

## Chapter 2

# “The Future Depends on What You Do Today”: The Library as a Leader in Open Science

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### **EXECUTIVE SUMMARY**

*UCL (University College London) strongly supports the implementation of Open Science policies and practices. The library has taken the lead in the university across all eight areas of Open Science: the Future of Scholarly Communication, the EOSC, FAIR data, Skills, Research Integrity, Rewards, Altmetrics, and Citizen Science. UCL has modified these themes slightly to better fit its academic requirements, developing ambitious programmes and services to support the change of culture which is required. From the future of scholarly publishing, with the formation of UCL Press as the UK’s first fully open access university press, to research data management, rewards, research integrity and next-generation metrics, UCL has become a leader in Open Science. This chapter analyses the success of UCL to date, describes the challenges, shows the benefits, and indicates what future steps are being planned to deliver a culture where Open Science is the default, thus delivering on the prophecy of Mahatma Gandhi, one of UCL’s most illustrious alumni, ‘The future depends on what you do today’.*

### **INTRODUCTION**

What is the role of a library service in a research-intensive university in supporting the university’s activity in Open Science? Is Open Science a topic which should be led by the academy, or can a University Library play a role here? In some countries, academic leaders have been appointed as Open Science champions. In others, such as the UK, it is the University Library which has taken on such a role, either through the University Librarian themselves or else via the appointment of a senior manager to reach out to academic members of staff. The purpose of this paper is to look at possible roles that the University Library can play in this debate through a particular case study, that of University College London (UCL).

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## University College London (UCL)

UCL is the third oldest university in England, after Oxford and Cambridge, founded in 1826. It is renowned for ‘disruptive thinking’, a characteristic inherited from one of its earliest supporters Jeremy Bentham, the utilitarian philosopher (UCL, 2020b). It was Bentham who first invented the word ‘international’. Amongst English universities, UCL is the

- 1st in England to welcome students of any religion or social background;
- 1st in England to welcome women to university education;
- 1st in England to teach English, German, Chemistry, and Engineering;
- 1st in England to have a fully Open Access University Press, UCL Press.

As much as League Tables are a significant indicator of quality, UCL scores as follows:

- 8th in the world (QS World University Rankings 2020)
- 4th in Europe
- 1st in London

Academic excellence is where the university excels. UCL has/is:

- 29 Nobel laureates
- 11 academic faculties
- 42,100 students
- 13,360 employees
- 1st in the UK for research strength (REF 2014)
- 440 undergraduate programmes
- 150+ nationalities represented by the student body
- 675 postgraduate programmes

UCL has a total group income of £1.45 billion, of which £476.3 million is from research grants and contracts (UCL, 2020a). The university has an unparalleled reputation for academic excellence underpinned by creative and innovative thinking with a global perspective. UCL has 250,000 alumni in 190 countries. 48% of its students are international students and 29% of UCL’s students studied abroad in 2017/18; 35% of the staff are also international. The picture created by this data is one of a vibrant community engaged in research, teaching, learning and knowledge exchange.

## The State of Current Literature on the Role of Universities in Open Science

Much is written about the topic of Open Science. In Europe, the debate has been shaped by a number of Declarations and activities, many emanating from the European Commission and these are listed on the Commission’s Open Science Platform (European Commission, 2020). Particularly important was the Dutch Presidency of the EU in 2016. Here, the promotion of Open Science was a major plank of the Dutch Government’s activity during their presidency. This resulted in the Amsterdam Call for Action on Open Science (2016). Its vision consisted of four components:

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- Full open access for all scientific publications
- A fundamentally new approach to all use of research data
- New assessment, reward and evaluation systems
- Alignment of policies and exchange of best practice

This vision was supported by twelve concrete actions, clustered under the following headings:

- Removing the barriers to Open Science
- Developing research infrastructures
- Fostering and creating incentives for Open Science
- Mainstreaming and further promoting open science policies
- Stimulating and embedding Open Science in science and society

In this vision, the university as a research-performing entity lies at the heart of delivery. However, the Amsterdam Call concentrated on the end-result of all these actions – the delivery of Open Science solutions. It did not, in itself, identify how a university could deliver on the massive agenda which Open Science represents. It did not look in detail at power structures in universities and determine exactly *how* Open Science solutions could be advocated, managed and embedded at university level.

What is the role of a research-led university in the 21<sup>st</sup> century? An important insight is provided by Gerald Chan’s lecture *The Research University in Today’s Society* in 2017 (Chan, 2017). Dr Chan concluded that University research is now the most powerful impulse for human progress. That is an ambitious claim, for the emphasis is on the role of a university in society. That being the case, a number of university consortia and membership organizations began to look in more detail at the role of universities in developing Open Science solutions.

The European Universities Association has produced a number of reports on Open Access activity, for example the 2017 EUA Statement on Open Science to EU Institutions and national governments (European Universities Association, 2017). However, this Statement did not identify exactly *how* universities should implement Open Science practices at the organizational level. There was a gap in the literature on exactly *how* universities could manage the transition to Open Science.

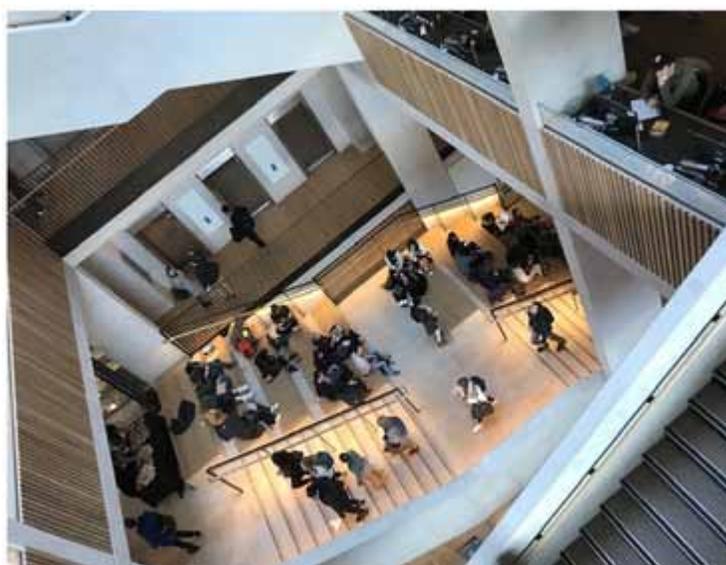
The gauntlet was picked up by LERU, the League of European Research Universities. In 2018, LERU produced its *Advice Paper Open Science and its role in universities: a roadmap for cultural change* (League of European Research Universities, 2018). This paper is still the best high-level guide to the changes and developments necessary at university level to engage with Open Science. It called for massive cultural change throughout the academy, the appointment of Open Science champions at university level, and identified the Library as a key component and service provider in the Open Science landscape. A companion advice paper on Citizen Science has also been produced by LERU members and LERU promoted the recent signing of the Sorbonne Declaration on research data by 9 global university networks in Paris in January 2020 (Wylter, Grey, Maes, & Fröhlich, 2016)

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## UCL LIBRARY SERVICES

The Library service at UCL was founded in 1829 and the first Librarian was Dr F.A. Cox. By the beginning of 1829, he had carefully built up a collection of 6,500 volumes (Harte, North, & Brewis, 2018). In 2020, the Library’s collection stands at over 2 million items, plus one of the most extensive digital libraries in Europe. The Library is a family of libraries, managed centrally under the Pro-Vice-Provost (UCL Library Services). 17 libraries make up the UCL family, which extends across the whole of London and beyond (UCL, 2019a). The latest building to be opened is the UCL Student Centre, a facility managed by UCL Library Services with over 1,100 learning space which are open 24 hours a day, 365 days a year (Figure 1).

