for researchers to provide information that supports the reproducibility of scientific research
- Inclusivity: Ensuring that all publication outputs are included, assuming they pass a series of objective checks, even if they include negative or non-confirmatory result

Head of Open Research at Wellcome, Robert Kiley, recently published a blog highlighting the achievements of the first year of the Wellcome Open Research platform. Key data points include:

- A total of 142 articles published and 100 articles sent to PubMed.
- By volume of publications indexed in PubMed, the platform is the fifth most used publication venue for Wellcome-funded researchers, after Scientific Reports, PLoS One, Nature Communications, and eLife.
- Costs are lower on the platform than for other publication options. The average APC paid on Wellcome Open Research is £793, compared to an average of £2,044 paid by Wellcome in the 2015-2016 academic year.
- Speedier publication times: The average time from submission to publication is 23.5 days. The average time from submission to being indexed in PubMed is 45 days.
- Speedier peer review process: Median time to first review is 14 days, and median time to second review is 25 days. A total of 406 reviewers participated with 9,491 peer review report views.
- Of the research outputs published, 60% are traditional research articles, while 40% are other article types. The top five articles types are research articles, method articles, research notes, study protocols, and software tools.
- One hundred and four datasets have been deposited in public repositories, 62 in field-specific repositories. There have been 21 software code entries.

Wellcome has also had a data management and sharing policy in place since 2007, requiring grantees to make data available in a timely and responsible manner, with as few restrictions as possible. In 2017, it announced a new policy on data, software, and materials management and sharing. This was done recognizing that a more holistic view of outputs management was required, given that many researchers now also generate original software and research materials of significant value to other researchers and crucial for validation or replication purposes. The new policy supersedes the previous one, with the key change being the need for a broader output management plan, setting out how researchers plan to manage and share significant data, software, or materials for the greatest benefit to health and research. Implementation of the policy will be actively monitored, but sanctions will not be put in place at this time, subject to further research and investigation into the open data environment.

2018 and Beyond

Wellcome is dedicated to pursuing and enabling open research. It has established an open research team and developed a roadmap to enable it to take a leadership role in facilitating the sharing of research outputs, extending beyond publications to data, code, and materials. These actions support its core beliefs around accelerating new discoveries to help improve health, reproducibility, or research, and increasing the efficiency of the research enterprise. It sees key challenges around costs and researcher burden, a lack of infrastructure, tools and skills, a lack of incentives, and a lack of an evidence base. Its two-pronged strategy focuses on a combination of direct activities supported by its operational budget, and community-led initiatives, either commissioned or supported by grant funding. These include:

- **Direct Activities:** Policy-led initiatives, such as redefining its OA strategy and developing incentives programmes. Also includes infrastructure-led initiatives such as a central service for preprints and extending the Clinical Study Data Request consortium (CSDR) for academic trials.
- **Community-Led Initiatives:** "Responsible Research" funding scheme, Biomedical Resources funding scheme (leading to the creation of tools and services to facilitate data discovery and reuse) and commissioned activities such as discipline-based pilots.

Going forward, Wellcome is also supporting calls for a central service for preprints. It already allows researchers to cite preprints in their Wellcome grant applications and end-of-grant reports, and is now working with an international group of funders to explore the value and feasibility of establishing such a central service.

Other future plans include a review of its OA policy, which was last reviewed in 2012. As part of this, it is considering its position around its research being published in hybrid subscription/OA journals. Several options are on the table for consideration at this time: doing nothing; stopping the funding of hybrids altogether; introducing a funding cap on hybrids; or becoming "greener" by more actively promoting the green OA model and/or changing the model for paying APCs. A combination of any of those options is also possible.

Wellcome's open research team is also commissioning reviews around data infrastructures, data standards, training and skills, and global research equity to build on its data, software, and research materials policy. It continues to explore the area of impact, both in terms of moving beyond journal titles as a proxy for quality, and the journal research article as the currency of research impact, as well as examining new ways to assign impact. Improving the incentive system for researchers is also important, as it doesn't see researchers leading the way in terms of making their research open being recognized or incentivized to do so.

In Outsell's Opinion

The Wellcome Trust is actively looking to take a leadership role in ensuring that the research outputs of its funding are findable, accessible, interoperable, and reusable. From the introduction of its game-changing open access policy back in 2006, through its introduction of sanctions to ensure compliance to the policy, its funding of eLife, the launch of Wellcome Open Research, and the extension of its data management and sharing policy to include software and research materials, in Outsell's opinion, it has consistently moved towards attaining that role. Other funders, publishers, and other industry stakeholders alike look to Wellcome and follow its lead.

Because it made early moves in comparison to other funders, its impact is also becoming visible. An example of this includes 150 funders instigating their own OA policy after Wellcome introduced theirs, and publication of first-year results from Wellcome Open Research. This is a highly influential organization, unafraid of innovating and causing disruption to the scholarly communication ecosystem where it sees the need, in line with its mission and beliefs. At the same time, it is generous in sharing its experiences and is keen to collaborate and partner. Both attributes are widely recognized and appreciated within the industry. Outsell expects Wellcome to become more influential in the future, both as it continues to further its ambitions around open research and as it looks to extend beyond its core geographic base.

