2019

Open Scholarship and the need for collective action

Knowledge Exchange

Cameron Neylon,
Curtin University, Australia

Rene Belsø,
DEIC, Denmark

Magchiel Bijsterbosch
SURF, the Netherlands

Bas Cordewener
Knowledge Exchange

See next page for additional authors

Authors

Knowledge Exchange; Cameron Neylon,; Rene Belsø,; Magchiel Bijsterbosch; Bas Cordewener; Jérôme Foncel; Sascha Friesike; Aileen Fyfe; Neil Jacobs; Matthias Katerbow; Mikael Laakso; and Laurents Sesink

Open Scholarship and the need for collective action

Published October 2019

Preface

The first draft of this book was written through the medium of a five day 'Book Sprint', using the Book Sprints method[1] which took place from 7 to 11 September 2018 in Berlin, Germany. Several additions and revisions have been made to complete the final book presented here.

Participants and contributing authors to the resulting book are:

▸ Rene Belsø, DEIC, Denmark

▸ Magchiel Bijsterbosch, SURF, the Netherlands

▸ Bas Cordewener, Knowledge Exchange

▸ Jérôme Foncel, University of Lille, France

▸ Sascha Friesike, Berlin University of the Arts and Weizenbaum Institute for the Networked Society, Germany

▸ Aileen Fyfe, University of St Andrews, United Kingdom

▸ Neil Jacobs, Jisc, United Kingdom

▸ Matthias Katerbow, DFG, Germany

▸ Mikael Laakso, Hanken School of Economics, Finland

▸ Cameron Neylon, Curtin University, Australia (lead author and editor)

▸ Laurents Sesink, Leiden University, the Netherlands

Acknowledgements go to:

▸ Faith Bosworth - Book Sprints facilitator

▸ Sarah James – Knowledge Exchange office

▸ Juliane Kant – DFG/Knowledge Exchange. Co-lead KE activity 'Economy of Open Scholarship – conceptual models'

▸ Barbera Rühling - Book Sprints CEO

▸ Verena Weigert - Jisc/Knowledge Exchange. Lead KE activity 'Economy of Open Scholarship – conceptual models'

Footnotes
1   Book Sprints Ltd - booksprints.net

Contents

Executive summary

Aim and background

Background and rationale

The aim of this book is to enhance community understanding of the mechanisms and processes that can enable Open Scholarship to reach its full potential. The book is the result of a **Knowledge Exchange (KE)** (**knowledge-exchange.info/about-us**) activity to explore the economy of Open Scholarship across six European countries (Denmark, Finland, France, Germany, the Netherlands and the UK) and beyond.

In September 2018, Knowledge Exchange brought together eleven experts from across these countries. These experts are all currently involved in exploring the development of Open Scholarship, and include researchers, policy makers and information systems providers. Through the medium of a five day 'book sprint' we prepared a first draft of the released document, combining our different perspectives and experiences into a coherent text that could aid progress.

The discussions and findings in this book are inspired by KE's Open Scholarship Framework[2]. It models Open Scholarship as a combination of levels (micro-, meso- and macro-level actors), arenas (political, economic, social, technical) and research phases (discovery, planning, project phase, dissemination), in order to better understand the challenges to make scholarship more open.

A focus on the economic arena and on meso-level actors

Many of the challenges in navigating the transition to Open Scholarship are economic, either in the sense of being directly financial, or in the sense of being related to incentives. We therefore focus on the *economic arena*. Our conclusion is that it is challenging to capture the full details of the economy of Open Scholarship in terms of existing models. Application of economic theory and analysis techniques to Open Scholarship needs further exploration and development.

An important aspect of the scholarly landscape and the transition to Open Scholarship is the diversity of actors involved. These can be described as 'micro' (individuals such as researchers, or support staff, users of research or employees of service providers), 'meso' (groups, communities or organisations such as universities, disciplines, scholarly societies or publishers) and 'macro' ('system-spanning' actors that provide structure to whole countries or regions, such as funders and governments). Insufficient attention has been paid to the incentives, actions and influences of *meso-actors*, and therefore a major focus of this book is on *meso-actors*. We conclude that the key to making progress is to better understand and overcome challenges of collective action.[3]

Footnotes

2   knowledge-exchange.info/event/os-framework

3   A variety of publications on (aspects of) community and collective action have been published, this book refers to several of them. In general, collective action refers to action taken together by a group of people whose goal is to enhance their status and achieve a common objective (see Wikipedia: https://en.wikipedia.org/wiki/Collective_action).

The shaping and organisation of research

Our systems of disciplinary organisation, research communications and publishing, as well as of organisations that house scholarship, evolved together with many significant developments taking place in the 18th and 19th centuries. The legacy of this history is a complex system of values with significant interdependencies between a diverse set of meso-actors. Open Scholarship introduces new values that challenge the roles, responsibilities, motives and ambitions of these actors.

When values and motives clash

Meso-actors will clash when their individual incentives do not align with one another. This may be due to a division of responsibilities, particularly when new work and roles are needed (eg who will be responsible and gets credit for curation and review of digital data resources), or it may be due to differing financial incentives or revenue sources (eg in debates over the appropriate costs of scholarly publishing and who should pay these). Our analysis of changes in practice and culture towards Open Scholarship indicates that clashes are an inevitable part of change, so understanding them is crucial.

Analysing scholarship with economic models

Many of the changes in scholarship are driven by the shift from physical determined prints to digital available information. This has changed the nature of scholarly 'goods' generally making them less exclusive and therefore more like 'public goods' (which are neither exclusive nor rivalrous). The development of shared digital repositories and the persistent identifiers that support them are an example of this shift in the nature of goods. Competitive markets are not predicted to provide such goods; to achieve change we need to find new economic models.

Analysing action at the community level

Community and collective action provides one such model for the provision of 'public-like' and collective goods. Institutions that support such collective action are a form of 'community capital'. The current disruption is an opportunity to rebuild community capital. To do so we have to recognise the much broader sets of exchange, goods and capital in play including prestige, reputation and trust.

Institutions and collective action

By default, network effects and returns to capital will drive the creation of 'gravitational hubs' like Google, or Facebook[4]. To counter these we need to build (or rebuild) our own community institutions that have their own network effects and hub-characteristics. The key to distinguishing between 'good' and 'bad' gravitational hubs will be standards of governance.

Footnotes

4   In 2005 Lorcan Dempsey in a blog on 'Systems in the network world' made this observation about public platforms such as Google, Amazon and eBay: "They make data work hard: they extract as much intelligence as possible from growing reservoirs of data, and their services adapt reflexively based on accumulated data about users. They are massive gravitational hubs for consumers. http://orweblog.oclc.org/systems-in-the-network-world/

The literature on collective action includes Ostrom's principles on the community governance of collective goods (including community capital and 'hubs') and Olson's guide to how the challenge of collective action for change can be organised. By applying these principles we can outline a set of consequences for key stakeholders including:

▸ The need for more effective community organisation and development of nested hierarchies of community governance, particularly for scholarly communities

▸ A need to distinguish clearly which members of the scholarly community are subject to rules and which are not (such as commercial service providers), and the appropriate forms of relations with such outside actors. For instance, there is a need to define carefully which parts of the publishing process are community activities, which are appropriate to be left to a market of service providers, and what the relationship between those should be

▸ A critical role for funders as the main actors in a position to drive change in response to societal demands, but also for that position to be supported by trust from the communities that are being subject to the changes

The key to understanding change is that it is meso-level actors, communities and groups, and their responsibilities, interactions and output that ultimately bring change about.

▸ For change to be sustained it requires both **community institutions** that support the new status quo (establishing clear definitions of requirements, clarity on the process for selection, and transparency and trust), and **communities themselves** (eg funders, research performing organisations, and scholarly communities) that suppport change - not only in statements but through actions

▸ A supportive infrastructure, both technical and social, is key to ensuring long term sustainability and also to enabling communities to engage in the shift

This book is meant to help increase our understanding of research moving towards Open Scholarship. For a successful transition, collective action approaches and establishment of a supportive infrastructure are important. These conclusions are explained in more depth and detail in the following chapters. We hope the book will inspire all involved in research to contribute to realising the full potential of Open Scholarship.

Chapter 1

Introduction

Three stories

What are the assets? Glossa and Lingua

Once upon a time, a group of academics walked out of their agreement to edit Lingua, a journal owned by a large publishing corporation. They set up a new journal of their own, on an Open Access platform. Much has been written about the disagreements that led to the creation of Glossa, the new journal in this story. The creation of a new, and highly successful Open Access journal is described from some perspectives as a heroic triumph for scholarly sharing and openness in the face of profiteering big publishers. But from another perspective, that of the original publisher, it did little to change the fundamentals of the journal and its viability. The original journal, Lingua, still exists. A new editorial team has been recruited and submissions keep coming in. Libraries keep paying subscriptions and, perhaps most importantly, relatively few other journal editorial boards have followed Glossa's example.

The purpose of telling this story is to highlight two different perspectives on the value of scholarly journals. Is a journal a mechanism through which like-minded scholars share their research and expertise, creating a sense of community? Or is it an income stream for the organisation that owns it, an operation that should be treated like a business? Academics who serve as the editorial team, and those who submit their work for publication, provide the prestige and scholarly expertise corporation. But is that more or less valuable than ownership of the title, the trademarks, the accrued citation metrics and the banner? An important part of the Glossa story was the availability of a low-cost technical platform and a funding mechanism that could provide longer term sustainability through the **Open Library of Humanities** (openlibhums.org) (for more information on OLH see also our report **Insights into the Economy of Open Scholarship: A Collection of Interviews** (repository.jisc.ac.uk/7296/11/KE_Insights_into_the_Economy_of_Open_Scholarship_A_collection_of_Interviews_June_2019.pdf)).

This story is not just about the difference between scholarly and business perspectives, but of the many varying perspectives within the scholarly community and those that provide services to it. The original editorial board cared enough about Open Access to set up a new journal using a different business model, but there is sufficient perceived value in being an editor that the original publisher was able to find other academics within the same broad field to keep the original journal going and there are enough researchers producing papers for both journals to have submissions. It seems relatively clear that a publisher's interests will differ from those of the scholarly community, but which group of academic editors can be said to represent the scholarly community? If this form of transition is desirable as a policy goal then where might it succeed, and where might it fail? And what measures would we apply to determine success or failure?

Who is responsible for transparency? Reproducibility and software

An increasing amount of modern research depends on software and computational power. It is a long time since most computer hardware was built directly by universities. Both personal computers and supercomputers are more easily bought from external providers. Researchers also use a wide range of software provided by commercial suppliers. Sometimes, commercial software becomes deeply embedded in the work of a discipline. Examples include SPSS[5] in the social sciences, MATLAB[6] in areas of engineering, and a substantial proportion of the software that underpins computational chemistry.

Footnotes
5   https://en.wikipedia.org/wiki/SPSS
6   https://en.wikipedia.org/wiki/MATLAB

Is this good, because the providers of this software produce high quality products efficiently and keep developing their products? Is it bad, because the proprietary nature of the software makes testing and criticising results harder? What guarantees are there that critical software will continue to be available and updated to run on modern hardware, or that the organisations providing them will continue to exist?

Some academic communities have become increasingly critical of work involving cutting-edge analysis that cannot be critically assessed as it is 'black boxed' in a proprietary system. For some disciplines direct access to the source code of any analysis is becoming a requirement of publication. A number of Open Source and free software tools are becoming popular, including **Python** (**python.org**) with its ecosystem of Jupyter, pandas, and related tools and the Open Source statistical environment **R** (**r-project.org**). These systems and tools can provide greater transparency in terms of the code, but does that make the scholarship itself more transparent? If Open Source is the best way forward then how should it be funded? Software platforms of this kind are infrastructure, providing a stable platform that others can work on, and like other infrastructures they struggle to find sustainability models (Egbahl, 2016)[7]. If we had funding mechanisms to support infrastructural software, what would be the appropriate level of investment? How could we tell which software needed continuing investment and tension that against new efforts that are worthy of support and funding?

What platforms can we trust? Consumer services and the scholarly community

If we choose to support Open Source and free software, on what platforms should that software be developed and shared? Researchers are increasingly using GitHub for sharing and archiving specialised research software as well as for data. Should the fact that GitHub is now owned by Microsoft raise worries about long-term availability? Is **GitLab** (**gitlab.com**), an

Open Source and non-commercial competitor to **GitHub** (**github.com**), a better fit for the academic community, or should we be concerned about its sustainability? Is Microsoft's stewardship of GitHub more reliable? Is the larger community of users at GitHub the deciding factor?

Similar questions might be raised with a comparison of **Zenodo** (**zenodo.org**), the data and content sharing platform hosted by the European Organisation for Nuclear Research (CERN), and **Figshare** (**figshare.com**), a for-profit offering based within Digital Science. Zenodo is run by an organisation in the academic community but has no dedicated sustainability plan or guarantees. Figshare has a sustainability model and revenue sources due to its for-profit nature, and has additionally made preservation arrangements.[8] The question remains as to whether free is a sustainable price point for these services, particularly if it operates as a loss-leader, not asking the market-bearing price as a strategy to attract increased future business. Once data no longer has current value for reuse or sharing, it is unlikely to have any money-making potential – thus, there will be no interest from commercial players in its long-term preservation.

Footnotes

7   The work of Egbahl showed that for many pieces of important consumer software infrastructures (languages such as Python, Matplotlib, OpenSSL) support was patchy and unreliable. In the sciences key pieces of infrastructure including Matplotlib, NumPy and pandas may be reliant on the (inconsistently funded) work of between three and six people.

8   More on the various business models of platforms and services in this area are described in Knowledge Exchange publication Insights into the Economy of Open Scholarship: A Collection of Interviews http://repository.jisc.ac.uk/7296/11/KE_Insights_ into_the_Economy_of_Open_Scholarship_A_collection_of_ Interviews_June_2019.pdf

This is why the long-term preservation of physical research objects and data has traditionally been provided by archives, museums and libraries supported by public funds and with a clear mission of preservation and not one of profit-orientation. Early digital archives followed a similar model, such as the UK Arts and Humanities Data Service, which was supported by public funds.

From one perspective it is good news that the market has caught up. The entry of third-party actors shows a maturity in the markets, and the opportunity for external investment in the parts of our scholarship that are no longer core intellectual activities. But what control are we giving up? Have these services actually reduced the long-term need for publicly funded archives? How do we decide on a case by case basis that we can rely on external service providers? Who is the 'we' who would make that decision? What risks are there for the future and how will we handle them? What if we discover crucial pieces of software, data or communication have been irretrievably lost?

Open Scholarship

Open Scholarship is variously viewed as an external policy agenda imposed by funders or governments, as an ethical imperative to change the practice of our scholarship to align with changing societal needs, or as a simple re-assertion of the core values of our scholarly institutions to advance and disseminate knowledge. It is defined in many places in different ways, encompassing activities as broad as: Open Access and data sharing; the production and sharing of software and systems for the open annotation of texts; the involvement of patient representatives on grant awarding panels; and the direct engagement of wider publics in research activities.

In this book we will not seek to define Open Scholarship (or Open Science). Instead we observe that the various agendas being taken forward under this banner have in common systems, practices, services and platforms

that support or depend on the wider sharing of research outputs, greater engagement with those outputs by more diverse communities and the coordination of that engagement across broader networks. We start from the motivation that these shifts are desirable, but that the changes involved are challenging for scholars, their communities, their institutions and the providers of services that support them. We will see that the central challenge is coordinating collective action amongst these many different, and differently motivated, actors. The aim of this book is therefore to enhance our understanding of the mechanisms and processes that will enable Open Scholarship to reach its full potential. As illustrated by the stories above, there is a need to analyse our current practices and systems through different lenses. We need to be able to analyse the differing perspectives of the wide range of actors to develop a comprehensive understanding of the landscape of Open Scholarship. To achieve this we will need to identify and discuss theory. We will also need to go beyond that theory to encourage actors in the academic system to tackle challenges through organising collective action.

Three fundamental changes

Why is this discussion important now? Some of the reasons will become clearer as we move through this book. Issues of connectivity and scale are changing the economics of scholarship itself. These changes are part of a broader set of social, economic and technological shifts affecting societies globally. Many of these shifts are beyond the control of actors within the academic system.

They must therefore be understood by, but cannot be circumvented by, academia itself. In the following section we will examine three of these shifts that are important for the development of Open Scholarship: globalisation, digital technologies and ownership.

Globalisation is a term used to describe the increasingly global interaction and integration of individuals, organisations and governments, and the financial and knowledge flows between them. It is driven by advances in transport and communication (which is arguably a form of transport) which in turn are driven by changes in the technologies and infrastructures that support them. Increasing global interactions have driven changes in international trade, cultural exchange and even creativity. Globalisation is characterised at the highest level of granularity as primarily an economic process with positive consequences for efficiency and capacity, and opportunities for the free flow of goods, services, capital and knowledge.

However, globalisation has also led to new social challenges and exacerbated others, including poverty, climate change, global health and the issues of migration that accompany each of these. Globalisation is of particular importance for the scientific system in two respects. First, the reasons for globalisation, and its effects, are issues for study themselves. Many of these are central social and technical issues of our time and many can only be tackled effectively if studied at the global level. Secondly, although modern scholarship has always been international in its scope, it is slowly becoming a truly global endeavour. However, scholarly institutions, organisations, funding and infrastructures are still organised at the national level and frequently lack coordination at the global level.

Digital technologies includes all types of electronic equipment and applications that use information in the form of numeric code. The application of computers, and of the communications networks they have enabled,

has profoundly changed society. One of the key drivers, and also a contributor to globalisation, is the development of communication networks on a vast scale, with the main example being the World Wide Web ('the web'). Digital technology has had a profound effect on the academic system, in a first wave through our capacity for data gathering, analysis and modelling, and more recently through being caught up in wider changes in the dissemination of knowledge. There are significant opportunities to accelerate scholarly work, but these require changes in deeply embedded systems and processes such as the conduct of peer review, the financing of publication and the processes of data sharing. Making publications, data and software findable, accessible, interoperable and reusable (FAIR)[9] is another challenge in and of itself, entailing further complex politics, legal issues and technological hurdles. Building the infrastructure and services for this is costly and challenging.

Ownership is an exclusive right over property. In a world of physical objects the concept of ownership bundled up several sets of rights: the right to use, the right to sell, the right to control. The shift to online and digital goods and the rise of the service economy has added substantially to this complexity with ownership and control becoming separated. It is possible to be the legal owner of a digital artefact and to have little or no means of control over its use. The distinction is perhaps most starkly seen in the case of digital books 'purchased' through libraries, where despite 'owning' a 'copy' the end-user has no means of preventing the provider from deleting or otherwise removing their copy.