*Figure 1. UCL Student Centre, opened 18 February 2019 (Source: the author)*



It is a 21<sup>st</sup>-century concept of what a library and learning space should be. There are no paper books nor journals in the facility, although students can borrow materials from UCL’s libraries and use them in the Centre, if they wish. The UCL Main and Science Libraries are less than 5 minutes away. The focus of the building is on digital delivery, group working and community building. Seating is a mixture of formal seating with desktop computers, more social seating for informal study and bookable rooms for group/project work. There is also a café and a rooftop area for outdoor refreshments.

The Library holds one of the best collections of archival material in the UK. Its collection of materials relating to George Orwell, famous amongst other things for his book *Homage to Catalonia*, has earned the collection UNESCO Designation. *Treasures from UCL* gives an overview of the richness and depth of the Library’s historic holdings (Furlong, 2015). Newton’s *Principia* (entry 31), for example, is one of the seminal works in the foundation of modern science. UCL’s copy not only sits in UCL Special Collections, but it also goes out to undergraduate lectures. Students can then interact with the original of this great work, having just heard it described in their lecture. This is research-based teaching, one

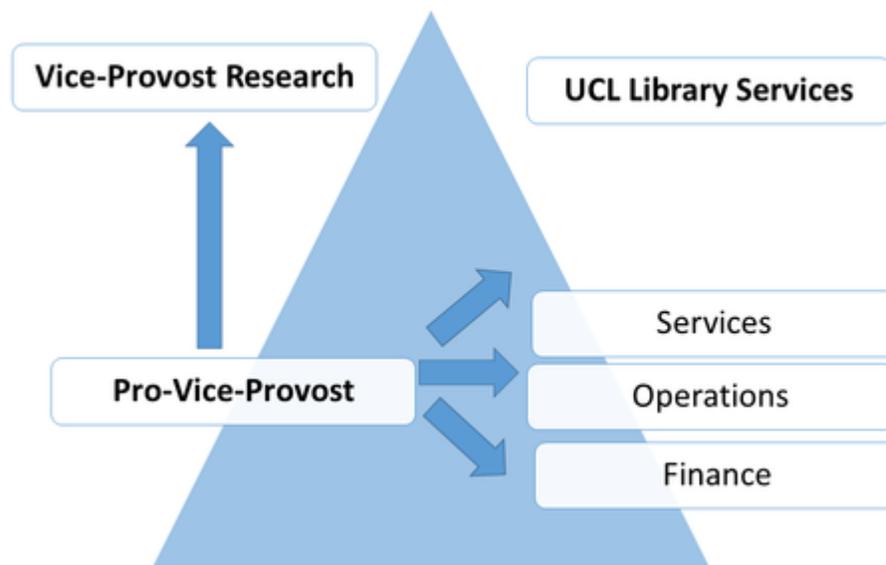
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of the cornerstones of the educational experience in UCL. As research on the holdings in UCL gathers pace, amazing new discoveries are constantly being made. The Trevelyon MS. (entry 27) is now known to be a previously-unknown third copy of a compilation by Thomas Trevelyon (born c. 1548). Equally important is the recent discovery of the manuscript of a poem by Byron (entry 41) inscribed into Samuel Rogers’ *The Pleasures of Memory* (London, 1810).

## **Organization**

Administratively, the Library is organized into three main groupings, reporting via the Pro-Vice-Provost (UCL Library Services) to the Vice-Provost (Research) (Figure 2).

*Figure 2. Organizational structure of UCL Library Service (Source: the author)*



Most of the Open Science activity takes place in the Services grouping, overseen by the Pro-Vice-Provost (UCL Library Services), who is the institutional Open Science champion. Within the services grouping, there is a significant number of Open Science activities which support research and teaching in UCL. These include:

- Open Access Team, monitoring Open Access compliance with funder mandates and the university’s return to REF 2021, a national research evaluation exercise
- UCL Press, the UK’s first fully Open Access University Press
- Research Data Team, acting as a support service to advocate for and train UCL researchers in Open and Fair data practices, and to participate in UCL engagement with the European Open Science Cloud (EOSC)
- Bibliometrics Team, who lead on Next-Generation Metrics activity, and in the implementation of DORA (San Francisco Declaration on Research Assessment, 2012)

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- Copyright Team, who advise UCL academics on copyright issues and Creative Commons licences

Management of these teams is spread across different role holders in the Library, but all reporting to the Director of Services, who in turn reports to the Pro-Vice-Provost. In this way, the Library has created a Virtual Open Science Office.

The Pro-Vice-Provost reports to the Vice-Provost (Research) and this reporting line is crucial if Open Science practices are to be embedded into the research and education landscape in UCL. With this working relationship, activity in certain areas of Open Science is the direct responsibility of the Vice-Provost’s Office, but overseen by the Pro-Vice-Provost. These activities are:

- Research Integrity and Reproducibility
- Sponsorship of the UCL Rewards framework, overseen by the Pro-Vice-Provost
- Joint work with the Library on Bibliometrics and Next-Generation Metrics

This partnership working with the Office of the Vice-Provost (Research) is vital. The Library leads in a number of areas of Open Science activity, but it is the University Librarian as Pro-Vice-Provost and a member of the Vice-Provost’s team who can extend UCL’s work in Open Science to cover all areas of Open Science activity. A new, original pan-university model for research support has thus been created by this partnership, with the Library taking the lead role. A typical current statement about research support in a University Library might take something like this form: ‘The Library Services Research support team can help you manage your research profile and disseminate your publications and data, enabling you to meet University and funder requirements’ (The Open University, 2020). Through its partnership with the Vice-Provost (Research)’s Office, UCL has developed a new model for research support by bringing into the Library’s ambit areas of policy such as Research Integrity and Rewards which are not normally seen as Library roles.

## **UCL Research Strategy**

UCL has a well-developed Research Strategy (UCL, 2020c). It has 3 core aims:

- To Inspire and Empower Research Leadership
- To Cross Boundaries to Increase Engagement
- To Deliver Impact for Public Benefit

Never has that mission been more critical. Regrettably, the key question for this generation of researchers has become: “How will society survive to the 22nd century?” By survival, UCL does not mean simply the continued existence of the human race, but also of the environments, institutions, structures and values that underpin and enhance society and enable humanity to thrive. UCL also recognizes the profound imperative to tackle the persistent injustices and inequalities in society today, and to help to deliver a more equitable future for all of humanity.

Society will not secure its survival without the knowledge and wisdom generated by multi-faculty research-intensive universities. Such progress will inform the innovations needed to address the enormous and critical challenges that humanity faces. Investment in the pursuit of enquiry and advancement of knowledge is critical; so too is an absolute commitment to collaboration in the generation and applica-

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tion of knowledge, and to ensuring that knowledge benefits society. Researchers and their institutions cannot deliver the necessary insights if they operate in isolation. UCL is well-positioned to make major contributions to help humanity survive and prosper.