Funder Impact on Information Service Providers

This section of the report focuses on the evolving impact of funders on other market stakeholders, particularly information service providers.

Of course, funder impact on information providers is not a recent trend. Funders impact information service providers at a foundational level, underpinning the research that drives the scholarly communication ecosystem. Funders becoming more actively involved in the publishing life cycle is more recent, however, and their policies, mandates, investments, and acquisitions significantly impact the strategic and operational direction of information providers.

Current Levels of Interaction

Interactions between funders and information service providers are, by and large, relatively informal. Relationships tend to develop at an individual organizational level and are often transactional: focused on a particular task or element of the research funding cycle.

The information service providers we interviewed claim to be responsive to funder needs and requirements. What that actually means in reality, however, runs the gamut, given the tendency for individual one-on-one relationships. ACS, for example, describes formal agreements in place with some funders, "agreements of trust" with others, and yet others with whom they are in open dialogue and discussion. Other providers, such as ŰberResearch, Elsevier and Clarivate Analytics, offer services specifically for funders and have more of a vendor/client relationship in certain areas. Some report that they don't interact hugely with funders at all, although this is the exception rather than the norm.

One gets a sense, however, that despite the talk (on both sides) of partnership and collaboration, that information service providers are the ones doing the running here. One vendor talks about the need for "proactive outreach"

whilst another highlights its open conversations with funders, but as the one making the approaches: "we do a lot of the sales function in the relationship!"

> ***"We proactively reach out to people in order to be part of the discussion, get feedback, get advice, talk about the challenges. We really do monitor the funder landscape so we can understand and react to changes coming. We also regularly do surveys and interviews with funders in particular areas, really engaging to make sure we are meeting their needs."***

Of note, a number of those we interviewed discussed plans for offering services specifically targeted at funders going forwards, as well as those supporting other stakeholders — such as researchers, authors, and institutions — in their interactions with funders. This reflects feedback that information providers are receiving from their author, researcher, and institutional client bases, who are increasingly challenged by the administrative burden of keeping on top of multiple and evolving funder requirements.

ACS reports its researchers and authors looking for its support and wanting to see them work with the funders "to make the problems go away", whilst *Hindawi* reports institutions struggling with the inconsistency in OA announcements from funders and frustration that "funder vision is far ahead of implementation". Springer Nature reports similar feedback from institutions finding it difficult to manage compliance with different funder and publisher policies around OA. It also describes institutional burden compounded by author behaviour where OA is still not the major driver: "They are choosing the journal, not the policy. Not huge numbers of authors know the policies and what they need to submit, which is also adding to the administrative burden for the institution".

The burden on the information service provider is not insubstantial here, either, particularly those with a global remit: "We serve the entire world, and there are hundreds or thousands of funders and different, individual policies. The number of different funders publishing research in one of our journals could be endless."

Consensus amongst information service providers is that there isn't a comprehensive, global resource for monitoring funder activity. Several of those we spoke with invest significantly in monitoring the space themselves, but this is relatively low-tech activity in terms of setting up alerts on individual funders, monitoring press releases, etc. Conferences and networking events provide opportunities for dialogue, but as we've highlighted, publishers are primarily relying on their individual relationships with funders to keep on top of the changes themselves. This is a source of frustration for many as, ideally, they'd like to be able to participate earlier on in the conversation with funders.

Current Areas of Particular Impact

For the information service providers, we interviewed for this report, two key areas emerged where changing funder behaviour is particularly impactful:

- Policies and mandates around OA, open data, and broader open research initiatives such as Funder Open Research publishing platforms
- Increasing demand for quantitative indicators and metrics to demonstrate ROI across the research lifecycle.

The extent of the impact depends on both the individual funder — the funding landscape is fragmented and individually diverse — as well as the individual publisher and their business.

> ***"Not all funders are created equal."***

Pure OA publishers are less impacted than traditional information providers by recent OA funder mandates because their businesses are already in line with these policies and don't need to adapt. Equally, those publishers focusing on the arts and humanities sectors tend to be less impacted by OA and open data mandates, which are still primarily the domain of the STM and social sciences sectors, largely due to different research outputs and levels of awareness, although that is changing.

Geography is also an important consideration. The greatest impact around OA et al. comes from European-based funders — particularly the European Commission and funders in the UK, the Netherlands, Germany, and Austria — where the engagement with, and visibility around OA, is the greatest. In this region, funder mandates are a key driver in increasing OA uptake.

The drive for increasing data and metrics around the research cycle is more geographically universal. Public funders, in particular, are key drivers because of their need to demonstrate that public funds are spent wisely and for the public good.

> ***"The days when researchers just got funding and did some research that may or may not get results are history."***

Because of their scale and influence, the largest funders are able to be more prescriptive than smaller players, too. NIH's use of the RCR indicator is an example.