Footnotes

9   The FAIR Data principles were formulated and published in 2016, by FORCE11, a community of scholars, librarians, archivists, publishers and research funders that has arisen organically to help facilitate the change toward improved knowledge creation and sharing. See: (**force11.org/group/fairgroup/fairprinciples**)

This shift from owning an object to something closer to renting access through an online platform has moved through content industries such as music and newspapers to the academic world with new models of access to scholarly content. 'Ownership' can be less important than control.

Similar challenges are rising with respect to data, both personal and organisational. The ownership of data about individuals is far from clear. Regulations such as the General Data Protection Regulation (GDPR) (**eugdpr.com**) in the European Union (and also in the UK even after it leaves the EU) are intended to provide protection to individuals against the mis-use of 'their' personal data. However, from a strict legal perspective the 'ownership' of specific content rights in data often lie with the creators. The claims that might be made by the subjects or the creators of such data turn out to be largely irrelevant in practice compared to an actor that aggregates and has control over data. Actors such as **Facebook** (**facebook.com**) or Cambridge Analytica[10] can act in secret and sometimes, it appears, beyond any legal framework, either of data protection or of ownership.

These issues are highly relevant to scholars and our organisations. The questions of data management, ownership, rights of participants and responsibilities should be far more at the centre of our practice than they are, and this needs more resources. On the other side the ownership of 'our' content in the hands of third-party providers raises questions about the rights we have to data about that content. Is bibliographic data about the scholarly record 'ours' or 'theirs' to control and own? The costs of 'buying back' access to academic publications and metadata by the academic system might in relative terms appear marginal. Yet, on an aggregated scale, the costs are quite significant.

Linking these three shifts is the concept of *networks*. Networks are drivers of globalisation, connecting people, organisations and content in new ways. These networks are technological and digital in their sources, and it is through the creation of networks at an unprecedented scale that the digital technology revolution is having its most profound effects. Finally, in a world where ownership is scattered and partial, and control is the central issue, what matters is how ownership and control are distributed over networks. Scholarly output is often described by its creators as a 'public good' in the sense of being good for society. However, although the content is financed largely with public money, the content rights are not generally in public ownership. Even where they are, for instance where a publisher allows copyright retention by authors, the control over access to that content can be in the hands of other actors. While the scholarly code on GitHub (or the data in Figshare, or the content in Lingua or Glossa) may be owned by scholars, it is often within the power of other actors, in this case the publisher and intellectual property owner, to turn off or reduce access.

These networks, technical and legal, economic and even physical are complex. Over the last 70 years the processes and mechanics of ownership of scholarly output have seen steady increases in their complexity. That complexity is at the root of many of the debates about who is creating value, who 'owns' what, and what organisations should have control. It is the fact that these are complex networks that makes collective action both challenging and critical. To address the challenge we will require models and theory that can help us to manage the complexity of these systems.

Footnotes
10 https://en.wikipedia.org/wiki/Cambridge_Analytica

The Knowledge Exchange Open Scholarship Framework

In 2017 the Knowledge Exchange initiative developed a framework to help understand the changes affecting the academic system (Knowledge Exchange 2017). The Knowledge Exchange Open Scholarship Framework (KE OS Framework, see Figure 1. below)[11] helps to identify the actors and arenas of change across an idealised research lifecycle. The framework maps three dimensions. The first dimension represents the phases of a research lifecycle (Discovery, Planning, Project, Dissemination).

The second dimension, drawn from the PEST framework[12] used in business strategy analysis, divides the 'arenas' in which actions and interactions may take place into political (more specifically regulatory), economic, social and technical (ie PEST) arenas.

Footnotes
11 knowledge-exchange.info/event/os-framework
12 https://en.wikipedia.org/wiki/PEST_analysis

Figure 1. The Knowledge Exchange Open Scholarship Framework
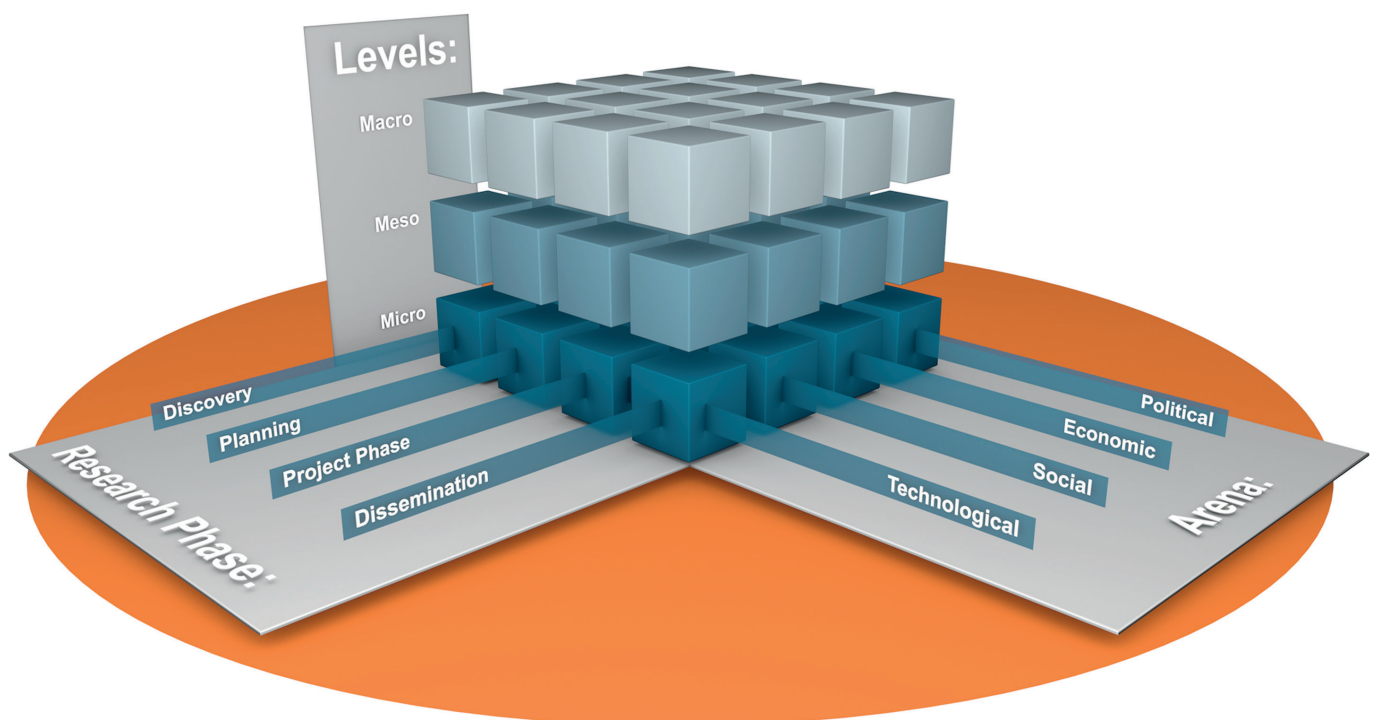
The third dimension is the 'scale' or 'granularity' at which analysis, or interventions, are occurring. This is divided into three levels; micro, meso, macro. 'Micro' refers to individual actors. 'Macro' to the system as a whole. 'Meso' occupies the space between, referring to groups, organisations and communities.

The framework is intended to help us to identify where a process of change might be hindered (or helped) by the behaviour and motives of different actors, and to guide us to the missing link between the motivations and goals of different stakeholders. For the purposes of this book, we are interested in the broad set of changes in practice, systems and organisations that have greater access and engagement with the outputs of research as a goal. This change towards openness, which is a political and social goal as well as being a response to economic drivers, has generally been regarded as slow, and as held back by inertia. This inertia arises because of the complexity of networked groups and organisations. We often refer to this as the challenge of 'culture change'.

Much of the commentary on the challenges of achieving Open Access or data sharing or public engagement has focused on issues of incentives, particularly the micro-level economics of individuals and their actions. Most of the actions seeking to drive change, however, have been through policy mandates or funding initiatives. That is, action at the macro-level, by governments and funders. We have failed to focus sufficiently on how actors at the meso-level (ie groups, communities, organisations and institutions) structure the choices that individuals make. For example we have not rigorously examined how shared culture and norms of behaviour can override both policy mandates and incentives for individual scholars. A central part of our argument is that insufficient attention has been focused on the meso-level.

A focus on the economic arena

The problems we are seeking to address are complex issues of coordination. One means of addressing coordination issues is through the lens of economics. This is also useful given that the focus of many of our debates is resource allocation, or more crudely money, and economics provides a familiar, if imperfect framing to examine those issues. Therefore, much of this book will focus on the economic arena of the KE OS Framework.

We will make use of various perspectives to explain that the slowness of change is in part because of the complex range of actors and goods in play. Our economic market analysis will show how the interests of different players are in complex tension, particularly where there are imperfect (or completely non-functional) competitive markets as the main form of coordination. It should be obvious that the wide range of actors involved have different drivers. This raises challenges for the development and adoption of innovation. We need to move beyond naive application of simple market competition analogies to rigorous analysis of exchange, goods and communities.

Conclusion – economics, markets and collective action. Frames for analysis

In this introduction we have referred to a number of concepts from economics. In particular we have touched on both collective action and market economics without defining these concepts. At this point it is valuable to provide some specific introduction to each of these concepts (See list of terminology, page 17).

Terminology:

Actor – we use the term 'actor' to refer in general to any of the large and diverse set of individuals, organisations, institutions or other players in the scholarly landscape. This will frequently be coupled with a description of the 'granularity' that we regard that specific actor as having. It is important to note that actors may not be individuals, and may in some cases not have clear definitions or boundaries.

Arena – we use the term 'arena' to refer to the category of actions or interventions being undertaken. From the Knowledge Exchange Open Scholarship Framework we take four of these, the economic, political (or regulatory), social and technological arenas. Our main focus is on the economic arena, but issues arising from the political, social and technological arenas all have a role to play.

Collective action – is broadly speaking, any action that is agreed amongst a range of actors. More specifically, it is coordinated action by actors that seeks to generate or manage collective goods (ie non-private goods that are in some sense shared by a community).

Framework/model – we use the terms 'framework' and model to refer to theories and ways of categorising actors, interactions, systems or exchanges. In most cases we refer to broad frameworks as ways to organise our evidence, and models are more specific, often mathematical descriptions of specific processes. In most cases these will refer to economic theories.

Granularity/level – much of this book is focused on the economics of groups, organisations and communities, and how they interact. The KE OS Framework defines three levels of granularity, micro, meso, and macro. These are defined more fully in

Chapter 2. We use the term 'level' to direct our attention to which of these categories we are addressing in our discussion of actors and interactions.

Institution – we use 'institution' as far as possible in the strict political economy sense of 'any shared body of rules and systems that guides a set of shared activities'. There is some risk of confusion with the common use of the term to refer to research performing organisations (RPOs) or other related organisations.

We generally try to use the term 'university' or 'RPO' to refer to these for clarity.

Lens – we will quite often refer to using a specific theory or framework. To make it clear that these are 'ways of seeing' and not necessarily a full picture of the reality of a situation we use the term 'lens' such as 'seen through the lens of market competition…'.

Market – a market in the general sense is any system of exchange between actors (who may be individuals or groups). Often used more specifically to refer to systems of exchange involving the interaction of self-interested actors seeking to maximise their own gain. In this book we use 'competitive markets' or 'market competition' where the latter meaning is intended.

Perspective – we use the term 'perspective' to refer to the views or motivations of a specific actor.

Market economics focuses on the goods, their exchange and how characteristics of the market exchange system affect pricing and costs. Classical models tend to involve homogeneous or a small number of categories of actors and the question of whether they can act in coordination through individual actions and their incentives to coordinate exchange successfully. In the cases where these competitive markets are seen to be functioning analysis generally suggests that a need will be met and that some equilibrium will be found between pricing and costs. These models tend to break down where there are multiple goods in exchange, or a disagreement about what is actually being exchanged. The introductory story of Glossa illustrates this – the editors' view of what constituted the value behind the journal is quite different to that of the publisher.

Arguments from classical economics have been used (by others before us) to show that the market in scholarly communication – particularly in publishing – does not function effectively. While market competition analysis may have some value, we cannot expect competitive markets of self-interested actors alone to bring about more open forms of scholarship. The success of Open Scholarship depends on the academic system being better able to organise and coordinate the collective action of a wide range of stakeholders.

Collective action describes how groups coordinate their actions, both internally within a group and between groups. In economic terms collective action is particularly relevant to goods that are neither purely private, nor completely public in nature. There is a significant body of theory on collective action that can help us to understand which groups are able to choose to act together and which are not. One simple example is that smaller groups find collective action easier to achieve than larger groups do. In seeking to solve these problems for larger groups collective action theory can help us to understand what kinds of support mechanisms, often in the form of

institutions, are needed to make collective action possible. In our stories, the Glossa editors were successful because they represented a relatively small and tightly linked community that could choose to act. In the second story where we have a more dispersed group writing software, collective action is more difficult to coordinate. In the third, GitHub provides an example of a coordinating institution that addresses this issue by centralising a point of interest for a broad set of users. Setting up a shared space specifically for research software might create new value but poses a collective action challenge. The tendency will be for users to gravitate towards existing well-networked providers who, as a result, have greater control over the system than may by ideal.

Beside market theory and collective action, other concepts and models such as business model theory or innovation management will also be referred to. The challenge for the course of the book is that – to our knowledge – no existing theory can provide a sufficiently complete picture to understand the dynamics at play. In the coming chapters, we will investigate the perspectives provided by market economics, collective action and other models, and show that a diversity of approaches is necessary to understand the scholarly landscape and chart a route towards openness.

We can benefit from applying these complementary lenses to analyse the landscape. We want to understand where markets are useful and what value commercial players provide. At the same time, we want strong institutions that enable us to manage interactions with commercial providers in a productive fashion. We want to understand which goods are better handled in our community spaces, which are better provided by the state, and which by the market. Ultimately, we wish to provide ourselves with insights and motivation to act effectively to address inertia and enable the transition to Open Scholarship.

Chapter 2

Actors, their interests and powers

While our focus is on economics at the meso-level, this only makes sense in the wider context. This chapter will map the sets of actors in scholarship and categorise them into the levels of granularity in the KE OS Framework. We want to understand the actors at all three levels (micro-meso-macro) and their motivations, as well as the levers they have available to motivate other actors. This is not an exhaustive analysis but rather a mapping of a set of relevant interactions, using efforts towards Open Scholarship as examples.

Defining the levels of granularity: micro, macro, and meso

Defining the precise boundaries of the micro-meso-macro model is not straightforward, particularly in the case of the scholarly community. It is useful, however, to have some examples (see Table 2.1) and a form of definition to work with. The micro-level is the simplest:

Micro-level actors are individuals, acting with free agency in their environment. They cannot be broken down into smaller actors.

The macro-level is more complicated. Strictly defined, it should only be applied to aspects of the 'system' we are considering as a whole. However, for our purposes, as is also common in many economic frameworks, it is helpful to consider those actors who have a role similar to the state in providing public goods or have sufficient reach that their policy statements or economic requirements will be adhered to. For our analysis, national-level funders will often fall into this group, particularly if there are few of them. It may, however, be useful at times to treat interactions between them as meso-level interactions. Governments and general legal frameworks with sufficient scope (such as the EU General Data Protection Regulation) can also be considered part of the macro category.

Macro-level actors are those whose policy statements and economics requirements will be adhered to or followed across the system of interest. They include any actors that can be seen as taking the role of 'the state' in some economic models.

The meso-level is everything in between. This means it is highly complex. It includes research groups, departments and universities (and groupings of universities), but also includes overlapping organisational groupings like disciplinary communities, scholarly societies, methodological groupings, professional societies and potentially other identity groups if they are relevant. Meso-level groupings can be formally organised with an institutional or organisational form, or can be entirely informal. Membership may be well defined or diffuse and shared culture and practices may be strong or unclear.

Meso-level actors are all those groups made up of micro-level actors or groupings of other meso-level actors that do not include the entire system. They may or may not be well defined groups and can overlap. Micro- and meso-level actors can be members of multiple non-overlapping meso-level groupings.

Table 2.1 Examples of actors at the micro-, meso- and macro-levels.

Level	Examples of actors
Micro	▶ An individual researcher ▶ Research support staff ▶ A member of the public
Meso	▶ A university ▶ A publisher ▶ A disciplinary community ▶ A scholarly society ▶ A professional society ▶ A commercial service provider company
Macro	▶ Government ▶ EU organisations ▶ (National and regional) funder ▶ General regulatory framework

The meso-level would also include groupings of those identified, ie scholarly societies as a group, whether that took the form of a formal organisation or a community that undertook some activities collectively.

Micro-level actors

At each level actors have different motivations and abilities to influence others. Even within levels, actors vary. For instance, there is a diversity of individuals whose primary motivation in our current context is to do, support, use or influence scholarship. Examples include:

▶ A researcher wants to discover new insights, contribute to social welfare, develop his or her career, and be rewarded and recognised for their work. They are primarily judged by the outputs carrying their name, though the ways in which this judgement occurs are heavily institutionalised, through recruitment and promotion practices, research indicator regimes and peer review. As

individuals within institutions (universities, disciplines), researchers are able to influence both the formal and the informal ways that things are done

▶ A staff member in a research support function, such as a research software engineer or data steward. They may be integrated into research teams, and have similar motivations to researchers. However, their name will not in some cases be included on the outputs by which researchers are judged, and their career path is less well defined, despite considerable recent efforts to remedy that. They do, however, make significant and sometimes crucial contributions to the research process and output. They may have professional communities and cultures, but these are usually less influential within institutions than those of researchers

A member of the public may be primarily interested in economic and social welfare arising from research. Some of them, for example a patient or amateur historian, might want (and be able) to engage more directly with scholarship, contribute to it as a citizen scientist, and influence its direction and priorities. This should not be underestimated; a 2014 UK survey found that nearly a third of the public want to be directly involved in decisions about science issues[13]

In addition, it is useful to remember that the staff involved in all organisations noted below may also have individual interests and powers outside of their roles purely as agents of those organisations, and this can explain otherwise puzzling effects. For example, university professional staff may also be researchers, and of course all will be members of various publics including that of taxpayers.