**UCL Library Services Strategy**

In a library system as large and as complex as UCL’s, it is important to identify and agree a vision which will guide the development of this division of UCL as it approaches its 200<sup>th</sup> anniversary in 2026. Institutionally, this is the purpose of *UCL 2034*, a 20-year institutional strategy for UCL (UCL, 2020d). This strategy identifies 6 Principal Themes and 6 Key Enablers. The Library’s contribution to *UCL 2034* can be seen in the accompanying Library Strategy (UCL, 2018b). This strategy is overseen by the Library’s Senior Management Team and comprises 6 Key Performance Areas, all aligned with *UCL 2034* (Figure 3).

*Figure 3. Key Performance Areas in the Library Strategy 2019/22 (Source: UCL, 2018b)*

<b>Key Performance Areas</b>
1. <a href="#">User Experience</a>
2. <a href="#">Staff, Equality, Diversity and Inclusion</a>
3. <a href="#">Finance and Management Information</a>
4. <a href="#">Systems, Collections and Processes</a>
5. <a href="#">Sustainable Estate</a>
6. <a href="#">Communication, Outreach &amp; Open Science</a>

The User Experience is key to the success of the Library in delivering the mission of the institution. Already in this strategy period, UCL has supported the Library in delivering on this goal as shown in Table 1.

*Table 1. Visits to UK academic libraries 2018/19 (Source: SCONUL Annual Statistics)*

<b>Institution</b>	<b>FTE students</b>	<b>Total visits</b>
UCL	35,900	4,814,668
RLUK Mean	22,142	1,965,956
Imperial	17,570	1,660,496
King’s London	28,520	2,353,973
Oxford	n/a	1,999,561
Cambridge	19,875	n/a
Edinburgh	31,660	3,034,755
Manchester	37,090	3,149,162
<b>SCONUL Strategic Benchmarking Data 2018-19</b>		

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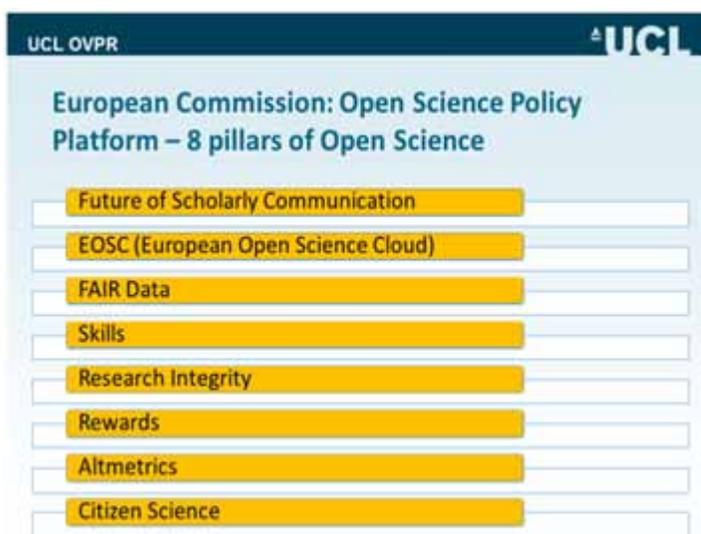
As can be seen from Table 1, UCL is easily the most heavily used university library in the UK, as measured by the number of visits to physical library and learning spaces. The figures reflect the opening of the UCL Student Centre only from February-July 2019. The figures for 2019/20 are certain to be even higher.

It is in the context of this heavily-used service that UCL Library Services identified Communication, Outreach and Open Science as the 6th of its Key Performance Areas. Activity in Open Science is overseen by the Pro-Vice-Provost (UCL Library Services) who has as part of his remit the co-ordination and promotion of Open Science principles and practice across UCL as a whole. It is the Library which has been chosen to lead the Open Science movement in UCL, with the Pro-Vice-Provost working with other Departments, Divisions, and the whole academic community to make Open Science approaches the norm going forward. This comprises 50% of his role, the remaining 50% being devoted to the strategic development of library services as the Head of Department for the Library.

## EUROPEAN INFLUENCES IN DEVELOPING OPEN SCIENCE PRACTICE

UCL’s model for the implementation of Open Science principles and practice is shaped by complementary movements on the continent of Europe. The European Commission has identified 8 pillars of Open Science, which form the bedrock of their advocacy for this theme (Figure 4).

Figure 4. 8 Pillars of Open Science as defined by the European Commission (Source: the author)



The nomenclature used in the 8 pillars of Open Science above does not work well in an Anglophone world, particularly around the phrase ‘Open Science’. On the continent of Europe, ‘Science’ encompasses all academic disciplines, including the Arts, Humanities and Social Sciences (AHSS). This understanding is based on the Latin root, *scientia*, which means ‘knowledge’ or ‘understanding’. In the UK, ‘Science’ means a subset of academic disciplines, which exclude AHSS. In some institutions, the phrase ‘Open

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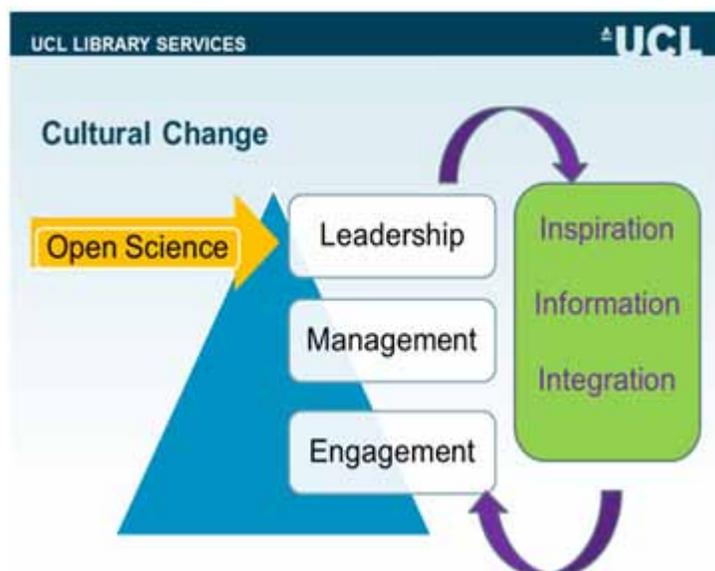
Science’ has been replaced by phrases such as ‘Open Scholarship’ or ‘Open Research’. These phrases themselves present challenges, since it is not obvious that Citizen Science is included in such definitions. There are, therefore, difficulties in trying to find a phrase in English which encompasses all the areas of research, study and practice outlined above. The meaning of ‘Open Science’ adopted in this chapter is the one prevalent on the continent of Europe and supported by the European Commission.

## **Culture Change and Leadership**

For Open Science to succeed, leadership is essential. For universities and other stakeholders to embrace Open Science principles, policies and practices, there needs to be a culture change in these organisations if the transition is to be successfully negotiated. This is the main problem which is addressed here. The LERU advice paper on Open Science is clear on this point and it forms one of the most important conclusions of their work in the Open Science landscape (League of European Research Universities, 2018).