An Evolving Impact

There is clear consensus that funder impact on the scholarly communications ecosystem is in a continuing cycle of evolution. Initiatives around OA, open data, and open research represent the major current focus of that evolution. The imperatives for funders in using open methods to make their funded research more speedily and widely available are clearly understood, but information providers also see this as indicative of more active involvement within the publishing lifecycle as a whole. As a result, the funder/publisher relationship is becoming less of a coexistence and more direct. Individual information providers also highlight how their

day-to-day relationships with funders are becoming more specific. ACS talks about its discussions with the Gates Foundation around the Chronos submission system, and Clarivate Analytics about their discussions with funders around datasets beyond the core Web of Science publication data, such as the Data Citation Index, for example.

> ***"Open is the gateway into the entire publishing community. When you see funders experimenting with publishing and elements of that workflow — Gates Foundation and Chronos, CZI and preprints, eLife and peer review — it is impacting the entire life cycle."***

Areas where funders are intervening more directly in the publishing lifecycle include the need for indicators that recognize and demonstrate a broader definition of impact, wider recognition of the value of non-journal article research outputs and the need to disseminate them, tightening mandates around OA and open data, the establishment of funder publishing platforms, and a growing focus on repositories. Fundamentally driven by the desire to get the research they fund more quickly, and to make it more widely available to those who need access to it, Outsell's Funder 5 use their power and scale to experiment and innovate where they feel that the existing publishing system is an obstacle to achieving their missions. This evolution drives and adds further momentum to the trend of scholarly research and communications becoming ever more data-driven, with an increased focus on evaluation for all stakeholders across the industry.

Evolution Brings Both Challenges and Opportunities

Outsell sees a two-stage reaction to funder evolution playing out: a short term, initial view that changing funder behaviours represent a threat, moving towards a longer-term perspective that, whilst it creates challenges, the overarching result is one of opportunity.

Publisher interactions with funders deepen and become more specific as they see opportunities to develop new tools and services to support funder needs. OA mandates create opportunities for traditional information services providers committed to OA. There is opportunity to create more widespread linkages between publisher datasets to support funders looking for a broader demonstration of impact and quantitative indicators of quality.

Many of those we spoke to — including Elsevier, Hindawi, PLOS, and Informa — also saw significant existing and future opportunities around the development of tools and services specifically meeting funder workflow needs and requirements. Potential was identified in areas such as proposal evaluation, portfolio analysis, compliance, reporting, and tracking mechanisms. The development of smart solutions to reduce the administrative burden on authors, researchers, and institutions in meeting funder requirements — as well as providing funders with the data points they need for their own workflow — is also an opportunity. As one interviewee noted: "Google Scholar is not trying to sell these products, [Outsell note: yet!] so it's a definite opportunity for us."

> ***"We're trying to understand new models and new processes that supports the scientific communication ecosystem in becoming faster, quicker, more relevant, reproducible, transparent and reusable. OA or not, we're open to any model that empowers knowledge."***

At the same time, the potential for future challenges also remains a concern. Publishers note how the requirements of the Funder 5, for example, became stricter over time, and expect that to continue in other areas. The Wellcome Trust, for example, indicated that it may put a cap on funding research dissemination in hybrid journals, whilst the NWO and FWF funding bodies (in the Netherlands and Austria, respectively) have already reduced their funding for hybrids. For Springer Nature, the Gates Foundation's strict OA mandate brought particular challenges, as a number of its high profile (and high impact) Nature titles do not comply. Other publishers, such as AAAS, adapted their policy to meet the Gates Foundation mandate, but Springer Nature wants an OA policy that operates across its full portfolio, which will take time to achieve. Informa talks about the considerable investment it took over the course of a year to meet Wellcome Trust mandates.

Equally, the establishment of funder platforms for their own research is clearly at the beginning of an evolution. Currently, the publishing platforms from, e.g., Wellcome and the Gates Foundation, are not mandated and represent small distribution channels. As they grow, however, clear challenges lie ahead around impact and researcher incentives and rewards, should their use become mandated: researchers will want to comply with funder policies, but will still want to publish in high impact venues (i.e., journals).

More broadly, technology, standards, and systems integration remain significant issues. Technology is a key enabler of the data-driven initiatives we see across the scholarly communications ecosystem, but significant challenges arise from the multitude of systems in use by industry stakeholders and their ability (or inability) to interact. As highlighted above, technology infrastructure is currently a key question for many. To enable the creation of more efficient and valuable workflow tools and solutions for funders to support more data-driven, evidence-based approaches, information service providers need funders to apply the same open data standards to themselves as they do to the market. This is no small challenge, but funders must prioritize investment in technology and IT infrastructure — as the Gates Foundation did with its Unison and Chronos systems, for example — to leverage the opportunities here. Standardized approaches across funding bodies and information service providers are increasingly viable — for example, with the increased uptake of FAIR open data principles — and would ultimately significantly reduce friction across the ecosystem for all stakeholders.

It was clear from the interviews Outsell conducted with the Funder 5 that they are essentially looking to work with information service providers as they look to improve and further evolve. It's worth noting that not all funders necessarily share this view. A relatively new group of funders, including the likes of the Arnold Foundation and Arcadia, for example, have a more disruptive agenda, whilst the technology-driven focus of CZI, for example, may also end up more actively disruptive.