Meso-level actors

Here we encounter organisations and institutions, broadly defined, whose primary motivation is to coordinate research. Examples would include:

Research-performing organisations (RPOs), including universities (which also undertake teaching) and research institutes, which have a discipline or topic focus. RPOs are usually geographically defined, though they may see themselves as oriented regionally, nationally or globally. While these organisations are often non-profits, they are still motivated by their own sustainability, as influenced by their income, costs, assets, reputation and relationships. RPOs have quite a strong ability to influence the researchers they employ, through the terms of that employment. They may influence those from whom they buy services, through procurement practices. Some of them, being responsible for the nation's research capacity and perhaps working together, may influence national actors, including

macro-actors through lobbying. Libraries within RPOs may themselves be institutions, especially where they combine into consortia to enable collective action, or where they manifest the professional culture of librarianship

Information service providers, including publishers, are motivated by their sustainability and, especially in the case of for-profit providers, their economic sustainability and the creation of value for shareholders or owners. Publishers have a strong ability to influence researchers through their management of books and journals that carry researchers' names and, therefore, affect their reputation. They are able to influence scholarly societies, where those societies depend on income from journals published by them. They are able to influence national actors based on lobbying, being responsible for disseminating the nation's research outputs, and often being significant taxpayers and employers. Many journals may themselves be meso-actors, though perhaps with limited independence from their publisher. Likewise, well-established conferences may be meso-level actors in some disciplines

Footnotes

13 In March 2014, Ipsos MORI's Social Research Institute in the UK published a report titled 'Public Attitude to Science', looking at attitudes to science, scientists and science policy among the UK public. https://assets.publishing.service.gov. uk/government/uploads/system/uploads/attachment_data/ file/348830/bis-14-p111-public-attitudes-to-science-2014-main.pdf

▶ It is helpful to consider scholarly communities or disciplines separately to the formally defined organisations that might represent them. These communities are self-defining and self-organising institutions of researchers, norms, practices and technologies that are motivated (and indeed constituted) by a common interest in curating the value of the discipline. They have a very strong influence on researchers, structuring their identity and community. Some communities are organised through scholarly societies and academies and some are informal. The degree of organisation may affect how much influence the community has on other actors

▶ In contrast, scholarly societies and national academies are the formal organisations whose main objective is to organise cooperation among researchers to promote their nation, discipline or subfield of research and pass on its culture to new generations. As organisations, they have an interest in their own sustainability. In many cases this is supported by publishing operations. They are able to influence researchers through their work to organise the discipline or scholarly community. They may be able to influence publishers, where publishers derive income from publishing a society journal. Being responsible for the nation's research capability, they can influence national actors. Scholarly societies represent an institutional means of achieving coordination and collective action – including influencing other meso- and macro-actors – for scholarly communities. Professional societies have many similarities to scholarly societies, but differ in being organised around a technical skill, training or role, rather than a subject area. As a result they may hold less prestige in academic settings and institutions

▶ Commercial service providers in the form of start-ups, multinational corporations, privately held and listed companies are all meso-actors. Their regulation and role can differ widely depending on location, sustainability models and product offerings

Macro-level actors

At the macro level, the entities might best be considered as 'authorities', whose primary motivation is to frame and mandate research. The instruments they typically have to achieve this are hard and soft policy (including regulation) and direct and indirect funding (including grants, loans and tax arrangements). For example:

▶ National governments play an important role in facilitating research in their countries. Their motivations for facilitating research vary according to the nation and in relation to political and economic circumstances. In many cases, an important reason is that they strive to enhance their populations' welfare. Increasingly, this motivation is articulated in terms of the role that research can play in national innovation systems, both through the direct commercialisation of research and through less direct approaches such as encouraging closer ties between research and national health organisations. Governments have strong economic and regulatory powers to affect the sustainability and operation of all organisations and individuals within their jurisdiction

▶ The organisations of the European Union (EU) share the interests of the national governments and have similar motivations and powers to those of national governments with respect to members of the EU (though noting the principle of subsidiarity), and are also able to influence national governments of non-members

- Many research funding organisations are effectively agencies of national or EU authorities, set up to be motivated to ensure the health and sustainability of the research sector for which they are responsible, and for the value it produces. They are able to do this through financial instruments, the provision of non-financial resources and facilities, support for international collaboration, and associated convening power. As representatives of the sector they fund, they are often able to influence governments. They are also able to influence all organisations, institutions and individuals that are directly or indirectly recipients of funding, mainly through financial instruments and associated policies such as terms and conditions of grants

- Sufficiently general regulatory frameworks such as copyright, privacy and data protection regulation, antitrust law, and indeed the rule of law and contracts more generally, can be considered as part of the environment, and therefore to the extent that they act through specific agencies, might be considered part of the macro-level

Interactions between the levels

The KE OS Framework sets out levels according to their scale as well as the arenas that they work in (political, economic, social, technological). No framework describes the world perfectly and it is reasonable to disagree on the precise characterisation of a specific actor. Many actors operate across multiple arenas and it is not always clear at what level of granularity a specific actor most naturally sits. The KE OS Framework provides a way of categorising and articulating drivers, motives, requirements, incentives, stoppers and disincentives that operate between levels and arenas. The main aim of the KE OS Framework is to help us to understand the interlinked rationales and actions of stakeholders between the three levels. An important aspect in understanding the actors at the macro-,

meso- and micro-levels is to analyse what holds them back in realising their ambitions. For the actors at macro-level, blockers are mainly political and social factors, including the acceptability of new policies, or the degree of alignment with the realities of national politics. Macro-actors can seek to influence micro-actors through regulation or economics.

Actors at the meso-level who seek to implement policy and strategic goals are most commonly dealing with organisational and technical change, that is in the social and technical arenas. Examples might include the social challenges of changing community practice around publishing or data sharing to optimally use a new technology. At the micro-level, it is largely social factors, particularly those involving group identity, that structure researchers' opportunities to change practice and influence the other levels. Economic concerns are common to all levels. At the macro-level, actors are concerned with national and international economic performance, at the meso-level with organisational revenue, costs and sustainability, and at the micro-level with research grants and salaries.

The rationales at the different levels offer a logical basis for a course of action, but here can, of course, be conflicts of interest between them.The following examples highlight major conflicts of interest between actors towards Open Scholarship.

A first example concerns research data. A government may be convinced that open research data supports innovation and economic growth, and therefore obliges research projects to make their research data available. However, doing so meaningfully requires investments of various kinds. For example, investments in repositories and data skills at the meso-level. Where the investment instruments from funders are designed as research projects, RPOs and infrastructure providers struggle to guarantee the sustainability of data infrastructure

after the end of the funding period, and the research communities lack criteria to select which data should be stored long term. These conflicts at the meso-level break down to the micro-level where researchers are unsure about how to fulfil the demands of a Data Management Plan (DMP) in their funding proposal in the absence of either a cultural practice, clear technical systems and support, or any monitoring of policy compliance.

In a second example, we consider the macro-level and the political goal of achieving 100% Open Access to research publications, most recently articulated in Plan S (**coalition-s.org**). Governments and funders have made it clear that significant additional funding is not going to be available to support this transition, and have indicated that some of the meso-level arrangements whereby Open Access has been pursued, such as hybrid Open Access, are no longer acceptable. However, researchers' incentives at the micro-level, and disciplinary cultures at the meso-level, remain geared to both publishing in and citing prestigious venues such as journals with high impact factors. This is why Plan S calls for these incentives to be addressed through a shift in the metrics used for research evaluation (an economic but also social change). In Plan S this is to be achieved through the implementation of the **San Francisco Declaration on Research Assessment (DORA)** (**sfdora.org**), which has a focus on a shift away from outlet-based metrics for research evaluation purposes. Plan S remains controversial. In part this is due to the challenges of addressing the meso-level, a challenge for all policy interventions which often seek to drive change through macro-level policy and funding. This clarifies why scholarly societies – particularly those dependent on publishing operations – are amongst the most significant opponents and blocks to achieving the goal of 100% Open Access in general and for Plan S specifically[14].

The examples above are an illustration of the fact that the actors at the meso-level play an important role in organising the collective actions to make the necessary transactions that lead to Open Scholarship as well as being the main source of inertia and active opposition to change.

Conclusion – the meso-level is required for a transition to Open Scholarship

To date, there has been much discussion about policy interventions at the macro-level and about the difficulties of inertia and lack of support from individual researchers at the micro-level. There has been some discussion about how these levels relate to each other but, with some notable exceptions (for example, discussion of the politics and organisation of library-publisher negotiations), relatively little about the interactions between meso-level actors. While actors at the micro-level lack the power to make the necessary changes, and the players at the macro-level can set the scene, they both need the actors at the meso-level to establish what is necessary for a transition to Open Scholarship. Among other things, these actors carry the cultures and traditions of scholarship and so, to understand the economic interactions between them, it is important to understand their histories. We set this out in the next chapter.

Footnotes

14 Publishers are also a significant block for similar reasons. However, the commercial motivation for protecting existing revenue is a much more obvious reason for incumbent publishers to seek to block or slow down changes that threaten those revenue streams.

Chapter 3

The shaping and organisation of research

Researchers work in groups and organisations. From the formal to the informal, and the large to the small, they define themselves by their relations to research groups, disciplinary communities, departments, scholarly societies, journals, conferences and academies. Key to understanding the political economy of research is to understand how these groups interact and how this affects the behaviour of researchers.

In the Introduction, we examined the wider societal and global context, including how this has changed the underlying environment for scholarship. In this chapter, we focus on meso-level actors using disciplinary communities, publishers and publishing services, and universities as examples. In each case we first provide some history and background. We then examine that history through a broadly economic lens discussing the kind of 'goods' in play and what tools and models might be useful to analyse their interactions.

Our goal is to provide a rich understanding of how the history of group and organisational forms has a strong effect on the economic shape of our interactions. Many of our assumptions about how scholarship works are built on the accidents of history. This does not make the constraints within our systems any less. Understanding their histories and placing them in an economic context is intended to help us start to dissect what kinds of change are feasible. To do this we will examine three sets of meso-actors that dominate the landscape: research communities, publishers and the set of services around them, and universities in their role as research support organisations.

The history of disciplines and research communities

Scholarship was once a solitary activity but, from the 17th century onwards, scholars have increasingly gathered in groups to share their findings and offer mutual support[15]. Such groupings ranged from informal correspondence networks stretching across Europe, to formal institutions whose members met in a particular town. From the 19th century, these scholarly groups increasingly coalesced around specific topics or fields of research. These became the disciplines.

The emergence of disciplines was associated with the creation of specialist scholarly societies and journals which provided means for sharing research orally and in print. By the late 19th century new disciplines such as chemistry, biology, modern history and anthropology joined the mediaeval professions of medicine, law and theology in the curricula of the universities. Universities provide the mechanism for initial training of new members of the discipline, who are then socialised into disciplinary norms by participation in the relevant national or international research community through conferences, societies and publishing.

Footnotes

15 This is in no sense a comprehensive history. Useful supplementary reading includes (Stichweh 2001; Tobin et al. n.d.; Krishnan 2009)

Since World War II there has been massive expansion, specialisation and fragmentation of research[16]. New societies, associations and journals have been created to cater to these new areas, and some (though not all) have been formally incorporated into university teaching through the creation of new degree pathways. It is within disciplines that research identities, norms and values are formed. This includes definitions of 'good research questions to ask' and 'appropriate methods to use', as well as forming notions of appropriate behaviours for members of each discipline, ranging from the norms for attributing credit to co-authors, to the value placed on publishing books rather than journal articles.

The sustainability of these communities, and their increasingly formal organisation (through entities like journals and societies), is most clearly seen through the lens of collective action. Journals, conferences, research networks and formally organised clubs or societies all help to build a sense of membership within that disciplinary community. That identity and sense of community is a collective good for the group concerned. An important historical point is that the set of communities that define our current behaviours, including publishing venues (most obviously journals), scholarly societies and associations as formal organisational structures supporting disciplinary communities, and the disciplines found within the formal structures of research performing organisations, have their roots in the mid to late 19th century with their current forms largely defined in the period after World War II. The changes discussed below that arise in the second half of the 20th century have continued to strain, but not break, the structures that developed in that earlier period. Bioinformatics provides an example. Despite being a new 'discipline' the community still defines itself through scholarly societies, conferences and journals to a large extent. In both bioinformatics and in digital humanities the practices that are accepted as 'research' within a university setting map closely onto forms that are older, with their focus on traditional publications as the main output.

Increasing scale and collaborative research

One of the striking changes in research since 1945 has been the emergence of large-scale and collaborative research, sometimes referred to as 'Big Science'[17]. This is research that involves large groups of people, often with complementary skill sets. As it scales up it can become highly resource intensive, in terms of equipment, staffing and support services. At some point it grows beyond the capacity of a single university or traditional research performing organisation to support it. The extreme examples are from physics, where huge international teams work at the Large Hadron Collider (LHC)[18] at the European Organisation for Nuclear Research (CERN) or the Square Kilometre Array (SKA)[19]. But collaboration and team-based research have become markedly more common in many fields of the natural, medical and social sciences, as well as in parts of the humanities. Across all disciplines, funders and universities are encouraging projects that involve teams and collaborations.

Footnotes

16   Sociologists of higher education have (over the last two decades or so) switched from focusing on 'disciplines' to discussing 'research fields'. In this book, we will use 'discipline' and 'disciplinary' to apply to all research fields, regardless of their position in the universities.

17   Wikipedia page on the origin and development of Big Science: https://en.wikipedia.org/wiki/Big_Science. It also provides an overview of and topical guide to Big Science: https://en.wikipedia.org/wiki/Outline_of_Big_Science

18   https://home.cern/science/accelerators/large-hadron-collider

19   https://skatelescope.org/

The emergence of collaborative research means that human resources have to be mobilised differently. It raises questions of management and resourcing, as well as the division of labour and the attribution of credit. The use of complex equipment and the needs for data storage, sharing and analysis have led to growing needs for support services and staff. Managing these support needs has become complicated, and often the choices are not driven by a business analysis but by local conditions (such as the availability of personnel or even how internal management systems support or make particular choices difficult).

A collective action framing suggests that these resources strengthen boundaries that could be around the whole team, or internal to it. Questions arise around the need for critical mass to deliver sufficient capacity in terms of infrastructure and resources. At the large-scale end, this leads to shared facilities, which in most cases now are multi-national or regional. Different communities can be more or less effective at making the case for these kinds of facilities. Often the size of a university, and competition between universities, limits the scale of these efforts. Multi-university research collaborations remain challenging, with one organisation normally being the dominant partner.

This has resulted in an increasing set of internal university support functions being formalised, including analysis and computational facilities and also the training and knowledge capacities for Open Scholarship, often provided by university libraries. In turn arguments over the internal pricing of access to these facilities are common, with perverse incentives often arising (eg it is cheaper to buy a new instrument on a grant than to use the existing instrument in a shared facility).

At the same time as members of research teams collaborate, they are also individually (and as groups) involved in competitive striving for prestige (to get the next job, prize or grant); and the universities as employers are also competing with each other to improve their standing. Organisations within a collaboration are also often competitors and communities are competing with each other for prestige and resources, particularly where large-scale projects or facilities are involved.

The players, goods and markets in academic communities

There are many forms of capital in play within research communities. These include prestige and reputation, alongside other forms of social capital that can be used in various settings to gain financial capital. In turn, financial resources are used to conduct research, which (when valued) enhances the social and prestige capital of those who carried it out. In some communities, particularly those with reasonably large scholarly societies, these may be linked to funding in the form of grants or prizes, but communities themselves do not generally engage in large-scale financial activity per se.

A few research communities aggregate around significant direct funding, with the most extreme version being large-scale infrastructures such as CERN. Such large collaborations have strong group identity and codified shared practices for data sharing, authorship and the attribution of credit.

Most community organisations, however, are funded through some combination of membership payments, philanthropic income (eg bequests, endowments, or grants), and trading income (usually publishing revenues, but sometimes event organisation or the sale of branded souvenirs). Publishing revenues may come from internal publishing operations or from third-party service providers that run those operations on behalf of the community. Such service providers range from mission-driven organisations (for example, university presses) to profit-oriented commercial publishers.

Supporting communications: publishers and publishing

There is a long history of a mixed economy in the circulation of knowledge, combining sharing between personal acquaintances, publishing for public sale and publishing subsidised by patrons or sponsors[20]. This mixed economy continues to this day, and the different elements of it overlap and interconnect. As we seek to share more complete records of research, and more complex objects, the sets of players involved and their interactions have become correspondingly more complicated.

Publishing: for public sale, or subsidised, or a combination…

Printing was, for centuries, the only way of creating large numbers of copies of an essay or book for circulation. Authors were very rarely (if ever) printers, so this involved coming to an agreement with a printer and publisher and bookseller. That raised questions of who would pay the costs of printing. Either, a publisher needed to be convinced that there was sufficient public demand (so that sales would cover costs), or another source of funding was needed (e.g. an author's own funds, a patron, an advance public subscription).

Scholarly books are older than scholarly journals (books since 1460s; journals since 1660s), but since the mid to late 19th century, journal publications have become increasingly significant for generating research prestige. It can be argued that books have remained more effective at communicating research among wider audiences. Books and journals also have very different histories of financial support. For books, public sale was the original means of funding production, with forms of philanthropic subsidy emerging later. For journals, philanthropic subsidy was key to the long-term success of early journals, and income from public sales only became a significant income stream in the second half of the 20th century.

Books in certain fields of natural history, geography, travel and anthropology had commercial potential, but many scholars found it more difficult to address their research to a wider audience. By the late 19th century university presses, with a mission for scholarship and some level of support or subsidy from their home institutions, became increasingly important publishers of research books but, in certain fields, commercial publishers continued to play an important role.

From the 1970s and 80s the consolidation of the publishing industry has meant fewer, larger commercial players in research monograph publishing with less willingness to take on the risk of books that look unlikely to be commercially successful. Some publishers have shifted towards textbook/reference book publishing and some have moved out of research monograph publishing altogether.

Publishing journals

Scholarly periodicals emerged in the late 17th century. The successful serials of the 18th century were supported by learned societies or academies (eg Royal Society, Académie des sciences etc). Such scholarly organisations had funds to support the publishing and circulation of knowledge, and also a mission to do so. The research they published had usually been presented (literally – gifted) to the society, not purchased in a transfer of copyright. These periodicals were largely circulated by exchange and gifting (to individual scholars, to other societies/academies/universities), though they might also be available via public sale. Low levels of sales meant that they were financed by patrons (eg the French crown), or members of a society, or through endowments.

Footnotes

20 There is a growing literature on the history of publication. Some useful points of reference include (Baldwin 2015; Fyfe et al. 2017; Csiszar 2018).

As the scale of scientific research output grew in the later 19th century, this subsidised model of journal publication became increasingly difficult to sustain. Alternative sources of funding had to be found. For instance, by the 1890s, the Royal Society was administering UK government funding to support the publishing operations of various learned societies (this continued until the 1950s).

Commercial players entered the journals market in the very late 18th century, but until the 20th century they rarely generated a profit (though they might be useful loss-leaders for the parent publishing firm). Throughout the 19th century it was a common complaint that scholarly journals were so expensive to produce, and the audience for them so small, that it was impossible for them to be profitable. These commercial journals followed the already-existing norms of the learned societies, by not paying authors and providing free offprints.