Open Science covers how researchers, research organisations in the widest sense, and educators support Open Science infrastructures, policies and approaches. Open Science also shapes how the resulting outputs are published, disseminated, conserved, evaluated, assessed and rewarded. It covers the whole range of activity, particularly in research-intensive universities, and embraces staff at all levels: researchers, educators, administrators, IT staff, and library staff as well as senior university decision makers. The size and extent of the challenge represented by a move to Open Science is so great that cultural change is needed institutionally and across all stakeholders to embrace the changes that Open Science brings in its wake. The process for this change, and how it is supported, is illustrated in Figure 5 below, which is built around a traditional model of Change Management.

*Figure 5. Cultural Change to deliver Open Science (Source: Denning, 2012)*



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To deliver the cultural change that Open Science demands, there needs to be **leadership**. This should be leadership from a senior member of the organisation who can talk to members across the whole university – academics, students, senior decision makers, administrators, professional service and academic support staff. Without this leadership, it will not be possible to identify a unified position across the university, nor to send a clear message to all stakeholders about the change that is necessary to deliver Open Science solutions. This change has to be **managed** through a formal programme, consisting for example of training, events, policy changes, development of new infrastructures, changes to appointment, reward and evaluation systems. For the change to be managed, there needs to be **engagement** with all stakeholders – and the list of stakeholders is large, comprising (but not restricted to) researchers at all grades, Principal Investigators, IT and Library staff, those involved in Human Resource management, members of appointment, interview and appraisal panels, policy and strategy developers, and senior decision makers. The three strategic drivers of Leadership, Management and Engagement are themselves supported by three enabling movements: Inspiration, Information and Integration. Inspiration is needed to enthuse stakeholders about the benefits that will ensue once Open Science practices are adopted. Open Science is not a threat, but an opportunity and implementing Open Science approaches is easier if those advocating change can do so in a positive spirit. At the heart of Open Science lie openness and transparency. To **engage** with audiences, those delivering new messages need to support their case with facts and case studies and the audience needs to feel that they are being given the correct information. In this way, the changes that ensue will be easier to deliver because the whole community – academic, professional services, academic support services – is working together and supporting each other on their journey to embrace Open Science as a new way of thinking and doing.

## **Pillar 1: Future of Scholarly Communication**

What does the future of scholarly publishing look like in an Open Science world? This is the key challenge addressed in this section. Plan S, from a group of global research funders, aims to force through a rapid change to full Open Access publishing (cOAlition S, 2018). ‘With effect from 2021, all scholarly publications on the results from research funded by public or private grants provided by national, regional and international research councils and funding bodies, must be published in Open Access Journals, on Open Access Platforms, or made immediately available through Open Access Repositories without embargo.’ The current subscription model for journals is to be replaced by transformative deals which deliver on the coalition’s ambitions, notably through ‘read and publish’ deals, where payments are made both for publishing OA research outputs and for reading them. ‘The Funders do not support the “hybrid” model of publishing. However, as a transitional pathway towards full Open Access within a clearly defined timeframe, and only as part of transformative arrangements, Funders may contribute to financially supporting such arrangements (cOAlition S, 2018)’.

Plan S has come under significant criticism. The Royal Historical Society, for example, has studied extensively what the impacts on History would be in following Plan S (Royal Historical Society, 2019):

*If the goal of OA instead is to build sustainable scholarly systems which—at scale—are capable of both equitably producing and delivering high-calibre research publications to an expanding universe of users, alternative mechanisms to Plan S would surely be devised. These systems would recognise that no person or community can read everything and that different groups of readers and researchers rightly have different types of needs. Systematic investigation of what different communities of readers’ needs*

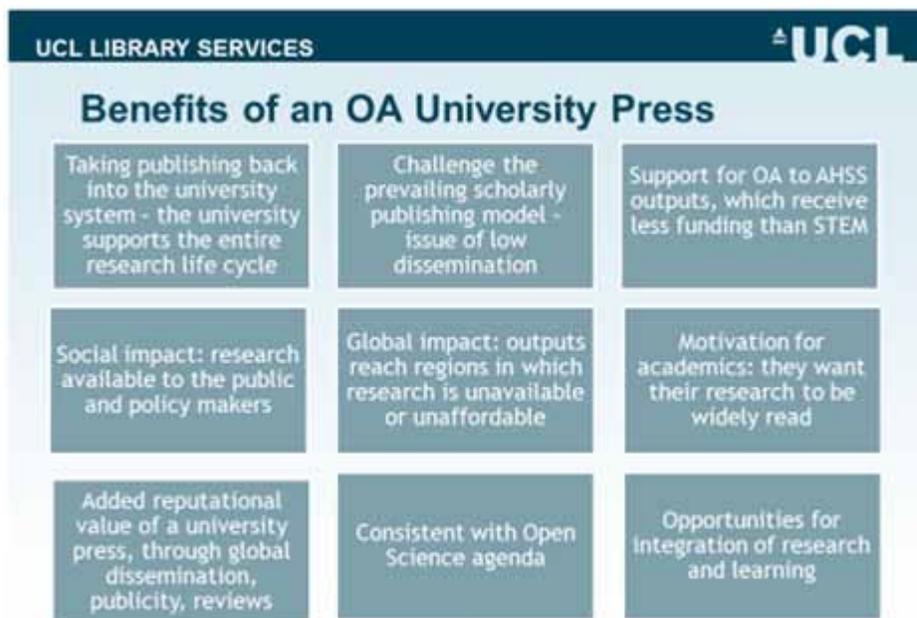
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*are and how they are best served is one of the most glaring gaps in cOAlition S Funders’ approach to OA. To rectify this anomaly, an optimal approach to OA would likely be hybrid—not simply in the sense of including ‘hybrid’ journals, but in recognising that meeting authors’ and readers’ constrained actual needs—in sharp contrast to fulfilling their imagined infinite needs—may require multiple or tailored delivery systems as well as a diversity of both incentives and mandates for those who produce and disseminate research outputs. This diversity would allow OA systems to accommodate the full range of discipline-based and interdisciplinary research and researchers. It would also foster rather than stifle innovation.*

This conclusion comes from the President of the Royal Historical Society, Professor Margot Finn, who is also Professor of History at UCL. The criticisms are deep and show a lack of engagement between the Funders who have signed up to Plan S and the academic community with whom these Funders engage.

In recognizing the challenges which Plan S poses, UCL has developed its own publishing mechanism to address some of these issues. This is the creation of UCL Press as the UK’s first fully Open Access University Press (UCL, 2020e). The Press was born in 2015 after a series of extensive discussions with UCL academics (well in advance of Plan S) to see how UCL could support researchers (particularly in the Arts, Humanities and Social Sciences) to publish research outputs, typically long-form monographs. A number of benefits from OA presses were identified in the course of the discussions (Figure 6).

Figure 6: Benefits of an Open Access University Press (Source: UCL Press)



One of the strongest drivers for the creation of an institutional University Press was the global impact that published research outputs would have as a result, since researchers who could not afford to buy commercially-produced research outputs would have free access to UCL Press’s whole catalogue.

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Three publishing areas were considered: long form monographs, textbooks and interdisciplinary journals (sometimes called megajournals); long form monographs were chosen for the Press’s first publishing programme.