Where Funders Are Currently Most Impactful

In our research, Outsell focused on the activities of the Funder 5, paying particular attention to their activities around OA, open data, and open research; the launch of publishing platforms by some of these players; and their recent investments and acquisitions in the scholarly communication ecosystem. In doing so, our intention was to concentrate on those currently creating the largest waves within the STM sector. Our research with information service providers validates our choice of funders when viewed from that perspective, and it is clear that, in general, these actions are viewed with positive interest. However, the fragmented and individual nature of the global research funder landscape means that the actions of this particular group of players, however high profile, are not necessarily indicative of the global research funder sector as a whole, and should be viewed within that context.

> ***"There are different types of funders. CZI is trying to make non-profit investments in commercial players to change the space. eLife has started to make a change in publishing. Larger funders are trying to influence the space as a whole. Smaller ones are more focused on advancing the progress of their mission."***

The funder landscape makes most sense when viewed through particular lenses:

- **Type of funder:** Private vs public.
- **Size of funder:** Large vs small.
- **Geography:** Primarily national or regional boundaries.
- **Discipline:** Subject-specific, but also, more broadly, STM vs HSS.
- **Focus:** Broad-based vs niche; long-term view vs short-term view.

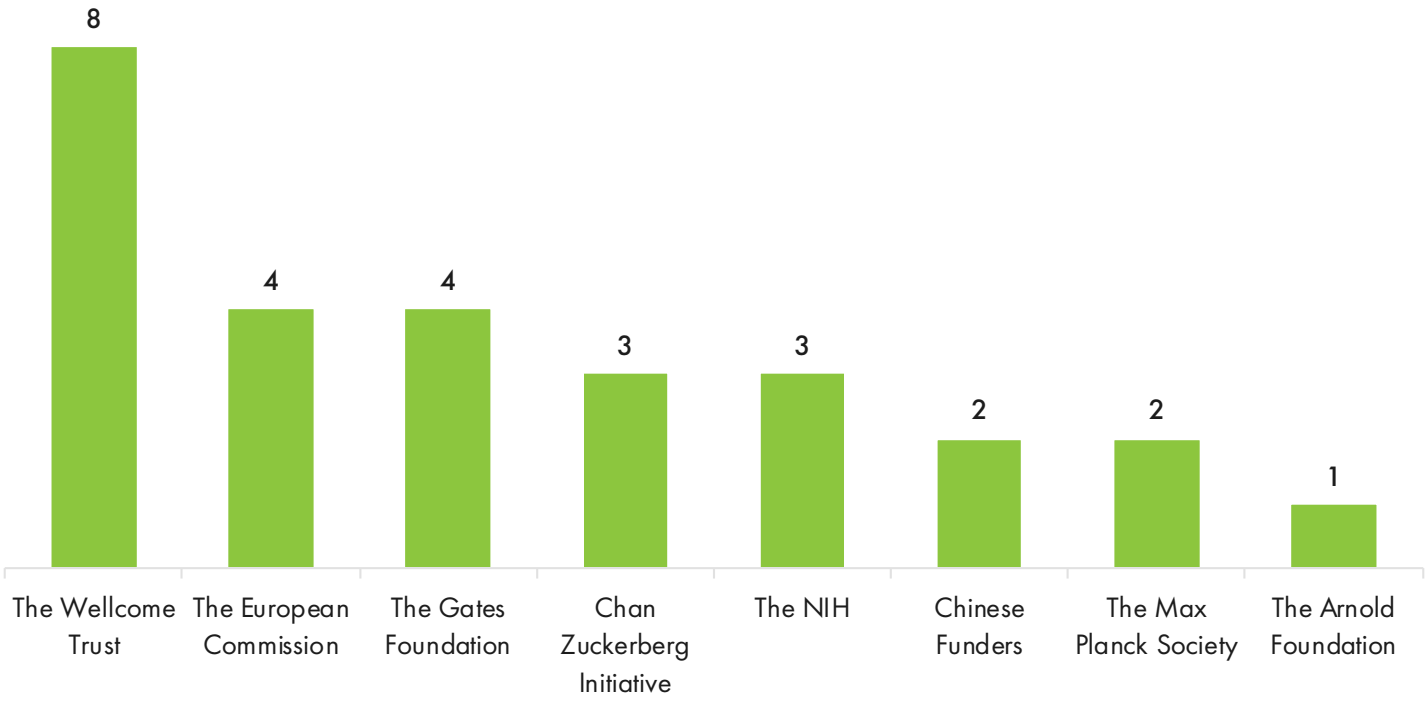
The Funder 5 are all active within the biomedical sector which, according to ŰberResearch, currently reflects the majority of research funding. However, they are different types of funders, from different regions, varying significantly in size and focus on different areas. The ability to move markets takes scale and, of those focused on here, only the European Commission and NIH are truly in that position. Wellcome, Max Planck and the Gates Foundation are smaller, but have the freedom to influence and drive momentum through their thought leadership, innovation, and focused drive on ensuring the particular changes they need to support their ultimate missions. Funders born of technology, such as CZI, add a new dimension through their innate understanding of technologies such as predictive analytics, machine learning, and AI, and how they can potentially accelerate progress in these areas.