After 1945, a new breed of commercial publishers (Pergamon, Elsevier) found a way of making the commercial model of journal publishing sustainable. Their new business strategy depended on selling to institutions such as university libraries at higher prices than the rate for individuals, and targeting an international (rather than national) market, particularly by creating English language journals. They also did very well by focusing on, and in many cases developing, the newly emerging sub-fields and specialist disciplines that were not yet provided with journals by the existing societies or university presses. For a few decades – Fyfe et al call the 1950s and 1960s a 'golden age for commercial publishing' – this model worked well for publishers and for scholarship since it catered to new specialisms, and it did a good job of circulating research internationally.

But it depended on the existence of institutions such as university libraries with sufficient, and increasing, funding to subscribe to a growing portfolio of journals with more and more content. Since the cutbacks in university and research funding in the 1980s, this condition has no longer been met. The difficult situation for subscription-based journal publishers has encouraged publishers to seek economies of scale, and to diversify their operations.

Just as book publishers have merged and consolidated, so too have journal publishers. This has occurred both through the merger of publishing companies and by successful efforts to buy or create more journals. Five big international conglomerates now publish more than 50% of the global scholarly literature (Larivière, Haustein, and Mongeon 2015); and in certain fields their dominance is even greater (notably the social sciences, where the big five account for over 70% of all articles).

A desire to diversify, coupled with a trend towards acquisitions and mergers, has resulted in many major journal publishers being part of international conglomerates which also provide a variety of other research services, such as bibliometric databases and research information systems.

The digital transition

The advent of digital technologies has transformed the work of editing, producing and distributing research publications, and radically changed the economics of production and consumption. The overall effect on the political economy of scholarship is less clear. In some areas, digital technologies have enabled new scholarly groups to manage the circulation of knowledge. But in other respects, the cost of digital innovation has consolidated the influence of existing, well-capitalised publishers.

Among the new players in the digital publishing world are organisations that provide services to publishing companies. The majority of publishers do not control the end-to-end systems that manage their workflows, outsourcing both on the input side (submission systems, particularly for journal articles) and on the output side (digital production, layout, server platforms and printing). Many of these technology platform areas are oligopolies (Manuscript Central, ScholarOne and Editorial Manager for submission systems; Atypon, Silverchair, HighWire for platforms).

Currently there is a tense process of consolidation going on in these markets as the largest publishers purchase the technology platforms they, but also their competitors, use. For instance, when Elsevier purchased Aries, provider of Editorial Manager in 2018, it bought not only its own editorial platform but also, ironically, that used by the Open Access publisher PLOS.

The digital revolution has also affected the circulation of knowledge in other ways. There are new media options in the communications ecosystem, in addition to those options that are the digital equivalents of paper-based publishing. Researchers have much easier access to audio formats such as podcasts or audio books, video formats such as recorded TED-talks and interactive formats such as digital learning environments or platforms. Some of these are extensively used in collaboration between researchers, but are not (yet) recognised within the traditional systems for accruing prestige for reward and recognition in academia.

In what is sometimes presented as a return to their roots, digital technology and its economies have also enabled the creation of new academic- or community-led journals and platforms. These include early examples such as **arXiv** (arxiv.org) and more recent efforts such as **Open Library of Humanities:** (openlibhums.org/) the Public Knowledge Project's **Open Journal Systems platform** (openjournalsystems. com) and 'insurgent' publishers with a strong focus on a specific radical mission such as **Punctum Press** (punctumbooks.com). These work with knowledge products that are based on printed format (ie 'papers' and 'books'), but they are produced and circulated in very different organisational contexts with very different business models from those of traditional legacy publishing companies.

Players, goods and markets in publishing

The classic analysis of goods and markets in the publishing space is of a market in content, supported by communications technology services. Generally this is presented as a two-sided market, with authors exchanging content for services from publishers, and publishers aggregating that content as a service to subscribers (Schonfeld 2008; Gans 2017). Often this is presented as a story of market failure (Houghton 2002; Gans 2017), either through non-substitutability of content, bundling, vendor lock-in, network effect, oligopoly or other issues.

However, the role of non-content goods such as prestige and attention is often not well described by market models. An alternative is to describe the publication objects themselves (journals primarily, but the analysis can be extended to books or book series) as clubs, which act as coordinators of service provision, run by and for the

authors, reviewers and editors who are members of those clubs. In some models it is also helpful to see those clubs through the lens of networks and related economic models (Potts et al. - '(Potts et al. 2017); Hartley et al. 2019).

Current analyses of the financial economics of publishing tend to start and end with prices and the scale of content, rising out of the reach of research libraries. The golden age of commercial publishing ended with the slowing of university expansion and flattening library budgets. Such analyses reach the conclusion that the market is broken in some sense, without going much further. The more sophisticated analyses provide a diagnosis of what specific market imperfections exist but tend not to provide clear answers as to how to fix them. A case can be made that library funds should be seen as a common pool resource of the scholarly community, and need to be analysed and managed through different – and yet to be developed – mechanisms.

Universities and the emergence of an academic job market

Shifting our analysis from one focused on prices and financial transfer requires us to include an understanding of the wider 'economics' of the system. This includes questions of social dynamics, prestige and community structures. In the academic and scholarly landscape these issues are connected to our assumptions about what success looks like, including career pathways, and how gatekeepers manage access to those opportunities. As with publication, the development in universities of scholarship as a career with required qualifications is quite recent.

Until the professionalisation and institutionalisation of research in the 19th century, research was not a career. Mediaeval and early modern universities were primarily teaching institutions, and it was not until the late 18th

century in Germany (and later elsewhere) that research skills came to be seen as desirable features of a potential professor. Nor were there many jobs for researchers outside universities. Monarchs, princes and aristocratic patrons might recognise the value of an individual and act as a patron to specific eminent scholars, but there were limited institutional options for academic career paths.

Researchers would either have their own resources or might be lucky enough to find a patron. Patronage could be based on the prestige value of having a specific person on the payroll, or on specific technical skills or knowledge that they brought. In this sense, scholars would occupy a similar place in society to artists. To the extent there was a market, it was one in people or in the accruing of prestige through the acquisition of talent or the connection with a patron.

The research university emerged during the 19th century. The parallel timeline in the development of disciplines, journals and scholarly societies is not accidental, these institutions building on each other. By the end of the 19th century European states were beginning to recognise the value of funding for scientific research and broader scholarship. Industrial research was also on the rise. These developments meant that by 1900 researchers were operating in a job market.

Scholarship as a job

The period of massive expansion in research after World War II was followed by a contraction in the growth rate of universities and funding in the 1980s. This has led the research job market to become increasingly competitive over the last 40 years or so. Universities compete among themselves for the best researchers. This is particularly the case since the creation of league tables and government research evaluation exercises from the 1980s on. In certain fields, universities compete with industry to appoint and retain researchers as well as

qualified research infrastructure and support function staff – especially in the field of information technology. On the other side of this market, the competition for permanent academic research positions is intense. There are not enough permanent academic research positions for all the PhD students who graduate. By some accounts, fewer than 5% of graduating PhDs obtain such permanent academic positions. The percentage who remain in research is a relatively small proportion, raising questions about the scale of training. And among those who do succeed in staying in academia, there is ongoing competition between researchers to gain access to the opportunities that will allow them to generate the prestige that is convertible into promotions, grants and prizes.

The economic role of the university

Framing the role of a university in economic terms is not straightforward. Universities are not only employers (and educators) of researchers. They are also providers of a set of platforms, services and resources to their researchers. Being professionally associated with a university (and especially with a well-resourced university) brings significant advantages for a researcher.

Until the academicisation of research in the 19th century, carrying out research was heavily dependent on personal resources available to individual researchers or their patrons. Buying books, journals or equipment, or travelling to undertake fieldwork, were all easier if you or your patron were rich.

Universities typically provide their researchers with desk and laboratory space, access to libraries and proprietary databases and technical equipment. They also provide analytical and technical services. However, locating research within universities has come with disadvantages as well. As with the previous two sections the second half of the 20th century saw increases in the number, heterogeneity, size and global distribution of universities. This has led to an increasing

administrative burden of managing large teaching and research institutions and to the need for top-slicing of funding to support coordination costs. The combination of roles with requirements for teaching, administration and other duties reduces the time available for research even as the provision of support systems should make that research more efficient. National governments have grown concerned about transparency and efficiency, leading to an increased requirement for auditing across this larger set of universities and a further increase in the internal costs of reporting and coordinating.

Efforts to address this have their own problems. The increasingly toxic effects of casualisation, in which teaching and, increasingly, research are delegated to staff with limited term and part-time contracts, has been widely discussed. On one level, this is a natural business decision driven by business and market analysis emphasising the value of the division of labour into greater specialisation. However, in terms of providing a well-resourced community with shared goals that are engaged in scholarly work, it is damaging. In many countries there is increasing divergence, or perception of divergence, between the interests and motivations of scholars, support staff and university leadership.

The role of the university as a platform on which a scholar is able to pursue their own curiosity, which developed most strongly in the phase of government investment in the first half of the 20th century, has faded. The notion of a university as a community is also under threat with individually focused assessment and rewards breaking down the interest in working collectively. Understanding this shift in economic terms may become crucial for universities to understand themselves.

The players, goods and markets in universities

Universities are significant organisations that require sustainable financial models. Significant direct financial

revenues are required to support teaching, research and development. Depending on the national or regional funding context for research, universities may be competitively funded based on specific projects, or there can be substantial general public funding. Teaching may be funded by the state, through tuition fees or a mixture of both. Industrial funding for research in the form of sponsorship may be significant, alongside gifts and revenue from reserved capital, such as endowments.

Universities often have substantial capital, although this may not be in the form of liquid assets. Property and buildings will form a large component of the assets of a university, particularly those in wealthy cities. Alongside potential investments in shares, this makes financial markets potentially highly significant to universities. Many universities also have significant debt, which may make credit-rating and debt markets significant. In many places building programmes are funded through debt or through public-private partnerships. Both of these approaches are relatively recent. The donation of resources for building has a much longer history. Finally, in some areas universities have a substantial exposure to future pension commitments.

Alongside these financial assets and obligations, prestige and social capital are significant assets for a university. Brand value and the ability to convert that into teaching and research income is key, and is a significant part of the attraction for both students and researchers, who in turn provide further financial income.

Since the 1980s, universities have become increasingly keen to commercialise the knowledge produced by their researchers, eg through technology transfer offices that facilitate spin-out companies. Institutional policies (in tandem with employment contracts) gave universities full or partial ownership of the intellectual property in their researchers' outputs, but this has been more forcefully applied in the case of patents than copyright in published works where many universities have – until recently – waived their rights.

Conclusion – history has shaped a complex system

Overall, the above shows that the situation is complex. A meso-economic analysis of the kind we have proposed requires us to recognise both the plethora of organisations in play and the complexities of their interaction. It requires us to recognise that some players operate exclusively in the scholarly economy, while others see scholarship as just one part of their operations. It requires us to understand the relationships between players and also the roles of individuals within their organisation. And, to be usable, our analysis needs to enable us to focus on the part of this complex ecosystem that is specific to the question of greater openness.

A pattern that is important to observe is that the current set of important meso-actors (as well as the role of funders as macro-actors) are a product of the mid-19th to the mid-20th century. That pattern has come under increasing strain over the past 50-70 years with economic and technical change, globalisation and the related scaling-up of scholarship across the world. The system of communities, organisations, communication and coordination that evolved for (and in) a different world holds the scholarly community together but also imposes a set of constraints that hold change back.

To understand what we need to preserve, and what ties we can afford (or need) to cut we need frameworks that help us organise the players, both those that have a formal existence as organisations and those that are less formal collaborations or groups. This will aid us in dissecting their internal economies as well as the economics of their interactions. As we will see in the following chapter, it is precisely these interactions and the complex webs of incentives, motivations and needs for coordination that they create, that we need to understand better.

Chapter 4

When values and motives clash

In the previous chapter we focused on the interests, development and resources of three sets of meso-level actors. Our ultimate goal is to better understand the interactions between them. That analysis will be the focus of the later chapters in this book. In this chapter we will prepare the ground for that discussion by examining four cases where meso-level actors clash. These clashes are what led to many of the barriers to Open Scholarship introduced in the previous chapter.

These clashes arise out of the differing values, histories, incentives and cultures of different meso-level actors. Universities and publishers are not simply made up of different people. They have different revenue models, value systems and cultures, and these will respond to changes in different ways (David 2003). Businesses, for instance, may see Open Access as a threat to existing revenue sources, while community-led groups may see it as an opportunity for public engagement. More subtly, a disciplinary community will value different things (publishing in conference proceedings, for example) to a university, or university department (which may prefer books or journal articles). Individuals may, of course, be members of more than one community or organisation. The head of department demanding one thing of staff may be the same person privileging the value of something entirely different in a disciplinary community context. This means that an institution's values and motives towards Open Scholarship will also be affected by the practices of the other institutions to which its individuals do (and do not) belong.

This leads to situations in which organisations and communities are trying to resolve and negotiate internal differences in values and motivations while simultaneously seeking to communicate and negotiate with other meso-level actors in a constantly changing landscape. The mixture of overlapping groups, internal inconsistencies and disagreement over shared values leads to a complex and messy situation. Motives and values seem to clash everywhere, and this in turn hinders the agreements required for adoption of Open Scholarship practices. If we can't agree on what outputs signal good scholarship then it is very difficult to agree on how we might adapt and change our priorities on outputs to support Open Scholarship.

To provide some structure to this complex set of interactions we will divide our discussion into two main types of clashes:

▶ Responsibility clashes: where values are at stake there will be disagreements over who has the rights and responsibilities to rule on how values are expressed. Open Scholarship can involve new kinds of work and systems and new roles to support them. Disputes can arise both from too many actors wanting to take control and from actors not being able to agree who should take responsibility

▶ Revenue clashes: a revenue clash will arise when there are differences in the financial interests of meso-level actors who are in contact with each other. In some cases these will be resolved by well functioning markets that support negotiation. However, the shift to Open Scholarship involves changes to established business models. The potential for loss of revenue, or even viability, is a major contributor to clashes that we can see within the context of Open Scholarship

Responsibility clashes and revenue clashes differ in their character and it therefore makes sense to interpret them as different categories. In order to solve responsibility clashes, a common vision and development of shared values will be required. They will be solved by a division of labour that is perceived as just and justified by the actors involved. Solving revenue clashes requires the construction of markets or negotiation spaces in which there is a shared understanding of what academic goods are being exchanged, how this can be managed fairly and what the goals of exchange are. Responsibility clashes will frequently revolve around the 'what' while revenue clashes revolve around questions of 'how'. In the remainder of this chapter we will discuss a series of examples building on the interactions between actors discussed in the previous chapter.

Responsibility clashes: who does what work and where?

One of the main motivations of the Open Scholarship movement is to share more of the outputs and process of scholarship with the goal of making research more collaborative, participatory and transparent (Friesike and Fecher 2016). This may mean developing new types of research output, sharing more of the outputs we have and more effective and broader sharing of outputs that are already part of our dissemination processes. All of this requires new kinds of work. It also frequently involves wider and deeper collaboration and cross-institutional collaboration is a driver of success (Lee and Bozeman 2005). New outputs, forms of sharing, kinds of work and breadth of collaboration also require new supports in the form of infrastructures, both technical and social. It is therefore helpful to distinguish between responsibility clashes that relate directly to the work and responsibilities of researchers, and those that relate to the responsibility of providing supporting infrastructures. In this section we discuss the responsibilities of researchers as authors and reviewers, and the support of curated databases as examples of these two types of responsibility clashes.

Responsibility clashes in the activities carried out by researchers

A major objection of researchers to Open Scholarship agendas being driven top-down by macro-actors is that they demand more work. Sharing a wider range of research outputs, such as data, is more work. In addition to this, the interaction of these newly shared outputs with existing systems and assumptions can create further work in ways that can rapidly spiral out of control. Data sharing provides a good example. For researchers not already embedded in Open Scholarship discussions the idea of sharing may start from an assumption that all formal outputs are peer reviewed. If data is to be published, they reason, then this will substantially expand the work of peer reviewers. The response may be, and frequently is, that it is unnecessary for this data to be peer reviewed. There are therefore two responsibility clashes in play: whether a new responsibility needs to be taken on at all, and if so, who will take it on.

Similarly, post-publication review presumes that academics will keep revising and updating their manuscripts. It also implicitly assumes that someone (the editors? the reviewers?) will continue to monitor those revisions and updates to ensure that they occur. Expectations of public engagement and social media create additional workloads and additional clashes over what standards and expectations from our more traditional systems apply, and in turn who is responsible for monitoring them. In the context of the professional scholar and their position in the meso-institutions such as universities and research institutions that pay their salaries, the question arises about what responsibilities are connected to the researcher's job. What are they actually paid for?

The roles of professional scholars in their workplaces is, and should be, changing. It has also become more heterogeneous. While, a generation ago, researchers were primarily concerned with teaching and publishing,

the job profiles have expanded and diversified considerably in recent years. New fields have emerged, research activities have become much more differentiated and the rise of team-based research makes it challenging for a meso-level organisation to compare the works of individual scholars. However, this has not been effectively addressed through changes to established recruitment and promotion practices.

Authorship provides a good example of this. There is an increasing range of skilled contributors to research who support and publish with different teams. They may be involved in many publications but would rarely be recognised as a primary author, and may not be regarded as authors at all. As a result, a highly skilled group of workers does not have the correct 'currency' to achieve progression in a conventional scholarly career. In some areas new disciplinary formations arise, as might be the case for fields including 'digital humanities' and bioinformatics in those cases where new research centres are formed or core facilities are supported within universities. In others the valuation given to a specific technical skillset is degraded to make its practitioners 'mere technicians'. In both cases universities frequently fail to develop career paths for them and funding agencies often regard them as the further development of laboratory assistants. Funders do not regard it as their responsibility to provide new career structures. Scholarly communities seek to protect the boundaries of what is considered 'proper' academic work in their own spaces, and universities do not feel they have the funding or flexibility to create new systems. Shifts generally come when single actors or philanthropies donate a large sum to a university for the support of a 'new activity', meaning there is limited strategic thinking across the multiple stakeholders involved. This pattern has played out across a wide range of technical skillsets that contribute to scholarship.