As of 31 December 2019, UCL Press has published 120 monographs, 13 journals, and 1 interdisciplinary journal (megajournal). The Press’s publishing strengths have developed naturally. It publishes in all academic areas, but the following disciplines are now the subject of active commissioning:

- Anthropology
- Archaeology
- Architecture & Built Environment
- Education
- History
- Sustainability

Book series are also being established – 12 have been created up to 31 December 2019. The standard UCL Press Book Processing Charge (BPC) is £5,000 and non-UCL authors are charged this sum. There is no charge for UCL authors, editors, or to series editors with a UCL affiliation. The Press arranges peer review, editing, typesetting, proofreading, and indexing. The Press operates a waiver scheme for up to 5 non-UCL books per year, where non-UCL authors can publish for free. To 31 December 2019, the author/editor profile – including all co-authors and joint editors - is 50% UCL, 50% non-UCL.

*Table 2. UCL Press downloads by country, 2015-2019 (Data source: UCL Press)*

Country	Downloads
USA	712,151
UK	280,828
India	106,179
Canada	85,366
China	69,195
Germany	69,033
Australia	53,697
Philippines	44,744
Nigeria	36,293
Netherlands	35,681
France	34,563
South Africa	32,997
Brazil	32,311
Indonesia	31,559
Italy	28,876

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Between June 2015 and December 2019, the Press received 2.73 million downloads in 236 countries and territories across the world – an astonishing achievement when the average number of global sales for a commercially-produced research monograph across the bookshop counter is a mere 200 (Table 2).

These figures show that the original ambition of the Press, to receive global impact for its research outputs, has been achieved. The most downloaded titles are given below in figure 7. Professor Danny Miller’s *How the World Changed Social Media* (2016) has been downloaded 386,370 times. It is part of a series of books produced by Professor Miller from a grant from the European Research Council (Miller et al., 2016).

Figure 7. Most downloaded titles 2015-19 (Source: UCL Library Services webpage)



The main format for Press publication is digital, but paper copies can also be purchased as print-on-demand copies via the Press website. Professor Miller’s book has sold 753 copies. The sales figures of UCL Press titles disprove the theory that Open Access digital monographs destroy print sales. The evidence from UCL Press is the opposite – that digital copy actually promotes sales of the printed copy by acting as marketing material.

UCL Press has 9.2 FTE staff and is funded through a number of routes: income from sales, consultancy and publishing services, and funding from the UCL research budget. UCL Press offers white label publishing services to other universities, who want to establish their own university press imprint, but who do not want to invest in developing their own infrastructure. UCL Press can do the publishing for them in this context, but the outputs will be the badged as from the University Press of the commissioning university. Dublin City University in the republic of Ireland is the first university to take advantage of this offer. In terms of funding from UCL itself, the funding required to sustain the Press is a tiny percentage of UCL’s total income – less than 0.2% of UCL’s annual research income.

**Pillar 2: The European Open Science Cloud (EOSC)**

The writer was privileged to be a member of the first High Level Expert Group from the European Commission which produced the report *Realising the European Open Science Cloud* (European Commission High Level Expert Group on the European Open Science Cloud, 2016). The vision for that group was to see a web of inter-connectivity between differing platforms and repositories containing content – research

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data, publications, software – which would produce an ‘Internet of Things’ (European Commission High Level Expert Group on the European Open Science Cloud, 2016, p. 13). How has work developed in delivering this vision? This is the key issue addressed in this section.

The EOSC Implementation Roadmap (European Commission, 2018) envisages activity in the following areas shown in figure 8.

Figure 8. Workplan for the EOSC (Source: European Commission, 2018)



For universities who wish to associate their content and services with the emerging EOSC, there are significant challenges. A university stakeholder Workshop was held in Brussels on 23-24 January 2020 to identify what the challenges and opportunities were. One of the most important points made by stakeholders present was that the Rules of Engagement for the EOSC need to be defined as soon as possible so that universities can align their work in research data management with the EOSC’s ambitions to ensure that they can contribute metadata for their content to the Cloud. It was noted that universities produce significant amounts of research data, and that their presence in the EOSC was essential to its success.

Cost was also an issue raised in the Working Group meeting. Until now, the costs of the EOSC have been largely met by the European Commission. Going forward, this will not always be the case. What is the charging model for participation in the EOSC to be? The vision of a European portal, a portal rather than a Cloud, giving access to the shared endeavor of European researchers is compelling. However, for a European Vice-Chancellor, this is (in one sense) an extension of their costs. Perhaps, like Plan S, the burden of these costs will fall most heavily on the research-intensive universities. Is this sustainable?

The first EOSC Report also recommended:

*The number of people with [the] skills needed to effectively operate the EOSC is, we estimate, likely exceeding half a million within a decade ... we believe that the implementation of the EOSC needs to include instruments to help train, retain and recognise this expertise, in order to support the 1.7 million scientists and over 70 million people working in innovation. The success of the EOSC depends upon it.*

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Figure 9. Signatories to the Sorbonne Declaration (Source: Data Summit in Paris, 2020)



The EOSC identified the need for a new calibre of technical expert:

*Core data experts are neither computer savvy research scientists – although the latter also need to be educated to the point where they hire, support and respect Core Data Experts – nor are they hard-core data or computer scientists or software engineers. They should be technical data experts, though proficient enough in the content domain where they work to be routinely consulted in the research team at the very beginning (experimental design, proposal writing) until the very end of the data discovery cycle. They will work to secure that good data management plans are an essential part of good research practice (including data re-use and stewardship planning and proper budgeting) and the proper capturing of new data capture (formats, metadata richness, standards, provenance, publishing, linking and analysis), they will also support analysis. This package of skills and expertise is rare and the few people with this skill set are often attracted to industry or outside Europe where they are more respected and valued (European Commission High Level Expert Group on the European Open Science Cloud, 2016, p. 12).*

Where are the curricula to support such training? Who will deliver it? And what is the level of support amongst existing professions to support this new development?

Frankly, there are huge costs behind these figures and little thought has yet been given to how these costs can be met. There needs to be a dialogue between champions of the EOSC, research funders and universities to identify ways to deliver on this agenda.

The concept of the European Open Science Cloud is truly exciting and the ability to share data and publications across national borders truly inspirational. Nevertheless, there are challenges in delivering this vision which are uncosted, not yet deliverable, but which are essential for the EOSC vision to be successfully adopted.

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### Pillar 3: FAIR Data

On 27 January 2020, 9 global university organisations signed the Sorbonne Declaration on Research Data Rights (2020). It is the first time that such organisations have met together to agree on such a bold statement on research data (Figure 9).

As such, the Sorbonne Declaration is a major step forward for university organization in committing to Open and FAIR data. How easy will it be to deliver these agendas in universities? This is the main theme of this section.

Embedded in the Declaration is the principle that ‘Providing access to and openly sharing data enables the development of new knowledge, accelerates discoveries for the benefit of society and economic development’. One of the ways to achieve this is to make metadata describing the research data FAIR: ‘Supporting our universities and their researchers in making their data findable, accessible, interoperable and reusable (FAIR)’. Research data which is FAIR and Open for sharing and re-use means that researchers have easy access to experimentation by others, thus avoiding the need for costly duplication. Another advantage is that it enables research groups to look at research methodologies, to test the results produced by others, and to detect mistaken, even fraudulent, use of data.