> **"These are funders focused on trying to do what is right. They have a call to action: that their funded research gets out, regardless of the results and the actual shape of the product. They want to explore transparency, different types of science and the different ways it can be done in order to move the community and culture forward. Not every funder is where they are — but a lot are starting to turn that way."**

The Most Impactful Funders

Outsell asked information service provider interviewees whom they saw as the most impactful funders, and why. The question wasn't limited to the Funder 5, but they represented the vast majority of the responses. "Chinese funders" — such as the National Science Foundation (NSF), the Chinese Academy of Science (CAS), and the National Science and Technology Library (NSTL) — and the US-based, private, philanthropic Arnold Foundation, were added to our list.

Figure 3: The Most Impactful Funders



Source: Outsell Analysis, December 2017

The Wellcome Trust is mentioned most frequently when discussing the most impactful funders. Whilst the recent launch of its Open Research Platform was mentioned, interviewees were more likely to mention its longevity as an innovator. Wellcome is seen as acting in a forward-thinking way for long enough that some of its earlier initiatives are already impacting the market. Examples include helping to fund eLife in 2011, and the strengthening of its OA policy, with sanctions, in 2012. This, in the words of one interviewee, "proved OA could be sustainable because someone was putting money behind it". It is seen to be a proven leader in open research, and an example that others follow in a variety of areas: policy, preprints, publishing platforms, and open data policy. Interviewees also admire the consistency of its vision and approach, and the tangible, measurable steps it takes along the way.

> ***Re: The Wellcome Trust:*** **"They are very consistent. They've grown, but are always doing the right thing. They are also prepared to experiment and take the bull by the horns. That kind of entrepreneurial gusto in a more established funder is very energizing."**

The European Commission and the Gates Foundation followed the Wellcome Trust in terms of impact for our interviewees. Again, this was particularly a result of their mandates around OA — especially the European Commission, which, given its scale and influence, effectively cemented funding for OA in Europe. In the case of the Gates Foundation, interviewees also admire the development of the Chronos submission system as a particularly useful workflow tool for researchers and publishers alike. They also recognize that the Foundation's high profile enables it to influence future agendas with others looking to follow where it leads.

Announcements from NIH and CZI in the preprints area — allowing preprints to be cited in proposals, plus CZI's investment in BioRxiv and requirements around preprint versions — also attracted information service provider attention, although these are likely to be more impactful going forwards. CZI is also attracting attention because it is new and comes from an environment where data and data processing drive discovery: it's intriguing, and also a bit of a curiosity at this point in time.

Interviewees see the recent addition of key Chinese institutions as signatories to Max Planck's OA2020 campaign — including NSTL and CAS — as a potentially significant move. This more visible role by China in the global research and communication ecosystem is expected to be impactful going forwards as well, given the amount of research they commission, and the vast swathes of Chinese authors publishing research with our interviewees.

Specific Impact on Information Service Provider Businesses

Whilst the majority of the information service providers we interviewed are primarily STM-focused, a number of the largest providers also publish significant HSS portfolios. When we asked about the areas of their business impacted most strongly by recent funder announcements, the STM portfolio was clearly most affected. This is not surprising. STM is very much where OA, open data and open research activities and funding are focused, although there is increasing awareness of OA amongst HSS researchers, and some developing potential in the

HSS sector, particularly as the open movement expands to include non-journal article research outputs. Within the STM portfolio, it is more specifically the journals business where funder announcements are most impactful. Again, this is not surprising, given that the OA journals market is significantly larger than, for example, the OA books space at this time — again, in part due to the lower levels of funding available for OA beyond journal articles. Specifically within the journals sector, few overall trends were visible, with levels of funder impact differing by subject and, in particular, by region.

> **"Journals that have a range of submissions from different regions are quite impacted. If China goes OA, that will have a huge impact. We have a strong regional program and work hard in particular markets to build journals and activity. When a funder changes direction, it's a big deal."**

In general, our interviewees find it difficult and/or too early to connect specific actions they take in response to particular funder behaviours with performance metrics. Several discuss this in terms of a continuous process of aligning and adjusting to changing funder behaviour, with diverse changes made across multiple systems and across different departments. However, a number were able to highlight the funder announcements they found most directly impactful in terms of both opportunities and challenges to their businesses:

- **UK efforts around CC-BY licensing:** This prompted ACS to create a CC-BY license option in 2013. Around 25% of its authors now publish under CC-BY terms. Whilst ACS finds it difficult to say that "action A has led to impact B", it took a number of actions around OA which, in combination, enabled it to grow its OA output from 1% in 2013 to 7-8% of new content now (and still growing).

- **The Wellcome Trust and the Gates Foundation partnering with F1000:** PLOS describes this development as "interesting" and will actively explore how it can learn from the experiences of Wellcome and the Gates Foundation, and how they might apply to a publisher like PLOS, given the size and scale of the publishing program. "If we can learn from them, it's good for the community. It opens it up to more partnership and more collaboration and overlap. We don't all need to reinvent the wheel. We are stronger as a group. That is where the business impact is."