All of these clashes of responsibility, values and assessment can contribute to a degradation of trust between scholars and their employers and within groups of scholars. That in itself can block progress towards Open Scholarship, which depends on trust between individuals and groups. In addition, confusion over what responsibilities exist and how they are to be distributed also hampers progress. Together they can create enormous inertia. Where there is limited trust and limited agreement on shared goals, it is much easier to support the status quo than to effect change. To reap the benefits of Open Scholarship practices we need a cross-institutional understanding for an increased diversity of what constitutes academic work. This diversity needs to be reflected in career paths and funding opportunities that individuals can trust will continue to exist.

Responsibility clashes in the development and maintenance of research infrastructure

The shift towards Open Scholarship creates extra work for scholars, or at any rate the perception that extra work is required. One means of addressing this is the provision of new and improved support services and infrastructures that reduce this burden. There is widespread consensus that novel systems and platforms need to be built in order to reap the promised benefits of Open Scholarship. That is, however, where the consensus ends as there is little agreement on who exactly is responsible for the development and, above all, the maintenance of these systems and platforms:

▶ Research organisations hardly acknowledge the work their academics put into the creation and maintenance of systems and platforms. Their evaluation criteria are, for the most part, still concerned with counting formal research outputs like papers and books

▶ Research funders see their main purpose in funding innovative research. In general, this might be the development of systems and platforms but seldom their maintenance. That leads in many cases to situations in which critical research infrastructures lack a long-term survival plan

▶ For-profit organisations see a value in digital platforms and systems but, to them, they are primarily a key future revenue stream. This, for instance, explains why publishing houses have over the last decade heavily invested in academic infrastructure providers such as **Mendeley** (**mendeley.com**), **Figshare** (**figshare.org**) or **SSRN** (**ssrn.com**)

To illustrate the consequences of this clash we will turn to the example of 'curated databases'. The transition from paper ledgers and card index systems to online databases has made it easier for research data to be consulted by a wider range of people or re-analysed for purposes not originally anticipated. The development of these valuable tools has not, however, been accompanied by the development of a shared understanding of how they are sustained and supported.

Universities have a long tradition of curating and preserving collections of physical objects (geological or zoological museums, botanic gardens, manuscript archives). Yet the shifts towards digital, collaborative and co-located research make it much more difficult to decide what responsibility a university has towards a digital database created by its academics. These have the same needs for ongoing curation, maintenance and preservation as physical collections. However, unlike physical collections, they serve a community that is beyond the walls of a single institution. How can such digital collections be maintained after the project funding that created them runs out? The sustainability is a constant issue between universities, funders and

research communities. A particular problem arises when a platform or system is of general use to a community and too big for any single institution to support. Only in a few cases has it been possible to overcome this clash, either by successful collaborations between existing institutions or when a community has effectively organised to seek the support of many institutions in the form of subscriptions. A good example is Phoenix Bioinformatics as the home of the Arabidopsis Information Resource (Reiser et al. 2016).

Revenue clashes: who pays, who gets paid, and how much?

It should come as no surprise that clashes arise over changes to the revenue that supports organisations and communities. Organisations fear the loss of cash flows, and alignment with the goals of Open Scholarship as a principle may not survive an examination of the practicalities of keeping an organisation afloat. We will examine two clashes that arise out of changes to revenue flows. Firstly those that arise from the simple reproducibility of digital files with a focus on the history of 'offprints' (or reprints). Secondly we will examine the challenges faced by scholarly societies that are dependent on legacy publishing revenues as an example of clashes that are caused by a proposed change in fundamental payment flows.

Revenue clashes that arise from the technical possibilities of digital reproduction

Academia needs to address the same technical possibilities of digital reproduction that have transformed the music, entertainment and news industries, for good and for ill. There is, however, a key difference. In most (or at least many) cases the authors of scholarly research do not have a direct financial interest in the revenues related to their distribution. The publishers do. The author's primary concern is the dissemination and attention that their work receives and, as a result, they have little interest in limiting distribution to those who pay, in the way that for

example trade fiction authors or professionally distributed musicians may. On an institutional level, this leads to a clash in motives and values. This is exacerbated by the shift from print-analogue to online-digital production and dissemination but also predates this transition.

Offprints of papers in research periodicals have circulated through personal sharing networks in the scholarly community since the 18th century. They were produced alongside the process of publishing a periodical, but were often available more quickly than the full volume in which the paper would ultimately appear – somewhat like 'online first' today. They offered a way for researchers to build their community and claim their identity through connections to those they shared with. By the early 19th century, learned society publishers had begun offering authors a limited number of offprints for free. In the context of learned society publishing, offprints were seen as a means of improving scholarly communication, and thus a valid use of society funds. In contrast, when commercial journal publishers offered free offprints (from the mid-19th century, copying the learned societies), it seems more likely to have been a form of in-kind payment to authors (because it had become an expectation among authors). The modest circulation of free offprints (around 50 printed copies) does not seem to have raised any concerns that it might hurt sales of the published volume.

The relationship between scholarly sharing and journal sales has become more complicated now that offprints are digital. Authors continue to receive offprints (often as PDF files) for sharing among their personal networks. Unlike paper offprints, digital offprints are an unlimited resource (ie they can be copied and distributed without reduction), and their distribution is inexpensive. The ease and scalability has brought to the surface the revenue clash that existed all along, that distribution of

free copies by authors could reduce, or be perceived to risk reducing, the sale of print copies or subscriptions by publishers.

As the clash has become more obvious the trust between authors and publishers has in part broken down. Authors generally have no interest in the profitability of publishers, even though they may have an interest in their continuing sustainability. Researchers adopt new means for distributing free copies of their works: via email, through social media, uploading them to a wide range of general and specialist sharing platforms, making them available on their own websites or pointing users to illegal but reliable sources like **Sci-Hub** (**sci-hub.tw**). Publishers, on the other hand, are anxious to limit the free copies. They take legal action against **ResearchGate** (**researchgate.net**) or Sci-Hub, while running the risk of upsetting researchers and their institutions.

It is instructive that publishers have targeted the platforms, and the platforms have in a number of cases responded by notifying authors. It is not strategic for publishers to make authors too aware of this clash as the goodwill of authors is a key asset for them. Directly engaging authors would further degrade trust with the likely consequence of authors turning further to parallel sharing pathways. All of this means that partial solutions to the immediate problem are adopted rather than addressing the core issues, that there is a mismatch of interests in the dissemination of scholarly work published under a subscription business model. The clash itself, as well as the lack of a resolution, hampers progress towards Open Access as one component of Open Scholarship.

Revenue clashes that arise from changing the business model of publications

One area where researchers are frequently more aligned with the interests of subscription publishers is where they have a significant involvement in publishing within a scholarly or learned society. Learned societies and subject associations usually see their mission as supporting or promoting their field of scholarship. Typical activities include organising meetings and conferences for members, offering grants to support early career researchers, issuing a newsletter or website to circulate news among members, and acting as advocates for their discipline (and its members) in wider society. These activities are traditionally supported by membership fees, philanthropic donations and (in some cases) endowments.

But some societies and associations are also publishers of one or more journals or book series. The selection and publication of research is seen as an important part of the scholarly mission, and traditionally (pre-1950) was financially supported in the same way as other activities. But, with the development of the subscription-based model of journal publishing in the mid-20th century, publishing became a source of income. This has transformed the way societies think about their publishing activities. Rather than being a direct benefit to the scholarly community, publishing a journal became a way of financing other activities (e.g. conferences or grants for postgraduates). If publishing comes to be seen as a source of money, rather than part of the scholarly mission, then the potential transition to Open

Access becomes a means of reducing income and decreasing the range of scholarly activities, rather than a good thing to do. And this, in turn, raises the question of how a society or association can reconcile its commitment to circulating scholarship with its desire to generate income to support its members.

This revenue clash may be internal to a scholarly society or association, a debate on how to move forward in balancing its different roles and financial sustainability issues. It also may be external, placing scholarly societies at odds with funders and others advocating change. Some scholarly societies have taken a progressive leadership role, directly advocating for change. Others have taken much more conservative positions, frequently associated with having a significant publishing revenue. Others are effectively large corporations that disburse revenue to member activities rather than shareholders. Each of these categories has different perspectives and motivations. The clashes that result are driven from different prioritisation of the goals and needs of the organisation.

Conclusion – understanding the interactions of institutions is crucial

Open Scholarship can be seen as a shift from established research practices. While many stakeholders in academia agree that Open Scholarship is, in general, desirable we see that motives and values clash when we investigate the transition towards Open Scholarship in detail. We further see that these clashes are only in part due to changing financial models. It

would be a misguided simplification to assume that the commercial publishers prevent Open Scholarship on their own, while academia itself does everything it can to implement it. We see that institutions of scholarship can have diverging interests themselves. Moreover, the responsibility clashes illustrate how difficult the scholarly system finds it to adapt to changing roles and tasks. Finally, we demonstrated that the way today's activities are performed and appreciated is heavily influenced by the past.

Our examination again highlights the complexity of the scholarly economy. Complexity in itself is a contributor to inertia, as many institutions struggle to define internally how they would prefer to design the transition towards Open Scholarship. The moment we add interactions with other institutions to these struggles we get the 'messy situation' we are currently confronted with. While the clashes we outlined hinder the academic system from adopting Open Scholarship practices quicker and more holistically, there are still some key messages that emerge from this chapter:

▸ Institutions are not monolithic entities with a clear strategy in regards to Open Scholarship. Rather, they are complex structures with multiple revenue streams and different value systems within themselves. Some of these value systems may be financial, while others may be accounted for by the institutions' history

▸ The history of our academic institutions is a key ingredient in the clashes we witness. With Open Scholarship we are at a point where institutions need to revise the paths they are on. This, however, is exactly what our institutions struggle with. No institution in the scholarly landscape is an isolated actor – boundaries are blurry and permeable – and things get even messier when institutions need to communicate, translate complex ideas amongst themselves and interact

▸ To further make sense of how institutions in the academic economy interact, it is indispensable to look at adequate economic models. The following chapter will do exactly that and, together with an understanding of the clashes that hinder a transition towards Open Scholarship, it might equip policy-makers with a set of lenses that will, hopefully, prove to be important in the development of policies

Chapter 5

Analysing scholarship with economic models

One central challenge for enabling Open Scholarship is finances. How will it be funded? To what extent, and in what ways, do the changes in practice implied by Open Scholarship align with, or oppose existing economic systems? Where we identify 'blocks' and 'inertia' can we understand the extent to which they are only financial issues, or is there more at stake? By pushing for change do we risk undermining the sustainability of communities and groups, or even threatening their identity? Our goal here is to better understand the barriers to progress and to identify more precisely how they differ and how to tackle the different issues. Beyond this we need to establish sustainable economic structures that support the practices of Open Scholarship as the new status quo.

In Chapter 4 we saw that the motivations that underpin clashes between meso-level actors lead to a range of competing interactions. In this chapter we apply established economic models to investigate the extent to which they can help us understand and analyse these interactions. The chapter focuses on three specific examples: Open Access publishing, research data services and identifier services. It seeks to analyse them through a range of economic models. We will find that, although these micro-economic models can help us to understand why change is difficult, they do not usually provide a clear guide as to how to address this.

Some of the challenges are due to the nature of the markets in which the transactions between scholarly actors take place. Others are due to the changed nature of the goods and services in an increasingly digital world. The primary focus is on interactions of micro-level actors – researchers, research support staff and citizens, used as examples in Chapter 2. However, as the chapter proceeds we will see that it is essential to also consider meso- and macro- actors. However, including these high level actors complicates any simplistic economic analysis significantly.

The changing nature of the scholarly environment

Part of the argument of this book is that there is an opportunity for better, more efficient and more inclusive scholarship. Because some things are easier, or cheaper, or in some sense more effective, we can do better. These are all economic arguments at heart. Equally we argue that some of this change is hampered by issues including lack of resources, community resistance to change, or a lack of coordination between actors. These can also be framed as economic arguments.

'Economics' is not easily defined. It is too easily reduced to being merely a question of finances, or too tied to particular political ideologies. It is not infrequently attacked for making unjustified and simplistic assumptions, and as a result too often resulting in simplistic proscriptions as to the optimal action. However, at its best it provides a range of frameworks for categorising and analysing how individuals and groups interact when exchanging things, and how the characteristics of those goods in exchange affect the

ways in which they are, and can be, exchanged.
Therefore our first point of introduction is to identify
which goods are important in the scholarly landscape.

There are at least three broad categories of goods that
we need to consider:

▸ Directly financial 'goods': money, and access to it

▸ Concrete goods such as digital and physical
   content: publications, data and software, including
   control over them through monopoly rights such as
   copyrights and patents

▸ More abstract goods and capital such as
   researchers' time and 'prestige'

The economic literature notes that goods have two
important characteristics that determine how they can
be produced and exchanged. The first of these
characteristics is whether a good is 'rivalrous' or
'depletable'. This is defined by the degree to which
using, or taking, the good reduces it. An apple, a tree
from a forest and a physical book are all rivalrous. Once
taken they are no longer available. By contrast a digital
book is not taken, only copied. It is therefore almost
purely non-rivalrous or non-depletable.

Figure 5.1 - Ostrom's division of goods

Excludable
A good to which consumption can be effectively
excluded, by for instance a subscription barrier.

Non-excludable
A good to which consumption cannot effectively
be excluded

Rivalrous
Goods that are depleted by use. Characteristic
of physical goods

Non-rivalrous
Goods that are not depleted by use and can
therefore be infinitely shared. Characteristic of
some digital goods

Public Goods
Non-depletable goods that are non-
rivalrous. Generally provided by or managed
by the state

Private Goods
Goods that are depletable and rivalrous.
Generally provided well by competitive
markets.

Common Pool Resources
Depletable goods that are hard to exclude
use of. Best managed by communities.

Toll Goods/Club Goods
Excludable but non-rivalrous goods. These
often underpin membership based groups.

The second characteristic is ease of exclusion, meaning how easy is it to prevent access to the good. A physical book in a sealed vault is excludable, but so is a digital book controlled by an access system that restricts reading to subscribers. These two characteristics, rivalry and excludability, are frequently combined into a four-part classification (Figure 5.1) of goods with different characteristics[21] (Ostrom 1991, Governing the Commons). A significant amount of economic work has shown that different classes of goods are produced by different kinds of economies and markets, and require different kinds of management and governance to be sustained.

In general, digital scholarship radically changes the economics of knowledge goods. They become less exclusive and shift from being largely or entirely rivalrous (either I have them or you have them) to being largely non-rivalrous (can be copied without loss). Our systems for funding and producing these goods were in many cases dependent on exclusion. This can be more challenging in a digital world (eg digital piracy is impossible to completely prevent). At the same time the digital transition can lead to greater control over goods. For example digital knowledge goods, such as books and journal subscriptions, are generally rented rather than purchased. The right to re-sell a purchased physical book or journal copy is protected under 'first sale rights' – ie the right to sell a purchased, physical copy of a content work – but equivalent rights for digital copies are not clear. Regardless of the legal rights it is often technically possible, and not costly, for a publisher to revoke digital access with the flick of a switch.

This shift of goods from private to public is one of the major themes of ongoing economic change in the scholarly landscape, and, as we shall see, a driving factor behind the challenges of using simple economic models. The next step is introducing some of the systems in which goods are exchanged, and the use of markets as good, or poor, tools to provide certain types of goods.

The exchange of goods in markets

Goods are exchanged in many ways and for many purposes. They may be transformed into new goods, utilised by their holders, hoarded for future gain or future use, or even destroyed. A market is any system in which goods are exchanged. It is a technical term which is also used in common language and as a result can easily be confusing. Within the scholarly community you may often hear arguments based on the presence of a 'well-functioning (or non-functioning) market' as well as arguments against 'marketisation'. These arguments are of two types. The first, based on the idea that a properly functioning market is necessary to deliver certain kinds of optimisation, uses 'market' to refer to a market with particular characteristics (see below).

The second is an argument against particular kinds of governance that are driven by financial considerations, or 'market-logic'. Sometimes this kind of conceptual framework is also referred to as 'neo-liberalism'. In this book we use 'market' to mean any system or form of exchange. We use 'competitive market' or 'market competition' to refer to the specific class of markets that are based on self-interested interactions between individual actors and where concerns of 'market failure' to deliver some sort of overall optimum are most common. We focus on whether the markets we have in practice are predicted by economic frameworks to lead to outcomes that align with the goals of Open Scholarship. We intend that economic understanding be a tool to guide interventions, not to limit our scope to imagine possibilities.

Having introduced the concept of different types of goods we can now move over to consider how markets are shaped around provision of these goods. In economics a distinction between four different market conditions is usually made:

Footnotes
21 (Ostrom 1991, Governing the Commons)

1. Pure or perfect competition is a theoretical market structure in which the following criteria are met: all firms sell an identical product (the product is a 'commodity' or 'homogeneous'); all firms are price takers (they cannot influence the market price of their product); market share has no influence on price; buyers have complete or 'perfect' information – in the past, present and future – about the product being sold and the prices charged by each firm; resources such as labour are perfectly mobile; and firms can enter or exit the market without cost.

2. Monopolistic competition is a type of imperfect competition such that many producers sell products that are differentiated from one another (eg by branding or quality) and hence are not perfect substitutes. In monopolistic competition, a firm takes the prices charged by its rivals as given, and ignores the impact of its own prices on the prices of other firms.

3. Oligopolistic competition is a market structure in which a few firms dominate. When a market is shared between a few firms, it is said to be highly concentrated. Although only a few firms dominate, it is possible that many small firms may also operate in the market.

4. A monopoly market is characterised by a single firm, price maker, barriers to entry and possibly price discrimination.

One thing that is obvious from this categorisation is that each of these is a theoretical set of conditions that will never be met in practice. Nonetheless, by understanding such categorisations we can ask how it is that actual conditions in scholarly 'markets' differ from these conditions, and therefore how theoretical models of these systems may break down. Similarly it should be clear that our neat division of goods into binary distinctions is also false. There are no purely public or purely private goods, and the complexities of common pool resources and club goods are even greater as excludability can be hard to pin down.

The interaction between market conditions and the goods they can produce

If the point of economics is to understand how, and under what conditions, goods are produced and managed effectively (or not) then it follows that these different forms of market would be expected to produce different categories of goods. The simplest example of this is the theoretical prediction that a well functioning competitive market, one that is near the conditions for 'perfect competition', will efficiently support the production and management of private goods, even if this is a complex process. That is competitive exchange, where each micro-actor self-interestedly works to maximise their own benefits and is good at generating and managing goods which are both excludable and rivalrous.

The converse prediction of classical economic theory is that these kinds of competitive markets do not produce public goods. Shared systems – including functioning legal institutions, public roads and the air we breathe – will not be produced by markets and will not be well managed by markets driven by the self-interest of individual actors. In theory at least, self-interest prevents the individual actor from contributing to goods that anyone can use. This means, again in theory, that the rational, self-interested actor will merely use such goods but not contribute to their creation. Because all actors are supposed to be rational they will all become non-contributors or 'free riders', and the public good will not be produced or managed optimally. The conclusion of economic theory is that these 'shared goods' need to be provided and funded through some form of compulsion. The provision of public goods, which often take the role of infrastructures in one sense or another, is therefore dependent on actors that can compel a system to both contribute and provide such goods.