How Open and FAIR is the research community now? As Dr Simon Hodson (CODATA) showed at the launch of the Sorbonne Declaration, the response to the ebola outbreak included many organisations and the resulting data was very scattered geographically. 65% of the data collected was not shared. Most data cannot be accessed directly at the record level (e.g. summarized in studies). Most clinical records from the outbreak are simply pdf scans. There is a lack both of metadata to describe the data and also a common data dictionary (a set of definitions which allows the variables in the data to be understood). It is also technically difficult to integrate all the different types of data that have been collected. There are lessons to be learned here – data capture for the current coronavirus, a Global Health Emergency, must not make the same mistakes.

The economic benefits of FAIR data are beginning to be identified. A recent European Commission Report (PwC EU Services, 2018) found that sharing and better managing research data would save 10.2 billion euros per year in Europe, with an additional potential of 16 billion euros of added value by the innovation generated<sup>1</sup>. These are enormous sums which would benefit research and society.

It has to be admitted, however, that there is a mountain to climb to enable universities to achieve the potential gains in this part of the Open Science landscape. On the whole, researchers are reluctant to spend time on describing their data using FAIR principles. They would see the submission of a new grant application as more important than curating and describing data previously collected. This takes us back to the issue raised by the LERU Rectors in the LERU Open Science Roadmap. There needs to be a fundamental culture change at university level to enable researchers to see the benefits of Open Science and the changes in workflow that these benefits require.

### Pillar 4: Skills and Education

One of the roles of the Open Science champion, the Pro-Vice-Provost (UCL Library Services), is to address researchers in all disciplines who are new to UCL in the regular Induction sessions which are organized by UCL Human Resources. How easy is it to embed Open Science training an awareness in to the researcher landscape? This is the main theme of this section.

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In the UCL training sessions, researchers learn what is special and different about undertaking research at UCL. The UCL Research Strategy is carefully aligned to the global Open Science agenda (UCL, 2019b). The Research Strategy makes clear that it embraces the Open Science approaches being advocated in UCL. It welcomes ‘policies and developments in open access (most notably, the establishment of UCL Press, the UK’s first fully open access university press) and open science.’(UCL, 2019b, p. 10). It also expresses the desire to ‘continue to deliver the necessary systems and processes to further advance our [UCL’s] commitment to open access and open science.’(UCL, 2019b, pp. 11-12)

Many researchers arrive at UCL without a deep understanding of Open Science. The purpose of the Induction session is to open up these issues for UCL’s researchers and to present them with six things they can do on day 1 of their UCL research career. These issues are further developed throughout their time in UCL with specific training courses, run largely by the Library, on different aspects of Open Science and a 1-day Workshop on Open Science, open to all, each Summer. It is also planned to develop videos and podcasts as training materials for researchers going forward, with funding from UCL Human Resources.

What are the 6 steps to Open Science that UCL researchers learn about in their first Induction session in UCL? (Table 3)

*Table 3. 6-step test to adopting Open Science practice in UCL*

Theme	Message
Publications	<ul style="list-style-type: none"> <li>● Talk to the Library’s Open Access Team about the funder requirements in Plan S</li> <li>● Be prepared for the OA requirements of the UK’s REF (Research Evaluation Framework) (Research England - UKRI, 2020)</li> <li>● Use the UCL Research Publications Service (RPS) to record all your publication output</li> <li>● Upload research outputs (where permissible) to UCL’s repository UCL Discovery</li> </ul>
Publications	<ul style="list-style-type: none"> <li>● Consider publishing with UCL Press</li> </ul>
ORCID IDs	<ul style="list-style-type: none"> <li>● Get an ORCID ID and link it to your RPS account</li> </ul>
Research Data Management	<ul style="list-style-type: none"> <li>● Plan for how to manage your research data at the start of planning your research proposal</li> <li>● Ensure you have a Data Management Plan</li> <li>● Consider using the UCL Research Data Repository (RDR)</li> </ul>
Reproducibility/ Transparency	<ul style="list-style-type: none"> <li>● Ensure your approach is in line with the UCL Statement on Transparency in Research (UCLC, 2019c)</li> </ul>
Next Steps in Implementing DORA	<ul style="list-style-type: none"> <li>● Use the UCL Bibliometrics Policy to guide how you evaluate research outputs</li> </ul>

To assess success, the Library regularly monitors and produces reports on a number of the above activities. Use of RPS and downloads from UCL Discovery are reported at the UCL Press and Publications Committee each term, as is the take-up of ORCID IDs across the institution. Publications and downloads of UCL Press outputs are also reported. A reporting framework for research data and the use of UCL RDR is actively being prepared. How do researchers feel about the above matrix? Many early career researchers have concerns about the impact of some of the measures around DORA and what it may do to their research careers. Once it is explained that DORA is a global movement being embraced by an increasing number of universities, such researchers express themselves content at the road UCL is taking. More established researchers, who have forged their careers in a different research landscape, are slower to adopt Open Science principles, particularly around DORA. Here is the challenge and the culture change that Open Science needs to effect.

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### Pillar 5: Research Integrity

How does Open Science impact on the field of Research Integrity? What major changes need to be made? These are the main questions explored in this section.

UCL has both a Statement on Research Integrity and an associated Code of Conduct. The Statement emphasizes the importance of Open Access publication for the UK’s Research Excellence Framework (REF) (UCL, 2015.). UCL’s Code of Conduct for Research Integrity was produced in 2013 (UCL, 2013). It is amplified by initiatives such as RRI – Responsible Research and Innovation (n.d.). RRI is a movement which is committed to developing an Open Science and innovation system that tackles societal challenges. The European Commission has provided six policy areas that RRI wishes to further. One is Open Access which is defined as follows:

**Open Access** addresses issues of accessibility to and ownership of scientific information. Free and earlier access to scientific work might improve the quality of scientific research and facilitate fast innovation, constructive collaborations among peers, and productive dialogue with civil society.

UCL is taking the debate around research integrity much further, stimulated by the creation of the UK Reproducibility Network (University of Bristol, s.d) by Professor Marcus Munafò at the University of Bristol. UCL wished to be one of the early adopters of this work in Research Integrity. Working through the Office of the Vice-Provost (Research), UCL produced an institutional statement on Reproducibility and Transparency (UCL, 2019c). Reproducibility forms part of UCL’s wider commitment to transparency and rigour in all of its research. The university recognises that behaviours in support of transparency and rigour vary considerably across disciplines and methodologies, and encourages its researchers to adopt actions most appropriate to their disciplines. Reproducibility / Transparency is about openness in methodology, the sharing of publications and research data so as to enable conclusions and workings to be checked, evaluated and, where necessary, replicated.