- **Take-up of Gold OA in particular countries:** Springer Nature's preferred OA approach is to flip whole countries rather than individual journals. Real market transition is happening in Europe around Gold OA at the moment, particularly in the UK, the Netherlands, Austria, and Sweden, with strong movements in Germany too. A blend of stakeholders — such as funders, consortia and publishers — working together in support of Gold OA can make a huge difference. Where there is established funding for OA, take-up is higher. Springer Nature's approach involved the establishment of Springer Compact licensing agreements with the UK, the Netherlands, Austria, and Sweden, as well as the Max Planck Society. These combine reading access to subscription content with OA publishing in one agreement. A researcher from a participating institution is able to publish an OA article at no extra cost and access the full text of all subscription content.

- **Systems development in response to compliance needs:** Developing the internal systems to meet the requirements of various funders was impactful for Informa, both in terms of systems development and ensuring that the organization was properly resourced to be able to meet those needs.

- **Max Planck Society's OA2020 campaign:** Through its Taylor and Francis division, Informa is working with MPG in transformational offsetting of its publishing agreements, as part of OA2020. It describes this as a "game changing relationship, impacting their relationships with others as they looked to meet needs with flexible solutions that are sustainable for both parties."

Whilst noting that funder announcements often serve to accelerate items on their roadmaps, rather than introducing them per se, other specific actions taken by our interviewees particularly focus on promoting OA. ACS introduced author rewards to further incentivize authors to publish via OA, and worked hard to separate the concept of "predatory journals" from "OA journals" in the minds of their researchers and authors. Clarivate Analytics has flagged OA journals within Web of Science and InCites for several years. Following its 2017 partnership with ImpactStory, more than 10 million legal, verified versions of OA articles, including Gold OA and Green OA, are already discoverable in Web of Science. In addition, it released the Funder Explorer analytic lens within InCites that offers a range of features building on funder acknowledgment data. It is also looking at linking patent data too, to provide a broader view of impact. As noted above, Springer Nature developed the Springer Compact model, and also moved almost exclusively to a CC-BY license approach. It says that this means "happier authors and happier funders" as it removes confusion and friction from the licensing decision-making process.

Addressing the Future Impact of Funders

Many information service providers already serve the funder sector, albeit primarily indirectly. As they look to address the challenges and opportunities arising as a result of evolving funder impact on the scholarly research and communication ecosystem, many are planning and developing further services and solutions to support stakeholders. We highlighted current key questions for funders above and see information service providers addressing these in their plans, whilst also bringing their own perspective to what is required — and also what is possible.

> **"We are always striking a balance between our own ideas and what the clients need. Sometimes you need to say "no" to them: ideas may not work in reality, they could have an impact on data quality, it's not worth the investment, etc..."**

Data, unsurprisingly, forms the core of how leading information service providers look to develop and enhance their offerings to funders. Several mentioned developing and enhancing services for funders to support their need for data that helps them demonstrate the impact and ROI of their funding. Much of this is focused around landscaping data solutions, bringing together the "who, what, and where" data that information service providers can more readily provide.

Other, more sophisticated, data solutions are also planned. Predictive analytics solutions around where funders should be looking to provide funding, based on growing areas of research requirement, are an area of focus for Clarivate Analytics, for example. These build on its well-established Research Fronts methodology for identifying emerging research areas with advanced data science and machine learning methods."

PLOS is considering services that enable the creation of a new dashboard for funders and institutions to clearly demonstrate the OA footprint around publishing, readership, impact, and accessibility, compared to the traditional subscription publishing space. In addition to new data solutions, Springer Nature is also looking at support services, too. These include supporting both researchers and funders around ensuring that research data is fully discoverable and usable once deposited — as per open data policies — as well as support around OA take-up and compliance. Echoing PLOS, Springer Nature describes a "messy", decentralized situation. It is keen to support those funders without a centralized submission system, like Chronos, for example, in reducing the administrative burden around micropayments and policy compliance.

In terms of ongoing relationships with funders, information service providers are keen to develop and strengthen their existing ones as well as to reach further into the funder sector. Engagement with funders is really important to publishers, but there is dissatisfaction with the way it happens today and a number of perceived barriers to how it can improve going forwards.

Information service providers are keen to engage more directly with more funders, particularly earlier on in their policy evolution decision-making processes. Publishers often feel on the back foot, always reacting to change, and would like to be able to provide more input and engage more in dialogue with funders. Even the largest players with an active funder monitoring facility find it difficult to keep up. They are also aware that, where they are actively engaged, it is with a narrow band of funders (like the Funder 5), and they want to engage with others in the same way too. Some information service providers mentioned that there is, perhaps, an element of suspicion from funders regarding the publisher end-game, but their desire for more collaboration is genuine.

"We're trying to get a little bit more ahead of the curve — we would like to have more conversations at an earlier point in time as the funders are evolving their policies. We'd like to get into conversations earlier so we can have a dialogue, rather than a reactive approach. The benefit to funders is that things would be on our roadmap a lot earlier."

We highlighted above that funders are looking for improved data from information service providers to meet their needs around demonstrating impact and ROI. Information service providers share a similar frustration with the data that funders make available about their projects and research. This is an area of widespread concern and a major barrier to progress from the information service provider perspective.

"It would be good if funders would apply the same standards they apply to researchers to themselves!"