These are mostly actors that take on the role of government. In our analysis they can be equated with those actors we describe as macro-actors.

Those goods that are neither perfectly private, nor perfectly public, fall between these two extremes. Common pool resources and club goods are predicted not to be efficiently provided by markets of self-interested micro-actors. But nor are they well managed by 'the state' or macro-actors. The critical work of Elinor Ostrom on common pool resources and Buchanan on club economics show that these kinds of goods are best produced and managed by groups (ie meso-actors) [22].

Because they are 'collective' in the sense of requiring contributions from more than one micro-actor they require collaboration that markets made of micro-actors cannot provide.

But at the same time macro-actors like the state do not have the local knowledge and trust that is required to successfully build these systems, at least not as effectively as a group can. Thus common pool resources and club goods are best managed by meso-level actors.

Most of the things we care about in scholarship fit into this middle category to some degree. Goods in this category include grant funding (rivalrous, but intended to be 'open' to competition to at least some extent and therefore partly non-excludable), digital subscription content and data (non-rivalrous but excludable), scholars' time and attention (rivalrous but challenging to exclude) and knowledge itself, which is non-rivalrous but in the form we produce it, still quite exclusive **(see Figure 5.2)**. The digital transition makes content potentially less exclusive but many aspects of rivalry and exclusion remain. At core, the goals of Open Scholarship are to make knowledge goods more

'public-like', both less exclusive and also less rivalrous. However, as the discussion above shows there are no clear lines here, but degrees of exclusion and rivalry, combined with groups and organisations at different scales, some with sufficient power to appear to be macro-actors to the small meso-actors that depend on them. This is a complex environment and difficult to analyse with simple models.

Footnotes
22 The work of Buchanan and Ostrom will be referred to in more detail in Chapter 7, paragraph 'The governance of scholarly common pool resources.'

Figure 5.2 - Scholarly goods are not always easy to place into one of the four categories of goods.

Excludable
A good to which consumption can be effectively excluded, by for instance a subscription barrier.

Non-excludable
A good to which consumption cannot effectively be excluded

Rivalrous
Goods that are depleted by use. Characteristic of physical goods

Non-rivalrous
Goods that are not depleted by use and can therefore be infinitely shared. Characteristic of some digital goods

Public Goods
Non-depletable goods that are non-rivalrous. Generally provided by or managed by the state

Private Goods
Goods that are depletable and rivalrous. Generally provided well by competitive markets.

Common Pool Resources
Depletable goods that are hard to exclude use of. Best managed by communities.

Toll Goods/Club Goods
Excludable but non-rivalrous goods. These often underpin membership based groups.

Examples of scholarly goods and markets

In the remainder of this chapter we take the rather theoretical categories and characteristics we have discussed above and apply them to a series of examples in scholarship. In each case, to sharpen the discussion, we will show how change, focusing on the digital transition, has disrupted the existing market conditions. This can occur through changing the types of goods, as is the case in scholarly publishing. It can occur through new opportunities, which are the underlying driver for research data services, where communication and dissemination networks create

new opportunities for sharing and re-using data. Finally all of these challenges and opportunities create new requirements for shared infrastructure, both social and technical. In the remainder of this chapter we discuss each of these examples, drawing out the importance of networks and networking as opportunities and the investments required to fully exploit them.

Open Access publishing

The debates around the financing of scholarly publishing are well known and widely reported. Increasing subscription

costs, the challenges of the shift to Open Access alongside industry consolidation and challenges to the viability of small publishers encouraged a wide range of economic analyses. The clashes described in Chapter 4 are classically supposed to be resolved through competitive markets of micro-actors and many of these analyses reach a conclusion that this market is not functioning properly. A significant challenge to applying simple market models is the complexity of the sets of actors, goods and services that are engaged in a range of different exchanges.

The standard market analysis perspective of scholarly publishing is that it constitutes a 'two-sided market', where two interrelated spaces for competition exist. In a classic subscription-based journal market, journals compete with each other for the best research manuscripts from authors. The second of the 'two sides' is a competition amongst publishers for subscription or other revenue sources, primarily from a limited number of libraries who have often been treated as a captive market. Both of these markets show behaviour that is partly monopolistic. Publishers provide different content from each other that is not exchangeable for content from other publishers. Authors provide different content (and prestige) to publishers. Greco (Greco 2015) describes how the actions of scholarly publishers can be interpreted through economic theories such as product differentiation, perfect price discrimination and economic rent.

Product differentiation refers to the non-substitutability of journals and the articles published within them, meaning competition is imperfect at best and effective monopolies may exist in practice. Perfect price discrimination is when a seller is able to adjust the pricing individually for each customer, thus extracting the maximum that each customer is willing to pay and, by extension, the entire market. This has long been the norm for libraries and consortia negotiating individual agreements with publishers under no disclosure clauses where customers are not aware of what other customers are paying for the same offering.

Economic rent refers to the excess income above production costs generated by inelastic demand and market imperfections created by exclusivity, prestige, or scarcity of the provided goods. In the case of digital journal articles published under a subscription model the scarcity created is artificial (non-rivalrous goods) and the exclusivity and prestige are strong influencing factors due to the wide-scale use of outlet-based research evaluation as a proxy for evaluating individuals and organisations. Even disregarding the desirable benefit of having research publications open for everyone to read, market theory provides evidence that the subscription-based system is as a whole not a cost-efficient use of resources for its primary funders (ie universities and their libraries) due to the high profit margins extracted by dominant commercial journal publishers.

The transition to Open Access publishing as a value brings with it new opportunities to develop alternate economic systems for financing publishing services. Several models have emerged where alternate markets or different services are provided. The most commonly discussed is financing publishing services through author-side business models, where the author's institution is charged for services, generally in the form of an article (or book) processing charge or APC (or BPC). If we think of authors as pure rational actors we can not expect them to suddenly start choosing to pay for the same publishing service that they have previously received for free.

Of course the situation is more complex than this. Authors have often paid colour and page charges in the past and the services offered with Open Access publishing are not the same. One of the intentions behind the APC model was that authors would become more aware of the quality of services they were being

offered. The dysfunctional two-sided market with its complexities and hidden exchanges (eg voluntary peer-reviewing, non-financial rewards such as reputation and prestige, and incentives such as 'invited' or arranged submissions which receive lighter or faster peer review in exchange for the authors' prestige) was supposed to become simplified to a more transparent one-sided market that better approximates perfect competition for APCs (or BPCs). This would focus attention from one side on the quality of services and their relation to pricing, while focusing the attention of publishers on restraining pricing due to competition.

Unfortunately, there is no evidence emerging of competition either on quality of service or on price. Recent evidence (Siler et al. 2018; Khoo 2019) is consistent with the opposite, rising prices that are unconnected with the precise services being offered and much more strongly connected to the identity and brand of the journal. This can be analysed through price sensitivity and demand elasticity, the extent to which buyers (in this case authors) change their behaviour in response to pricing changes.

The failure of market theory to correctly predict the behaviour of the APC market is not necessarily a failure of market theory itself. It may be due to a misunderstanding of what goods are actually exchanged. There are two complementary approaches to this, applying classical economic models.

The first of these is based on an observation of information asymmetry, even in the context of a completely transparent market. Authors do not have much information, nor do they seem to care about the details of the services that publishers provide. In contrast, publishers have substantial information on the authors that submit work to them, and can make a strong inference as to how much attention a given article or book will receive. In combination with a strongly brand-driven market, where the good in play is not services or knowledge but is the prestige associated

with a publishing venue, this creates perfect conditions for a luxury good market or 'separating equilibrium'.

In a functioning competitive market prices should reach an equilibrium defined by the capacities and interests of buyer and seller. The market acts as a way of optimising the price to the benefit of both parties. In a luxury goods market, such as for high-value watches, sports cars or fine wine, the producer successfully links the brand and prestige of the product to its price. That is, price becomes seen as a proxy for the 'quality' of the product.

If a significant community in the customer base is seeking prestige and sees price as a proxy for this prestige, then instead of prices being constrained they can actually competitively increase. If publishers successfully link price in the researcher's mind with prestige, we may see a runaway price increase. The linking of APC pricing with the journal Impact Factors in the Springer Nature IPO (initial public offering) Documents is a potential example of this. The failure of the IPO itself is an interesting counterpoint to this.[23]

An alternate view of the situation is to reconsider the nature of the goods being created and focus on the groups engaged in that. Potts et al. - (Potts et al. 2017). Examine the idea of treating a journal as a club in economic terms. Starting from an ideal perspective, based on a scholarly society publishing a single journal, they come to a clear conclusion. The investment of the community around a journal should be seen as not generating articles, copyrights or 'knowledge' in some abstract form but as building and defining the community itself.

Footnotes

23 See The Scholarly Kitchen article: Why Was Springer Nature's IPO Withdrawn? https://scholarlykitchen.sspnet. org/2018/05/15/springer-nature-ipo-withdrawn/

Club economic models are built around understanding how the optimal size of the club is determined by the 'club goods' that are being produced and by congestion in access to that good. In the case of a journal Potts et al suggest that the important goods are access to the community itself and its attention on critiquing and refining knowledge products. This explains why in part the digital transition makes less difference than expected; expert attention remains expensive.

In analysing the growing complexity of journals, publishers and publishing systems Potts et al. - '(Potts et al. 2017).' also note that one possible transition is from a 'knowledge club' or an expert community to a 'social network market' in which the goods being pursued are prestige and membership of 'the club of people published in X'. In this sense the analysis parallels that of a luxury goods market, reaching a similar conclusion.

Alternative financial models for publishing
While much attention has been focused on author-side business models, and nearly as much attention on pointing out that too much attention has been paid, there are alternative models. These are covered in more detail in Chapter 7. All of these approaches involve a move away from market competition as the mechanism for cost management. They can involve local subsidy, such as the provision of support for infrastructure on which communities can run publication venues. Libraries providing hosting services for Open Journal Systems software is an example of this. They can involve collective subsidy arrangements, where a range of actors agree to cover the costs, presumably seeking a separate benefit for themselves. Open Library of Humanities is one example. The two approaches (local subsidy, actors agreeing to pay the costs) may also be combined through collective funding of infrastructure systems, both technical and social[24].

The challenge is that all of these involve collaboration and coordination that are not predicted amongst purely self-interested actors. Even on the national levels it has been hard to coordinate, or even gather relevant information about financial flows from the scholarly community to academic publishers (Lawson, Gray, and Mauri 2016). Such 'social infrastructure' would be key to collective organisation to effectively manage subsidies. Initiatives such as **OA2020** (**oa2020.org**) have been instrumental in creating increased collective international pressure for libraries and national consortia negotiating contracts with publishers, but this is going far beyond the micro-level of economic analysis and into strategic meso-level collective action.

Moral hazard in shifting markets
This analysis raises an important question. Are decisions being taken by the right actors, and do those actors have the necessary information to reach the right conclusions? There is a 'moral hazard', or information asymmetry in researchers selecting services that are paid for by other parties, including libraries. The goods in play are not simply articles, or specific services, or money, but also questions of identity and community and prestige. Authors choose publication venues without knowledge of the costs incurred. Author choices are driven by benefits they gain in reaching a specific audience, and being seen as part of that community, as well as the prestige that can help in gaining a job or promotion in their institution. Changing the evaluation of individuals at the institutional level, by reducing the importance of outlet-based metrics through efforts such as the DORA declaration (**https://sfdora.org/read/**), aims to change the micro-

Footnotes
24 This example is featured in Knowledge Exchange publication 'Insights into the Economy of Open Scholarship: A Collection of Interviews'
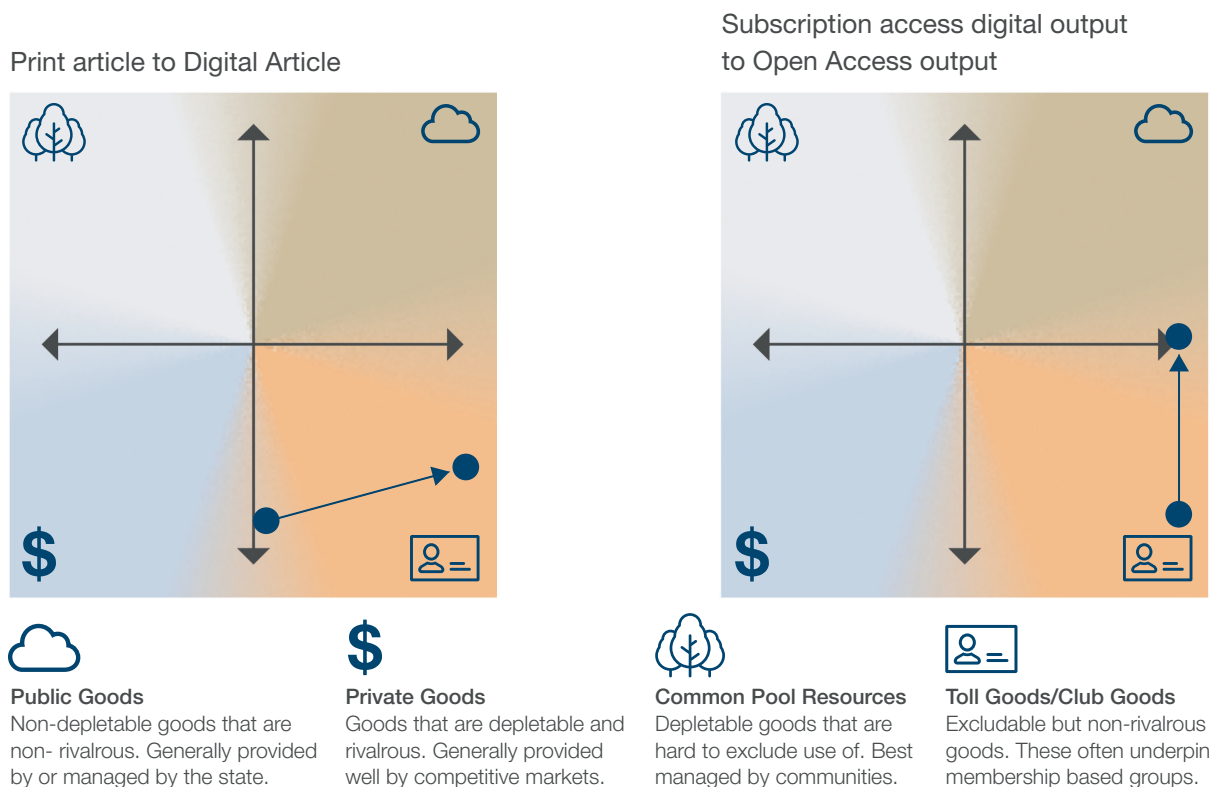
economic behaviour of individuals. Such a change would theoretically support a more competitive marketplace among journals. However, individuals are also engaged in their disciplinary communities, with their own concepts of which publications gain recognition and prestige. There is more going on than can be captured in any simple model.

A simple micro-economic analysis based on the motivations of micro-level actors in competitive markets can guide us to an understanding of why change is not occurring, but it provides little guidance on what to do about it. We can see that competitive markets are not sufficient to generate the desired shifts, but not what form of governance might. The transition from

subscription-based publishing to Open Access publishing is therefore a collective action problem (Wenzler 2017) where progress is slow or non-existent if no concerted action is taken.

Two examples are shown (**see Fig 5.3 below**) to illustrate different processes. The shift from print to digital makes primary research outputs less rivalrous, they are more easily shared without loss, while making it slightly harder to exclude access to them. If we change a subscription access digital output to an open access output we are primarily making it less exclusive and therefore excludable, without making it a completely public good.

Figure 5.3 The nature of goods shifting through digital scholarship.

Print article to Digital Article

Subscription access digital output to Open Access output

Public Goods
Non-depletable goods that are non- rivalrous. Generally provided by or managed by the state.

Private Goods
Goods that are depletable and rivalrous. Generally provided well by competitive markets.

Common Pool Resources
Depletable goods that are hard to exclude use of. Best managed by communities.

Toll Goods/Club Goods
Excludable but non-rivalrous goods. These often underpin membership based groups.

Research data services

An aspect of the transition to digital networked scholarship that illustrates both the opportunities and challenges of economic provisioning is the sharing and re-use of digital data. It is particularly instructive as we see that two quite different shifts were required. First, the shift from analogue to digital data recording, making data copyable and more consistent. Consider the trace of a pen on a chart recorder vs a digital representation of the position of the same pen. The latter can be replicated perfectly[25] and creates an incentive to use a standardised format to ease comparison and analysis.

The ease with which we can transmit, collate, compare and analyse digital data is a triumph of innovation. At the same time it is also one of the most frustrating aspects of Open Scholarship, because we still fall far short of the potential, and the financial challenges of creating high quality reusable data have tended to lead to enclosure rather than to opening up of those created resources. For example, the Protein data bank '(rcsb.org)' existed in digital form as a set of tapes that were physically transported, long before it went online. The real revolution, and the motivation towards standardisation and consistency on a hitherto unimaginable scale, came when those data could be easily copied to anywhere in the world with an internet connection.

To maximise the preservation, curation, discovery and re-use of data requires the provision of high quality curated data resources that are fully open and appropriately support their relevant scholarly communities. These are both technical systems (indexing, platforms, technology, storage) and also human systems providing curation, quality assurance and ongoing development.

However, we find challenges in balancing the need for repositories with ensuring their financial sustainability. For some repositories that want to move to a fully open footing, it is difficult to find a method of underwriting the risk of that transition. Erway and Rinehart (Erway and Rinehart 2016) present an initial review of the various funding strategies that research data management services can pursue, demonstrating that existing funding structures are often not enough to ensure sufficient funding for long-term preservation. The **Organisation for Economic Cooperation and Development** (OECD) Global Science Forum[26] also considered the possible sustainability models in a 2017 report (OECD Global Science Forum 2017).

For data and software, the markets and service providers are less homogeneous. In some disciplines there are longstanding and highly effective providers of data curation and management services. The scale of data being managed and the resources being deployed in these areas can dwarf those being used for document communication. In other disciplines, this is a very new area that is not well supported. The institutions in question range from projects within research organisations, through community governed organisations, to for-profit organisations providing a fee-for-service offering. Data collection arrangements vary significantly between disciplinary areas. For instance, arrangements at the Large Hadron Collider at CERN[18,19] differ greatly to those for the Square Kilometre Array, let alone for the Arabidopsis Information Resource (Reiser et al. 2016). Partly this is a question of different needs for the data, but it is also a question of the history of the development of those services.