The UCL Statement recognizes that Reproducibility is a concept which is particularly relevant to the experimental sciences with a quantitative focus. In the Arts, Humanities and Social Sciences it may be more useful to refer to transparency or academic rigour in the use of research methods through the whole research process. In terms of Reproducibility, the Statement has this to say:

*The reproducibility of research methods is required for research to be replicated. This, in turn, is essential in research contexts where findings must be robust and reproducible in order to form a solid foundation on which to build further knowledge. In research contexts where reproducibility is possible and appropriate, we strongly encourage researchers to use measures that support it. These include (but are not limited to):*

- *Pre-registration of study procedures with analysis plans, and use of registered reports where appropriate*
- *Transparent reporting of research in line with recognized community guidelines*
- *Disclosure of all tested conditions, analysed measures and results*
- *Transparency around statistical methods (including sample size planning and statistical assumptions and pitfalls)*

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- Use of preprints
- Carrying out replication studies
- Publication of ‘null’ findings

Professor Munafò and his colleagues have set out a summary of initiatives that support reproducibility, which has informed UCL’s work (Munafò *et al*, 2017). In return, UCL’s Statement on Research Integrity is being used as an exemplar Statement by the UK Reproducibility Network.

### Pillar 6: Rewards

If academics are to engage in Open Science practice, it is only fair that they should be rewarded for doing so. How can university policies be developed to reward Open Science practices? This is the main question in this section.

Professor Bernard Rentier, Rector Emeritus of the University of Liège in Belgium, was involved in the production of a report for the European Commission on rewards and careers entitled *Evaluation of Research Careers fully acknowledging Open Science Practices* (European Commission, 2017). At the OAI11 meeting in Geneva in June 2019, Professor Rentier said: ‘It will be impossible to implement Open Science harmoniously without a large, significant and determined consensus on new ways to evaluate research and researchers’ (Rentier, 2019). Professor Rentier has identified 23 criteria for undertaking such evaluation.

Figure 10. Matrix not Metrics in Evaluation practice (Source: Rentier, 2019)



This process has not yet been introduced into UCL, nor in any other university. Why? The reason comes back to the challenge identified by the LERU Rectors – the need for wholesale cultural change in

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universities if Open Science is to succeed. The new matrix represents a considerable challenge to traditional models of evaluation, where publications and Journal Impact Factors are given so much weight. Research publication do figure in Professor Rentier’s matrix, but alongside 22 other criteria. The San Francisco Declaration has to be adopted by all universities worldwide before the above matrix can be fully implemented. That is a process which will take time, it is not a single event.

UCL has made a start by amending its appointment and promotion systems to reward openness, one of the first universities in Europe to do so. The new UCL Academic Promotions Framework (UCL, 2018) fully recognises the work which academics undertake to make their outputs open and available for sharing and reuse. It looks at research grades from grade 7 right through to the professorial grade, grade 10. The scope of the policy explicitly includes Open Science practice:

*Enabling and leading research activities: contributing to the intellectual life of your discipline – including developing novel lines of enquiry; contributing to the development of open science principles; maintaining the highest standards of research integrity; developing cross-disciplinary research activities; addressing equality, diversity and inclusion issues in research; managing links to professional bodies, and generating research income at a level appropriate to the discipline.*

From Grade 7 onwards, openness is seen as a core (or threshold) requirement. For Grade 7:

*Threshold: an individual on this grade will demonstrate detailed understanding and knowledge of the subject and contemporary research activities within it. All research outputs are available through Open Access wherever possible (UCL, 2018a, p. 6)*

At Grade 10, the requirement is:

*Threshold: an individual on this grade will demonstrate successful delivery of outstanding contributions to a subject area o[r] body of knowledge, demonstrating both the ability to sustain [their] own research and to be successful against research competition in ways appropriate to the discipline. All research outputs are available through Open Access wherever possible (UCL, 2018a, p. 10).*

The applicant is invited to give examples of the level and nature of their engagement with the Open agenda in a free-text narrative. Since all researchers wish to submit their research papers to the REF (Research Excellence Framework) which has an Open Access requirement, publications can be used as examples of activity in applications for promotion. Research data and open source software would also be in scope, as would the implementation of the UCL Statement on Transparency in Research.

### **Pillar 7: Altmetrics or Next-Generation Metrics**

What does research excellence look like in an Open Science landscape and how can it be measured? These are the questions this seeks to address.

The Commission’s naming of the seventh pillar as Altmetrics is not completely helpful, as this is also the name of a software product. In UCL, this pillar is usually referred to as Next-Generation Metrics. The concept of metrics in an Open Science environment is fraught with difficulty. Professor Rentier calls his

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evaluation grid for research and researchers a matrix, rather than a set of metrics. This is a useful insight into UCL’s approach to the topic of measurement.

UCL is a signatory to the San Francisco Declaration on Research Assessment (2012) This is reflected in the UCL Academic Promotions Framework. If universities sign Declarations, there is no alternative but to implement them. The UCL Promotions Framework makes clear:

*Research activity is described with reference to qualitative and quantitative evidence of achievement, including appreciation by peers, impact, scale, originality, rigour and significance of research outputs. UCL is a signatory of the San Francisco Declaration on Research Assessment and we reject the use of certain quantitative indicators, in particular those that apply at the level of Journal or similar, rather than directly to the piece of research in question. UCL’s research strategy also establishes that “advancement and profile within UCL does not depend overly on easy metrics such as grant income or citation numbers that might penalise those who are advancing fields not yet fully appreciated by the wider research community, but instead suitably recognises and rewards creative and distinctive intellectual achievement” (UCL, 2018, p.5)*

In this context, it is not permissible to use Journal Impact Factors or simple journal hierarchies in job adverts or in their Further Particulars as a surrogate for academic quality. Nor should academics lapse into using them when making promotion cases. In the area of job adverts, such statements would be intercepted before the adverts are published and a re-write would be requested. There is no point in signing the San Francisco Declaration, if it is not going to be implemented at a local level. In the UK, this is easier because panels for the REF (Research Excellence Framework) do not use such metrics in their evaluations.

The next step for UCL was to codify its attitude to the use of bibliometrics in a formal Bibliometrics Policy, the first time the university had ever possessed such a policy. At the time of writing, it is due to be considered for signoff by UCL’s Academic Committee at the end of February 2020. The policy is grounded in the San Francisco Declaration and the Leiden Manifesto (Hicks, D, Wouters,, Waltman, Rijcke & Rafols, 2015). The policy takes the view that quantitative metrics are not replacement for qualitative approaches. Reading the paper and making a judgement of its rigour, comprehensiveness, accuracy and contribution to academic research is much better practice than relying on numerical indicators as a surrogate for quality. Metrics, but *not* the Journal Impact Factor, can be used but as a supporting statement for a separate qualitative assessment, not as a replacement for it. The use of journal hierarchies is discouraged, and instead academics are asked to consider the rigour of the journal’s processes, such as peer review, or the contribution of the journal to a particular academic community.

How was such an approach evaluated when brought to the Academic Committee, chaired by the Provost and President in March 2020? The Library had been careful to invest in close consultation with individual academic Departments and Faculties over a period of 2 years to identify a consensus position on the responsible use of bibliometrics. Once presented at the Academic Committee, and having been endorsed by academic Faculties, the policy was greeted with acclaim and hailed as ‘sector leading’. The whole episode is a model of how to introduce cultural change in a research organization. Digital training materials will now be constructed to support the UCL academic community to start using the practices the policy advocates. This change again is a process, not an event, and will take time to deliver. What the policy will do is to establish a baseline on which further successful work can be built.