ACS highlighted its desire for a better source of information regarding funded researchers, for example, attached to a researcher's ORCID ID. To try to address this, it led an author-focused education drive and actively checks the information. Unfortunately, it's seen little improvement, finding that authors still don't always add in all the funder information, or they add it incorrectly.

ŰberResearch highlights the challenges in creating a global grant database when funders don't make all of their own data publicly available in the way they expect other stakeholders to. The Horizon 2020 programme from the EU does not provide a principal investigator (PI) list, for example, because of privacy concerns. Whilst this is a decision of choice, other funders are hindered by their own infrastructures: poor, out-of-date technology, and convoluted processes based on multiple different systems, multiple document submission requirements, and manual and repetitive processes. A number of information services providers we spoke to strongly called for standardized solutions to ease the burden for all industry stakeholders. Unfortunately, it appears that information service providers are pessimistic about the likelihood of future improvements in the short to medium term here, discussing these types of improvements as if they relate to a fantasy utopian dream world rather than something that is technologically viable, albeit complex and requiring significant collaboration.

The investment in experimenting with and adjusting internal processes to meet funder needs — in terms of both finances and resources — is also an issue for some information service providers. Geographical barriers relating to some funders, like those in China, were also highlighted. The regional nature of the funder landscape is also particularly challenging for global information service providers, as it means they are moving at different speeds in different places. This is exemplified currently by the different approaches to OA by European and American funders.

Ultimately, information service providers are universally clear that funder policies will continue to impact their businesses going forwards. What specific funders will do going forwards, such as the European Commission, NIH, CZI, and those in China, was mentioned, as were ongoing industry investments in open source and AI technologies, for example.

Evolution around "open" is by far the biggest area for monitoring, however. There is a sense that OA for journal articles has already experienced its "earthquake moment", although the potential shift away from hybrid to "pure" OA by major funders such as the Wellcome Trust is an area that publishers are watching keenly. They expect to see the current drives around open data impacting more significantly in the future and, in the longer term, the momentum towards open research and open science. The European Commission's Horizon 2020 programme places this front and centre with its "Three Os" strategy, as will its forthcoming FP9 programme. Also high on the list of awareness for publishers is what happens in the US regarding NIH, its budget and its strategy going forwards around open. Other funders will undoubtedly follow where these behemoths lead.

"Open science" is a term that means many things to many organizations, but ultimately it moves beyond OA and open data and highlights multiple structural industry hotspots such as peer review, definitions of impact, and

the reproducibility of science. Unsurprisingly, this is of vital concern to information service providers as they look to stay abreast of funder evolution, to effectively address the business challenges and maximize opportunities for their organizations in a changing world.

Essential Actions for Funders

Funders are a foundational element of the scholarly research and communication landscape. Without their budgets, research dries up and the ecosystem shrivels. Many funders are directly impacting the publishing and information services landscape, driving change, innovation, and disruption via their policies, mandates, and focus on particular areas of research.

Outsell concentrated on a small minority of particularly large and influential players for this report — those who are especially impactful in the areas of open access, open data, and open science. The majority of funders worldwide impact our market in smaller and more indirect ways. Regardless, Outsell recommends the following essential actions for funders — and other market stakeholders — with a view to encouraging the types of interaction and relationships that will drive progress for the mutual benefit of all stakeholders.

View the Whole Ecosystem Holistically Rather than Cherry-Picking

Funders are mission-driven organizations. Regardless of scope, scale, sector, or geography, they are a crucial element of the research-based scholarly communication ecosystem. Many organizations are acutely aware of their importance and the potential impact of their actions on other stakeholders in the sector, but others are less so and may not necessarily understand the specific complexities, perspectives, opportunities, and issues involved.

In Outsell's opinion, it is vital for funders to educate themselves about this broader context within which they operate, even whilst they remain focused on achieving their own mission and goals. Looking at the ecosystem holistically rather than cherry-picking priorities leads to deeper understanding of both the challenges and opportunities involved, as well as the perspectives of other interested stakeholders. Opportunities to leverage relationships, and apply combined muscle, stem from this. So does a reduced risk of derailing potentially important initiatives by placing bets on the wrong horse due to a lack of appreciation of the broader market perspective.

Improve/Formalize the Relationships Between Funders and Other Stakeholders

Whilst there is an increasing number of funder groups and alliances focused around particular topics, and collections of funders with shared ambitions and those who work regularly together, these are largely individual organizations marching to their own tunes. Equally, relationships with other stakeholders in the scholarly communication ecosystem are often transactional: focused on a particular task or element of the research funding cycle.