There is a pattern in the development (and failure) of these infrastructures that can be understood through

Footnotes

18 https://home.cern/science/accelerators/large-hadron-collider
19 https://skatelescope.org
25 To a first approximation. Consider this a pragmatic not an absolute description.
26 oecd.org/sti/inno/global-science-forum.htm

the lens of group level economics (Neylon 2017). The initial development, based on specific community needs, is usually boot-strapped with limited resources or described as a project. Initial success depends on community building, which may have an explicit membership model.

However, many such services and infrastructures fail to make the transition to sustainability, due to (a) lack of effective financial instruments to transition from a project base to an infrastructure and (b) lack of community support systems that can support effective membership models. As these services grow and become important to wider communities they become more public-like, challenging the capacity of meso-level actors to support them.

Crucial to this is that most complex data resources have been developed during the digital age, whereas digital publication systems carry the legacy of the paper-based systems that had existed for centuries. These systems have externalities and the facilities they require have economies of scale. These facilities are very rivalrous as they are scarce. This means that the implicit assumptions around data management led to conditions where these could not be provided by competitive markets, but needed to be provided by macro-level actors.

The market analysis offers a range of explanations. While there are some data for which a competitive market based approach to provision can be found, there is an adverse selection problem: only the data that is profitable will be preserved or collected. For our purposes, we cannot predict what data that will be or how we might value it in the future. In addition, the pure public good nature of digital data creates clear free-rider problems for existing repositories with a subscription model and seeking a transition to more open access. While we can understand and diagnose the issues, market mechanisms seem unable to provide the

solution here. But simply expecting macro-actors to step in will not scale to support the wide range of interested communities. A solution will therefore require action by communities that can be sustained over the longer term.

Identifier services

Our examples have moved from the concrete financial challenges around the transition to Open Access, through to the large-scale sharing of data. Key to the promise of digital networked scholarship is the idea that the flexibility and comparability supported by these new systems allow us to create, handle, critique and manage more knowledge than ever before. In many ways the goal of Open Scholarship is to realise that opportunity.

That scale combined with flexibility is a challenge. Scale requires consistency but flexibility requires that consistency to be broken. The power of the web and networked digital information more generally is that it provides the means to achieve this, if certain conditions can be met. At their core those conditions require one thing. If you want to combine large scale data sources, you need to be able to identify when records in those disparate sources refer to the same thing.

The consequence of building such a highly populated networked system is a need to be able to tell what is what in a consistent way. Such scale of objects requires a shared infrastructure. At the very root of this is being able to unambiguously identify objects persistently, including research outputs (data, articles, software, even physical objects) and actors (people, organisations). As might be predicted from the argument in the previous section, because these infrastructures are very general in their application, they are very near to perfect public goods. However, their initial development is usually by interested (and sometimes self-interested) groups.

There have been, and continue to be, a range of overlapping and competing identifier systems for scholarly objects and actors[27]. The earliest focus was on objects and content with Handles, Archival Resource Keys (ARKs), Persistent URLs (PURLs), and Digital Object Identifiers (DOIs) being developed by different organisations and communities. These have experienced different challenges and levels of success. The dominance of the **DOI system** (doi.org) developed initially as a membership model for publishers but now seen as a de facto requirement for credible journal publishing services, provides a clear indication of how group level and collective action economics can help to analyse these histories (Neylon 2017).

The more recent history of developing identifiers for individual scholars and for organisations is also instructive. There was a clear market opportunity and need for a service providing unique identifiers for scholars and a number were built, most notably ResearcherID by Thomson Reuters (ResearcherID is now owned by Clarivate Analytics)[28]. The consumer market, consisting of researchers and libraries, showed strong resistance to a commercial operator controlling such a coordinating system. This could be interpreted as a product of risk analysis by consumer groups. However, there was no such coordinated risk analysis and an economic analysis also predicts that this kind of coordination amongst a large set of stakeholders is not feasible. Notably in the case of other systems such as the adoption of Current Research Information Systems (CRISs) by universities, organisations have often purchased such products and services from commercial players (Bryant, Dortmund, and Malpas 2017).

Nonetheless the challenges of adoption for ResearcherID as a product led to a community initiative to build a shared infrastructure. **ORCID (The Open Researcher and Contributor ID)** (orcid.org) was founded on a set of principles that were intended to provide confidence and trust amongst stakeholders. While publishers, particularly amongst the oligopoly, were quick to engage and support the new initiative, the financial engagement of funders and libraries as members was slower to follow. Arguably, the adoption process of ORCID can be perceived as a classic collective action problem, where the adoption process focused on providing targeted benefits to individual stakeholder groups so as to facilitate engagement (Fenner, Gómez, and Thorisson 2011). The process that lead to Thomson Reuters opening up control of ResearcherID as a facilitator also warrants further analysis as it represents a rare case of a powerful first mover being unable to achieve product adoption and therefore market control.

ORCID is now seen as a model, both inspiring a set of principles for the governance and management of infrastructures (Bilder, Lin, and Neylon 2015) and providing an exemplar that is being followed by the **Research Organisations Registry (ROR)** (ror.community) a community initiative that builds on the capacities of the major existing identifier providers **Crossref** (https://crossref.org) and **DataCite** (datacite.org) to provide a community infrastructure for identifying meso-level organisations. The collective action problem to identify the actors that need to address collective action problems is being addressed by other meso-level actors combining to share their experience of solving similar, collective action problems.

Footnotes

27 https://en.wikipedia.org/wiki/Persistent_identifier
28 In April 2019, ResearcherID was integrated with Publons, a Clarivate Analytics owned platform. See https://en.wikipedia.org/wiki/ResearcherID

Conclusion – change requires moving the debate beyond 'broken markets'

We have described the transition to Open Scholarship in economic terms as the reduction of exclusion for scholarly goods. In the context of the digital transformation, we might expect markets to provide a means of driving this transition. The transformation from physical to digital has allowed our scholarly goods to become non-rivalrous, and the costs for making traditional outputs less exclusive have dropped. In addition, digital technologies make it possible to create new value through the dissemination of objects that would previously have been difficult or impossible to share, such as data or software.

Market economic models based on competition between individual actors predict that many of the goods we see as important in and for scholarship will not be efficiently produced. While political debate often revolves around whether markets are 'functioning' or not, one conclusion is that this may not be the central issue at all. In the context of the shift to Open Scholarship, with its changing goods and interactions, this may be even more true. The decrease in the private-like nature of goods in play makes interventions beyond market competition more important.

In each of our three examples we can note a series of common themes. The increasingly public-like nature of the goods creates challenges. Existing players can have substantial influence and power, particularly in markets characterised by some form of oligopoly. Change is often hampered by existing systems and assumptions.

The power of existing players by default led to a disadvantage for the transition to Open Scholarship as monopolists and oligopolists have substantial power. This might include the ability to bundle goods or services or to dictate prices. This is negative in a market-competition focused sense as it reduces competition and therefore innovation. But there are also cases, such as shared infrastructures for identifiers and data services, where such centralisation and control can help guide change. But how would we tell where this is the case?

In examining some of the markets and economies relevant to scholarship, we see that many are imperfect markets with issues of monopolies and oligopolies being quite common. We can use these analyses to diagnose problems and identify some of the reasons for inertia in the transition to make scholarship more open. In many cases, these diagnoses are helpful as an analytical tool that helps us (and all stakeholders) to see the problem. But in most cases, they do little to provide solutions. The common thread is that the solutions lie outside a pure market analysis. They are collective action problems.

Chapter 6

Analysing action at the community level

In the previous chapter we discussed the limitations of a market analysis of the political economy of scholarship that is focused on micro-economic actors and self-interested decisions. While we saw that such approaches can be helpful in diagnosing the presence of problems, they are generally not useful in guiding us towards the shape of solutions or interventions.

At one level this is the standard problem of 'bounded rationality', meaning that actors chase immediate returns leading to premature optimisation. This supports the status quo instead of finding a more global optimum. The solution to this problem will be found in community intervention, developing or adapting institutions that support collective action that can extend over time.

In addition to premature optimisation we also saw the critical importance of groups, prestige, desire for membership and advancement as drivers of behaviour. The value of being part of a group, community or organisation is significant to scholars. This also supports the status quo, because change led by individual actors in a networked system is constrained by their existing ties. Again, this points to the need for acting as groups, communities or organisations, and building institutions that support processes of change over time.

In this chapter we will examine the challenges for groups to address these problems and identify the characteristics of solutions. In particular, we will see that there are broadly two failure modes, one in which we rely too much on bottom-up emergence of solutions, and the other in which we allow control over systems to be dominated by top-down, through environmental factors or network effects. Both of these challenges are connected to the transition to networked digital scholarship. In the first case they are driven by the increasing public good character of digital scholarly

goods, and in the second by the network effects that arise with the massive scaling up of connectivity combined with returns to capital. In both cases the answer lies in empowering groups to act effectively through collective action.

Public good features of digital knowledge goods

We have emphasised the shift towards a more public-like nature of knowledge goods driven by the transition from a print-based analogue world to one of digital networked scholarship. It is also worth noting that the idea of knowledge as a public good has deep roots. It underpins the justifications for monopoly rights such as copyright and patents, which in their original form were intended to encourage the dissemination of knowledge. It has deep roots in the culture of western scholarship.

That these values are never fully followed in practice does not make them unimportant. Indeed the compromises that have limited their expression, the technical limits on dissemination, the institutionalisation of scholarship, professionalisation, careerism and all that is attached to that are at the centre of our narrative. The ongoing tension between dissemination of knowledge and exploitation and control over the value created by its application is part of the motivation for seeking an economic analysis. The sudden shift in the rivalry and exclusion that has resulted from the shift to online digital scholarship has only brought these issues more clearly into view.

Competitive markets and self-interest are, or at least seem to be, an inevitable characteristic of human interactions. As the goods in play in scholarship became less rivalrous and less exclusive it was therefore inevitable that existing systems of markets, organisations, clubs and communities would falter in their ability to deliver an acceptable compromise in the production of these public-like goods. In particular, the fudges and compromises through which we linked the production of knowledge as a public-like (but still in practice rather exclusive) good to the financial systems that support it were inevitably going to be challenged.

In truth, markets never solved these problems. A combination of institutions, clubs, communities and processes of training and membership that supported them did. The idea that market competition could ever solve this problem illustrates both how radical the reshaping of our institutions has been, and how blinded we are to systems, rules and restrictions in which we operate. Merton (Merton, 1973) identified this clearly, well before the economists caught up, showing how our institutional systems and our desire to be a part of them led to the cooperative behaviours and collective action that made scholarship operate in the first half of the 20th century.

The challenge is, therefore, how to build new institutions that support our collective action where self-interest will not deliver. In a world in which the rivalry and excludability that aligned well with content and access subscription models is decreased, systems that rely on that revenue need to change. This change may be quantitative or qualitative in nature. At the same time, access to goods that are becoming less rivalrous, such as the attention and time of expert editors and referees, needs to be carefully considered. Market competition cannot be expected to solve the problem of supporting communities of curators. Alongside this, the new technical world with its large-scale networks requires new infrastructures to work efficiently. Again, as public-like goods, these will not be provided by market competition. The underlying structure of our dissemination networks, once based on physical transport of books to a relatively small set of defined places, now allowing nearly cost-free movement from and to trillions of locations, requires new kinds of supporting infrastructures that are more public-like and more 'infrastructural' than they have ever been.

In turn these new infrastructures have supported a substantial increase in inclusion and equity. More actors from more places can engage with scholarship. This in turn put those existing systems, journals, communities, under strain as dropping exclusion leads to congestion, precisely as classical club and collective action economics predict. Peer review is under strain. Publishers are concerned about the technical issues and bandwidth required to support machine readability. Universities and scholarly communities continue to struggle with issues of diversity and inclusion. The consequences of this strain, congestion in access to the club good, previously controlled through exclusion, lead to increasing rivalry.

Increasing equity and access are core values of Open Scholarship. Our naive market analysis of the costs of digital production and dissemination has led to assumptions about a reduction in costs that aligns with these goals. Opening up access to resources increases the potential usage of those resources, and hence increases the risk of potential overuse. Making club goods less exclusive at the same time can make a club good rivalrous. A transition towards a more open model, then, requires provisions to prevent overuse and associated collective action problems, also described as the tragedy of the commons. The solution to this is, as Ostrom (Ostrom 1991) described, institutions and community governance that manage these depletable and excludable resources effectively.

Network externalities and capital

The previous section positioned communities and institutions as the solution to the failure of market competition to provide increasingly public-like good. But the networks that define communities and institutions can also cause problems. First, the complexity of these networks and the nature of interconnections tend to favour the status quo. Scholars dedicate a large portion of their time to making these connections, and choosing to change individual practice can break them. The web of connections can tie us down. The solution to this issue is collective action amongst meso-level actors. That is, a coordinated shift in the position of the network centres.

The digital network transition also causes a more subtle but more serious issue. This is arguably not a market failure but the success of market competition to accumulate value. The scale and complexity of the network leads to a counterintuitive effect. Institutions that have an initial advantage in connectivity, either through innovation, history or the application of available financial capital, can exploit that position to increase their advantage. This ultimately has exponential feedback effects. Metcalfe's Law[29] states that the value of a network scales with some exponent of the number of connections. In practice that value is asymmetrically captured by those with more connections, creating a network effect. Many web services harness this 'network effect'. The more users they have, the more value they create for each user, and the more value they capture for themselves. They therefore tend toward gravitational hubs. Obvious examples include Facebook, ORCID and ResearchGate, as well as the behaviour of publishers and researchers around top-tier journals, as discussed previously.

The literature notes two kinds of network externality – direct and indirect. The examples above are of direct effects, where the increased value accrues directly to the service concerned. Indirect effects occur where value accrues both to complementary services (for example, connected products from the same supplier) and, thereby, also back to the first service. Such indirect effects can lead to incremental vendor lock-in, where each of a series of procurement decisions can increasingly favour connected products from a single company (such as Mendeley, Pure, Scopus and SciVal from Elsevier; Dimensions, Figshare and Symplectic from Digital Science; in the future perhaps Microsoft Academic, Office etc or Google Scholar, Google Docs and other Google Enterprise tools).

The value accrued via network effects can benefit users as a result of both their own use, or of the use of the service by others. This means that network effects are especially strong in scholarship because of the prestige associated with knowledge circulation – not only books and journals but also, increasingly, data and software. The value to a researcher of engaging with, say, a journal or data archive (as an author, reviewer or user of the knowledge) is more than simply the result of the functionality, visibility and reach available. It is also the result of the level of prestige that a particular channel may connote in the culture of a discipline or scholarship more widely.

An important aspect of these network effects, particularly as they connect to financial capital, is that they are 'flattening'. The network value, as expressed in financial terms, has little connection with the myriad local forms of value, community identity, expertise and knowledge. Instead, it drives homogeneity and instrumental behaviour driven by simplistic shared quantitative measures, with money at the top of that list.

Footnotes
29 https://en.wikipedia.org/wiki/Metcalfe%27s_law

These shared measures damage communities and institutions because they destroy context. Researchers are expected to publish in journals according to some external criterion, not to choose the most effective venue for communication to target audiences; infrastructure systems are judged on their usage, not on what value they create for communities. Most seriously, researchers are judged more by how much grant funding they bring in than by the impact or value of their research, their engagement with students and colleagues or their contribution to communities.

One of the biggest challenges we face in economic terms is the way in which central network actors support the status quo. The services they provide abstract, summarise and prioritise based on existing conventional assumptions of what is 'best'. In turn the meso-level actors that could resist this find it easier to align themselves with these outside definitions of 'quality' and 'excellence' than to defend their own internal views of what makes good research. This is a challenge for scholarship itself if it is to preserve heterogeneity and diversity internally. It is an even greater challenge for Open Scholarship, as it turns the technological changes supposed to underpin change against the actors at the meso-level that might work to drive that change. The solution, once again, is collective action by meso-level actors to work together against these 'gravitational' tendencies. The problem here is that it is exactly those actors whose incentives are being shifted in an adverse direction.

Rebuilding institutional capital

The previous two sections bring us to the very heart of our economic analysis of scholarly practice and the transition to Open Scholarship. Because the knowledge goods that are both the product and the inputs of scholarship and its application are not private goods they will not be efficiently generated by market competition amongst micro-actors. But because they are not perfectly public goods they will also not be efficiently and effectively produced through the actions of macro-actors. As Ostrom (Ostrom, 1991) noted, meddling in the details of production by macro-actors, in her analysis mostly national governments, damaged the local institutions that were managing common pool resources and club goods, such as local community-governed fisheries.

The economic challenge is two-fold. First, supporting the meso-level actors that support the generation of knowledge. Second, encouraging and improving the processes of 'public-making' that support openness in scholarship and achieve the societal goals of knowledge production as an activity that is good for the public, even if it never achieves the ultimate goal of being a perfect public good in economic terms.

The effective role that macro-actors can take to guide change is to support and guide institutions that reduce the cost of this public-making and enhance the benefits of meso-actors in engaging in public-making. The effective role that micro-actors, as well as smaller meso-level actors, can take is to organise. This reduces the complexity of the collective action problem by reducing the effective number of players in the negotiations of how to act together. Both of these involve the building of institutions in the (technical) political economy sense; shared sets of rules, systems, culture and practices that enable groups to work together. Achieving that goal requires building institutional capital.

As we have noted throughout, the Open Scholarship agenda is a response to (and is hampered by) the changes being experienced in the scholarly academic system. the online shift has magnified network effects and driven an accumulation of both financial and cultural capital to powerful institutions that drive behaviour across a much larger population than previously. This has been matched by an emphasis on quantitative assessment and individual competition that has reduced the cultural – and to some extent financial

– capital of community groups in favour of simplistic individual assessments. The role of communities in both identifying high quality work and organising for change has been degraded.

The networks that reduce the costs of dissemination, that enhance the potential for inclusion and create the opportunities for Open Scholarship are also the ones that are exploited by centralising actors for financial gain, and that create the incentives systems that reduce progress to Open Scholarship. The scaling up of the scholarly production system, which is a desirable goal for Open Scholarship, makes it increasingly difficult to allocate resources thoughtfully and fairly. This leads us to reach for simpler and more general metrics of value and quality, but in doing that we apply the same standards across too many actors and communities, driving competitive interactions down to the micro-level. This not only reduces the production of non-private goods but increases the costs for groups to engage in making their collective goods (common pool resources, club goods) more public-like.