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### Pillar 8: Citizen Science

What is the role of Citizen Science in the university landscape? This is the question examined here. The final pillar of Open Science being considered as part of the UCL Open Science programme is Citizen Science. Citizen Science is often thought of as a set of activities where the lay citizen works alongside the professional researcher and where the data gathering and/or results are crowdsourced, Citizen Science can also happen where the citizens work by themselves to add to knowledge in certain research areas. In UCL this latter activity is called Extreme Citizen Science<sup>2</sup>. UCL has adopted both approaches because the university sees Citizen Science as a principal means whereby universities can re-engage with Society and prove their worth. In the era of ‘false news’, and constant attacks in the Press for being ‘elite’ and ‘remote’, universities need to embrace the vision propounded above by Dr Gerald Chan – to become the most powerful impulse for human progress. Engagement with lay citizens helps universities to re-engage with society at a time when the academic voice may not be trusted or even heard. How can Global Warming not be understood by the population at large? 97% of climate experts agree that humans are causing global warming; but there is still a general myth that there is no consensus on the topic (Skeptical Science (2016)). The re-engagement of universities with society can only help to correct such gross misconceptions and help to solve pressing challenges which afflict the world as a whole.

In UCL, ExCiteS is currently working on 4 projects. Extreme Citizen Science: Analysis and Visualisation (ECSAnVis) is a five-year, €2.5M project funded by the European Research Council, which aims at the development of geographical analysis and visualisation tools that can be used, successfully, by non-literate people and any other community in culturally appropriate ways, that further fit their needs and social practices (UCL Department of Geography, n.d.).

Within UCL Library Services, colleagues engaged in Open Science have advised the Bentham Project on crowdsourcing the transcription of the complete archival collections of the 19<sup>th</sup>-century utilitarian philosopher Jeremy Bentham, the majority of whose papers are kept in UCL Special Collections. In the transcription update for December 2019, it was reported that 22,740 manuscript pages have been transcribed or partially transcribed. 21,951 (86%) have been checked and approved by Transcribe Bentham (2017) staff. These transcripts will form the nucleus of the printed volumes of Bentham’s works. The project also publishes an Open Access journal, using infrastructure supported by UCL Press, called the *Journal of Bentham Studies*. At the time of writing, the journal has published 47 articles with 10,098 views (Journal of Bentham Studies, n.d)

Within UCL Library Services, Citizen Science is one of the 6 Key Performance Areas in the Library Strategy 2019-22. The relevant ambition is listed as ‘UCL Library Services has identified key priorities for Citizen Science activity and embeds these in a pan-UCL Programme’. (UCL, 2018b,p74) To achieve this, a European consultant will be visiting the Library in summer 2020 to develop a Citizen Science Strategy for library colleagues. The work plan will be aligned with the recommendations of the LIBER Citizen Science Working Group, which the present writer chairs.<sup>3</sup>

## CONCLUSION

UCL sees Open Science as a defining movement in the evolution of universities in the 21<sup>st</sup> century. Following the LERU Roadmap for Open Science, it has appointed a senior manager in the university to co-ordinate activity across the institution. Cultural change in how individuals work and act are crucial

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to the successful implementation of Open Science principles and practice. Without this leadership, and ensuing cultural change, a move to Open Science will not be possible.

UCL has taken the 8 pillars of Open Science, as defined by the European Commission, and initiated activity in all areas. Some of these have been made easier by national policies, e.g. the Open Access requirement for the UK’s Research Excellence Framework (REF). The movement for FAIR metadata and Open research data has resulted in the construction of the UCL Research Data Repository (RDR) as a home for outputs where there is no national/international subject repository. The costs of research data management, as identified by European Commission reports, are daunting and will pose enormous challenges for universities going forward. In terms Skills development, training in Open Science practice begins when a researcher is first inducted into UCL with a 6-step test towards adopting Open Science procedures. The evolution of frameworks for Research Integrity has resulted in the development of the UCL Statement on Transparency in Research. In terms of Rewards, UCL has developed its Academic Promotions Framework to establish openness as a core requirement in cases for promotion. With Next-Generation Metrics, UCL is about to approve a Bibliometrics Policy which is built around the San Francisco Declaration and the Leiden Manifesto. In Citizen Science, there is significant activity in individual academic Departments and projects; UCL Library Services is about to develop its own strategy for this key activity.

At UCL, the Library is key to the successful delivery of Open Science principle and practice, and its partnership with the Office of Vice-Provost (Research) has been pivotal in developing a new concept for research support in academic libraries. Library and Research Office work together as partners, co-ordinated by the University Librarian who is a Pro-Vice-Provost in the Vice-Provost’s Office. This model has enabled the Library more easily to influence and shape university policy in areas which are not normally seen as part of a Library’s remit – for example in Research Integrity and Rewards policies. It is a defining model for the evolution of an academic library service from one based around collecting, to one shaped by giving – in support, training, university policy development and cultural change.

At a global level, what needs to be done in future to engage with universities to deliver the Open Science agenda. This paper suggests a number of challenges:

- Each university needs a senior individual to be appointed as Open Science leader for the University
- Further engagement with the research community is essential if issues such as FAIR and Open data and Research Integrity need to be addressed
- Cultural change is essential to underpin these changes, but that change will take months and years to deliver, not weeks
- Further research needs to be undertaken on future models for scholarly publishing. There is not one solution that will fit every challenge. For Plan S, how can research-intensive universities avoid greatly-increased costs if price is linked to research production rather than reading? How important are alternative publishing platforms such as UCL Press? What is their impact? How do researchers feel about this approach to publishing?

The case study around UCL presented in this paper suggests successes and challenges in their approach to Open Science. Universities globally need to seize this moment and tackle challenges outlined here if Open Science is to become the ‘new norm’ in the research landscape.

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## KEY TERMS AND DEFINITIONS

**Citizen Science:** a movement in Open Science which looks to the lay citizen as a participant in research practices or as the lead in research activity

**DORA:** The San Francisco Declaration on Research Assessment, which is aligned with Open Science goals

**EOSC:** European Open Science Cloud, a project to create a European Open commons of research data, publications and other outputs

**FAIR:** A term used in relation to research data which is Findable, Accessible, Interoperable, Reusable

**Open Science:** a global movement in research, education, innovation and engagement which emphasizes collaboration and sharing

**Reproducibility:** An Open Science movement which emphasizes transparency in methods, analysis and outputs and the importance of being able to replicate findings

**“The Future Depends on What You Do Today”**

**Sorbonne Declaration:** a statement signed in Paris in 2020 outlining the importance of research data and Open Science in the new research landscape

**UCL Discovery:** the Open Access repository at UCL

**UCL RPS:** UCL Research Publications Service, where bibliographic details of UCL research outputs are stored

## ENDNOTES

- <sup>1</sup> A longer version of this discussion can be found in P. Ayris, ‘The risks of not sharing data are greater than the costs’, *THE*, 8 Feb. 2020; available at <https://www.timeshighereducation.com/blog/risks-not-sharing-data-are-greater-costs>.
- <sup>2</sup> ExCiteS: Extreme Citizen Science: <https://www.geog.ucl.ac.uk/research/research-centres/excites>
- <sup>3</sup> LIBER Citizen Science Working Group: <https://libereurope.eu/strategy/innovative-scholarly-communication/citizenscience/>