Outsell was surprised, in the course of this research, to understand the extent to which relatively informal relationships between funders and information services providers represent the norm. We hear calls from both funders and information service providers for more opportunities for productive, timely, and constructive dialogue. Some are already strong in this area, providing regular opportunities to share experiences. Others are less so. Outsell recommends that both sides look to develop more structured and regular means of communication, so that both sides provide more opportunities for earlier input into developments, rather than reacting to a fait accompli. Equally, we encourage the development of further opportunities for three-way conversations

between funders, information service providers, and institutions, as their perspective and input with regards to the changing scholarly communication landscape is equally vital

Market Stakeholders Need to Work Together to Improve the Availability of Data in This Space

In a world driven by data and analytics, and particularly given the growing importance of the open data movement to a number of large funders and its influence on them, it is no small irony that data availability within the funder space is relatively poor. Whilst this is not surprising given the fragmented and regionally driven makeup of the space itself, it needs to improve rapidly. We hear funders wanting to take a more data-driven, evidence-based approach to enable the most appropriate response and allocation of funding, as well as to more effectively demonstrate impact. At the same time, we hear information service providers calling for funders to apply the same open data standards to themselves as they do to the market, to enable the creation of more efficient and valuable workflow tools and solutions. This is no small challenge, but it is clear that funders must prioritize investment in technology and IT infrastructure — as the Gates Foundation has done with its Unison and Chronos systems, for example — in order to improve the situation. At the same time, efforts to take a standardized approach across funding bodies and information service providers might be a pipe dream — although they need not be so with increased uptake of FAIR open data principles — but would ultimately significantly reduce friction across the ecosystem, not just for funders and publishers, but, crucially, for institutions and researchers too.

Essential Actions for Vendors

Whilst Outsell hears that funder impact is generally welcomed and accepted by information service providers, and often in line with their own roadmaps, there are areas where development and improvements would be particularly welcome. In understanding the perspectives of market-leading information providers with regards to the changing impact of funders on their businesses, Outsell provides the following recommended essential actions for other information service providers too, with a view to encouraging the types of interaction and relationships that will drive progress for the mutual benefit of all stakeholders.

✓ Active Monitoring of the Funder Landscape is Vital

Outsell's research highlights the fragmented and complex nature of the funder landscape. This is a landscape of organizations largely operating as individuals. Some share certain areas of focus, but their differences are driven by fundamentals such as budget, geography, sources of funding, what type of funder they are (public vs private), whether their mission is broad-based or niche, whether they are newly founded or long-standing, and whether they take a short-term or long-term view on funding. There is no comprehensive source of information about this space. The largest information services providers invest significant time and resources monitoring this space because they understand its importance to the future of their organizations. At this stage, there are very few shortcuts. Organizations need to stay on top of evolving funder needs, requirements, and areas of focus if they are to successfully adjust their own courses to meet the challenges and harness the opportunities of this evolving market. Establishing an active monitoring system is key.

✓ Improve and Formalize Relationships With Funders

As before, Outsell views funders as largely individual organizations marching to their own tunes. There are many funder groups and alliances focused around particular topics, as well as collections of funders with shared ambitions who work regularly together. However, relationships with other stakeholders in the scholarly communication ecosystem are often transactional: focused on a particular task or element of the research funding cycle. We hear calls from both funders and information service providers for more opportunities for productive, timely, and constructive dialogue. Some are already strong in this area, providing regular opportunities to share experiences, but it is clear that relatively informal, one-on-one relationships between funders and information services providers represent the norm.

We strongly recommend that information service providers look for every opportunity to develop more structured and regular means of communication with funders to enable the earlier input and open, collaborative dialogue they clearly seek. In Outsell's opinion, this benefits all industry stakeholders: not only information service providers and funders, but institutions and researchers as well.

✓ Work with Funders to Improve the Availability of Data in this Space

As above, the availability of data about the funder space is poor. This is not surprising given the fragmented, regionally driven nature of the space itself, but it needs to improve rapidly. In a world driven by data and

analytics, and given the advancements in technology over the past decade, there is no viable reason why this is not possible. Funders and information service providers have a common need here: funders want a more data-driven, evidence-based approach to funding allocation and to more effectively demonstrate impact. Information service providers want better access to funder data to enable the creation of more efficient and valuable workflow tools and solutions. Given these mutually beneficial ambitions, we urge collaboration at an industry level to develop solutions that enable more open, accessible, and usable data. We don't underestimate the complexity of the challenge but, in our opinion, the outcome is worth the investment: significantly reduced friction across the ecosystem — not just for funders and publishers but, crucially, for institutions and researchers too.

✓ Look for Standardization Opportunities and Efficiency Gains Where Available

Similarly, Outsell recommends that information service providers take a standardized approach when developing future products and services wherever possible. This is an ever-changing, never-completed, herculean task, but market consensus is growing around initiatives such as the FAIR open data principles, for example. Equally, the Gates Foundation is planning to make its Chronos submissions system publicly available. Widespread and collaborative adoption by information service providers (and funders) of these kinds of solutions again enables significant efficiency gains and the streamlining of stakeholder workflows, reducing the use of the multiple, often duplicated, and frequently manual systems and processes that currently characterize this space.

✓ Funder-Targeted Solutions Are a Mix of Data and Support

Information services providers sit at the centre of the scholarly research and communications ecosystem, uniquely positioned to leverage relationships with all other industry stakeholders, funders, institutions, and researchers alike. Market-leading providers are strengthening both their data and support services portfolios. These are, in the main, targeted at the institutional and author/researcher markets. The funder space is a clear opportunity here too. We've already highlighted the need for improved data, but in Outsell's opinion, additional support services around (for example) enhanced analytics, compliance, administrative support, and custom projects, must be part of the mix too.

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