Examples of market competition failures and network effects

To make these discussions more concrete we will now turn to some specific examples where competitive markets have failed to deliver solutions and where network effects and capital have driven concentration of control. These examples will be more complex as we seek to tease apart the series of interactions and tensions in play. In many cases the question of whether these examples are 'failures' will be one of perspective, illustrating the different perceptions and interests involved. In all cases there are multiple different ways to view the issues and in all cases we can debate the most promising solutions. All of this illustrates the challenges in building coalitions of meso-actors that can negotiate a shared view, and therefore a pooling of institutional capital, to facilitate change.

Preprint repositories and the missing link between economic and cultural capital

One of the challenges to changing practice is the structural power and institutional capital of the existing publication system. The technical possibilities of using the internet, and later the web, as a parallel dissemination platform were identified by many early pioneers of online scholarly communication. Indeed earlier cycles of similar innovation were also driven by new technical capacities, including a largely forgotten experiment in the distribution of research manuscripts through the National Institutes of Health (NIH) in the 1960s (Cobb 2017). The opportunities to disrupt the institutional capital of incumbent publishers was also seen early on, not least by publishers who acted to squash these initiatives, often successfully (Kling, Spector and Fortuna 2004).

An early and well-known success was the development of the physics preprint **arXiv** (**https://arxiv.org/**). This was the first major success in developing a parallel mode of dissemination using the internet. Building on a culture of sharing manuscripts and an existing community engagement with the new online technologies, Paul Ginsparg[30] built a system that rapidly came to be the heart of a community work-flow and practice for a growing range of communities. The centrality of particle physics to this community is significant as it is a highly networked community, with existing large-scale meso-actors in the form of national and international research facilities.

Footnotes

30 https://en.wikipedia.org/wiki/Paul_Ginsparg

Central to the success of arXiv was Ginsparg's ability to leverage the available technology, platforms and infrastructure to scale up the effort at low cost, including the effective subsidy of using the cutting-edge computing and network infrastructure at Los Alamos National Laboratories. The limit to growth of arXiv was, in fact, the human scaling issue required by performing a basic check of the appropriateness of submitted articles. It is notable that Ginsparg was opposed to the addition of new functionality, due both to the costs of implementation and also to the value of doing one thing well, adopted from the design philosophy of Unix systems. Multiple efforts to add functionality, particularly that of commenting, failed, primarily due to network effects. There was no reason for people to visit the commenting sites when the network and institutional capital was at the central site.

Following the move of arXiv to Cornell in 2001 and the assumption of running costs by the Cornell University Library the increase in the scale of its use did bring costs to significant levels. In terms of collective action economics the unilateral action by one community member could no longer be sustained (Cartwright 2010). The current financial model is an oligopoly with major university users contributing to running costs with additional funding from a philanthropic funder, the Simons Foundation. It has also proven challenging to shift existing funding streams from journal subscriptions to arXiv funding, even when these are for the same community. Partly this is due to the prevalence of big deals but also because the institutional capital tied up in publishing as a practice remains significant.

There are strong parallels and important differences with the history of the **Social Sciences Research Network (SSRN)** (ssrn.com/index.cfm/en/). SSRN was started with similar goals, to enable social scientists to share working papers, again an aspect of existing disciplinary culture for some communities. A key difference is that SSRN was formed as a for-profit entity with the intent of

it being viable as a business. This, alongside the more business-oriented background of its founders, is likely a key reason for SSRN more rapidly finding a stable and sustainable revenue model. However, like arXiv it reached a point where an injection of capital was required to enable a substantial technical overhaul and enhancement of the systems. Unlike arXiv, after a significant period looking for investors the founders ultimately sold the company to Elsevier for an undisclosed sum. From one perspective this is a success story. An innovative company generated significant returns for its founders and value for its community, and was able to gain the capital investment required for further development (Gordon 2016). From another, the enhanced network effects gained by Elsevier, the ability of capital to control and restrain the market and the lack of control of the user community over that process, appear as serious issues (Nagel 2016). One response is to demand that scholarly organisations have legal forms that prevent them being sold. However, this reduces their opportunity to raise capital. Another is to observe that, with a very small number of organisations controlling a very large proportion of the free financial capital in the system, such patterns of purchase and centralisation are inevitable and will feed on themselves unless challenged.

The solutions are not obvious but, with the rise of interest in preprints in other disciplines (Tennant et al. 2018; Chiarelli et al. 2019a) as both a parallel dissemination mechanism intended to complement traditional publishing and as an adjacent innovation with the potential to disrupt traditional publishing, these issues need more understanding. The different governance and financial arrangements (Chiarelli et al. 2019b) for initiatives like **bioRXiv** (biorxiv.org/) and **Open Science Framework-hosted repositories** (https://osf.io/preprints/) raise many of the same issues. As with arXiv the question of how community engagement is not coupled with financial engagement

and support and the challenges of raising capital for ongoing technical upgrades and innovation will become significant. More information on the place of preprints in the current research life cycle can be found in the Knowledge Exchange report Accelerating scholarly communication: The transformative role of preprints.[31]

Paying for publication

If part of the transition to Open Scholarship is a shift in communication and publication processes then we need to consider the options for how these are resourced and how this resourcing needs to change. This involves a community-level decision-making process about the journals to subscribe to and the books to purchase. One of the benefits of university affiliation is the club-like access to subscribed materials.

We have discussed some of the issues that arise when we move to a market in which authors or producers are involved in purchasing publishing services, most commonly paying APCs with the intent of making journal articles Open Access. Through the lens of this chapter we can see how the lenses of both luxury goods markets and social network markets reveal the same issues. Once price can be coupled to prestige or cultural capital, then an expanding network with simply driven incentive structures will drive increasing cultural, and then financial, capital to those holding it.

Due to the 'flattening' and scaling effects noted above the value of publishing in a disciplinary journal, with quality assurance based on local and contextual knowledge, cannot compete with the more generally held assumptions of quality driven by simple numeric indicators. We need to persuade communities to value a diversity of qualities, which will help to build a functioning market. That market could constrain prices via competition on those qualities if multiple stakeholders agree to reassess that value collectively and in a coordinated fashion. The San Francisco Declaration on Research Assessment **DORA** (https://sfdora.org) is a community initiative that is seeking to achieve this.

Another possibility for removing the connection between pricing and prestige is to address not the prestige, but the price. This would enable a return to the situation where authors did not see a price and costs are subsidised by another meso-actor. A specific example is the one we opened this book with, the move of the editorial board of **Lingua** (journals.elsevier.com/lingua) and their associated cultural capital to a new journal. The network was maintained, but there was also no change in visible pricing for authors. This can also be the case when research funding bodies make funds available for Open Access publications. These funds do not come directly from the author or their home institution, but are additionally made available precisely for the purpose of making a publication generally available.

Another mechanism for resourcing publication is to directly support the provision of underlying infrastructure, aiming to reduce costs through community in-sourcing. In this case funders, generally libraries, fund the system or infrastructure that supports the publication process. This might occur through funding of software and platform development, such as the **Open Journal System software** (https://openjournalsystems.com) or the **Collaborative Knowledge Foundation** (https://coko.foundation/product-suite) publishing modules. An alternative is to support a coordinating organisation that distributes resources. Models like **Knowledge Unlatched** (knowledgeunlatched.org) and the Open Library of Humanities operate in this way.

Footnotes

31 Knowledge Exchange 2019. "Accelerating scholarly communication: The transformative role of preprints" https://repository.jisc.ac.uk/7525/1/Knowledge_Exchange_Accelerating_Scholarly_Communications_Sept_2019.pdf

Some of these initiatives move beyond traditional publishing such as the 2.5% initiative in the US (Lewis et al. n.d.), **SCOSS** (**scoss.org**), and the Core Data Resources for the Life Sciences (Anderson et al. 2017; Durinx et al. 2017) which are also intended to address the needs of underpinning infrastructures and data resources.

The actual funding mechanisms here frequently take the form of subscriptions. However, the subscription benefit is not access to content but something more intangible: association with a progressive alliance, an expression of values, and some measure of influence over the strategy.

These models require community coordination and collective action. Some of these models have seen success, and some are still developing. Small-scale changes that have a clear place within existing budgets, such as Open Library of Humanities (Franck 2019) and Knowledge Unlatched (Montgomery 2015) have been more successful than efforts that involve radical shifts, such as the 2.5% initiative. However, it can be argued that some of these have greater long-term potential for transformation. Where there are effective oligopolies, such as is the case for the consortium of biomedical funders supporting the ELIXIR Core Life Sciences Data[32] Resources initiative, progress can also be made. Short-term project funding for new technical infrastructure initiatives can be obtained but, as has been suggested in several places, it is a challenge to build long-term sustainability for such efforts.

All of this, however, does not directly address the interests of researchers and their place in their various economies of status, prestige and time within their communities. Their social capital is tied up in community or group practices relating to their disciplinary communities and professional affiliations. Reducing the costs of changing practice will not be sufficient. Even if those collective action problems are solved, there are still challenges in changing the culture of research communities.

Hidden goods. Markets and exchange beyond money

One way to examine the complexities of scholarly communities, groups and organisations is to examine the flows of goods that are not directly related to money. If we want to intervene and change practices within the context of academia, awareness of the broader motivational forces that drive academic work is required. One expression of this is the so-called 'prestige economy'. One prominent manifestation of the prestige economy in most disciplines is the importance of which outlets, often academic journals, a researcher publishes in. There is generally no direct monetary reward for scholars to publish in outlets regarded as the most exclusive (and thus often most prestigious) but this act of being associated with a prestigious outlet can indirectly influence the career development and thus monetary rewards of the researcher. This goes beyond publishing to other duties, such as being active on editorial boards of journals and being active in various communities, including scholarly societies.

This prestige economy creates inertia for changes in market dynamics, and complicates application and interpretation of pure economic theories in this context.

It is hard for new entrants, for example, in the academic journal market to become established and competitive when there is such a strong emphasis on past prestige in informing decisions about where to submit one's work. And as the discipline's best work is being sent to and published in the most prestigious journals in a given field, the necessity to keep subscribing to these journals is retained. When interpreting economic models and attempting intervention, awareness is needed of this self-enforcing cycle.

Footnotes
32 biorxiv.org/content/10.1101/598318v1

Another form of (generally) non-financial exchange is the commitment of time. Researchers are generally time-poor but do have significant autonomy in choosing what efforts to contribute their time to. As we have noted earlier, the questions of which time is paid for by what organisations is a complex one. One way to understand this 'expenditure' is as a means of building social capital within particular groups that matter to the researcher. This speaks again to the issue of collective action and the community which will be the subject of the next chapter.

This attention to community building is also important in enriching our understanding of the concept of a 'prestige economy'. The question of prestige within which community? More particularly, how does this relate to status and membership? While it may seem like a simple exchange, we may need to consider the status granted within multiple communities and how that relates to the local and specific needs of that community.

If Open Access and, more widely, Open Scholarship are to become widely adopted practices, there is a need to be aware of these non-monetary economies and how they affect the behaviour of researchers. This is an issue in the current system, as well as in preparing for the future. Mandating behaviour that is not compatible with existing motivations and economies is likely to be met with non-adoption or even active resistance because those who have acquired a long track record in the established economy have more to lose than to gain by changing the rules of the game. Early-career researchers are often in a weak position to drive change and, in practice, are often driven to be more conservative as they compete for a limited number of positions.

Conclusion – disruption is an opportunity to build and rebuild institutional capital

The solution to the challenge of collective action is the building of new institutions, including infrastructures, culture, systems, platforms and practices that support Open Scholarship practice. To achieve this we need to build new institutional capital, both financial and cultural, as well as rebuilding the capital of neglected institutions. The current degradation of institutional capital and flux offers an opportunity to do this. 'Creative disruption' is often seen as being tied to right wing ideologies based on market competition as a goal and driver of innovation, but Marx also argued for a form of creative disruption. Each ideological extreme assumes there is a 'state of nature' or 'force of history' that ensures that out of chaos arises a better system. A more pragmatic and historical analysis would note that revolutions offer the opportunity to reshape underlying incentives, but this rarely occurs in practice.

In our analysis we would ascribe this to the combination of network effects and returns to capital. The status quo usually wins. Seizing the opportunity for change therefore involves directly addressing the existing accumulation of capital, and building new institutions that challenge that. Considering the routes to how that can be achieved which will be the subject of the next chapter.

Chapter 7

Institutions and collective action

In the previous chapters we have analysed the scholarly landscape through the lens of neoclassical economics, and examined community and group-level economics as a means of addressing its shortcomings.

We have seen that, while market economic models are often helpful in diagnosing the presence of problems, they are not generally useful in guiding us towards the shape of solutions or actions to support transition to Open Scholarship. Solutions will be found by considering how groups and communities interact, identify and sustain themselves.

The challenge, as has become apparent through the last chapters, is that the opportunities and risks, problems and benefits are all bound up together. What links them all is the accumulation of capital in networks. This capital comes in many forms, in the form of institutions that provide effective community governance, in the form of prestige and influence, and in the form of liquid and illiquid financial assets. Often, the problems we create arise from allowing the easy interconversion of money and prestige without considering what this does to community capital.

In a world of globalisation, digital technologies and increasing complexities in ownership of intellectual property, the academic system is under constant pressure to adapt. Given its decentralised nature, changes to the system always require collective action. The default in a networked system will be to move towards closed; not closed in the sense of access controls, or intellectual property, or proprietary systems and software, but in the sense of control. Turning completely to the other direction is not desirable either. The opposite of control is not 'open', it is chaos. An open system has structures and institutions that support action, constraints, norms and practices that make work possible. We seek neither a defined system of rigid controls nor an absolutist freedom in the negative sense of 'freedom from' (Holbrook 2015) but openness in the positive sense of agency and capacity, both collective and individual. We seek 'freedom to'. The challenge lies in finding the balance that enables it.

To steer necessary changes towards more Open Scholarship it is therefore important to understand how to organise collective action. We will use this chapter to explain what collective action is, why it is crucial for the success of Open Scholarship and which specific role institutions carry in organising collective action in the academic system. Given that many problems and opportunities for academia can be discussed as collective action problems, we can conclude that action towards Open Scholarship is, in general, possible. This action requires a deep understanding of how to make decisions and how to manage interactions between academic institutions. Therefore, a rigorous understanding of collective action is of utmost importance in the context of scholarship.

To achieve this balance, we need to engage in networked communities and to decide on many specific issues of how we can best seize the opportunities. We are well served by a strong body of knowledge that discusses collective action problems. This tells us that such problems are solved by institutions, either by strengthening existing ones or by creating new ones.

Networks and capital. A short recap

The key to understanding Silicon Valley, the revolution and devolution of the web and, indeed, the issues of late capitalism, is the accumulation of capital. We have touched several times on the way in which networked economies can accelerate returns to capital without addressing this head-on.

In Chapter 3 we noted the rise of disciplines, of publishing as a service industry, and of the university being connected. We saw that these were linked, with disciplines, publishing venues and their recognition as 'scholarship' by the academy and universities all being coupled together. What we did not delve into in detail is why these are linked, how the networks that define a discipline, including publishing venues, conferences and prestigious departments act as hubs that accumulate capital. We touched on history, but a great deal more insight will be gained through understanding how the staging, timing and environment in which a discipline comes to be created and recognised, leads to its character. Chemistry, a venerable and recognised discipline that calls itself 'the central science', is similar to physics but also perhaps to history, in a way that all of these differ from gender studies, or digital humanities, or bioinformatics[33].

In Chapter 4 we saw what happens as meso-actors clash due to differences in motivations. What we didn't discuss is how those clashes are resolved. Chapters 5 and 6 provided a view over some of those economic interactions, and led us to the point that collective action to build and sustain institutional capital is critical. The question is how. But before that, the question with respect to Open Scholarship is – how do we take a principled decision about where to break down institutions that need reform and restructuring, and where do we strengthen the institutions that can help us to do that? To answer that, we need to dig further into the questions we have left along the way, to understand networked capital.

Gravitational hubs and the accumulation of capital

Scholarship in the 21st century is extensive, expensive, intensive and complicated. Many of the factors leading to complexity are accelerating. The affordances of networked digital technology now allow scholarship to be undertaken and shared in ways unimaginable just a generation ago. That expansion and acceleration has happened alongside globalisation more generally, the spread of the Web in particular and, contrary to the expectations of its original architects, the rapid emergence of platforms that act as central points of control. Dempsey (Dempsey 2005) observed that Amazon and Google were 'massive gravitational hubs'. That is a familiar qualification, and we can add the social media giants and cloud services, such as Facebook, Dropbox, Skype and many more, to these hubs. Dempsey also noted that

"They are tied into the fabric of user behaviours and applications through an infrastructural tissue of lightweight, loosely coupled, webby approaches. They make data work hard: they extract as much intelligence as possible from growing reservoirs of data, and their services adapt reflexively, based on accumulated data about users."

Footnotes

33 Indeed, all disciplines are different from their original progenitor in the western tradition, theology. The sciences are, after all, a subset of the humanities, not the other way around. The humanities, strictly speaking, are everything that is not the divinities.

The truth of the last sentence about data has recently become a notorious issue, with scandals such as the actions of Facebook and Cambridge Analytica in US and UK democratic processes[34]. What Dempsey (Dempsey, 2005) describes as 'gravitational hubs' is the result of network effects. This concept explains a mostly positive effect that an additional user of a good or service has on the value of that product. The financial aspects of this value have drawn capital, and venture capitalists, to products that offer these network effects, creating massive and architecturally flat systems that are designed to grow as fast as possible, accumulating as much attention and data, and as many users, as possible. Capital is turned to enhancing those effects, creating a positive feedback loop that was decried by Jeff Hammerbacher[35] as leading to a situation where "the best minds of my generation are thinking about how to make people click ads" (Vance 2011).

The link between financial capital and network effects is not surprising, at least in retrospect. This is what competitive markets are best at, identifying value and bringing capital to bear on it to generate further private goods. What is perhaps more surprising is the way these network effects have also been linked to prestige. The academy is not simply failing to compete for the attention of those 'best minds' on problems of societal interest by providing less money than enhancing click-throughs, it has also lost its prestige, authority and credibility as a source of reliable knowledge. Prestige and cultural authority have often been connected to finances. The sponsors and patrons of early scholars sought prestige through expenditure on knowledge creation and the arts.

Many would argue that the loss of (perhaps largely unearned) authority is a good thing for the academy. Certainly a greater involvement with wider communities is part of the agenda of Open Scholarship. Engaging with global scholarly communities will require a greater respect for different kinds of knowledge and knowing.

But equally, if scholarly knowledge is to have value, it must garner societal and community acceptance, even respect. If we discard traditional 'authority' based merely on prestige then we must earn new kinds of respect (which is simply prestige with a positive spin) and build new coalitions to achieve that.

Within the scholarly landscape the same issues play out at many scales, and in each of the four arenas in the KE OS Framework. If the above focused on the political and social arenas we also need to examine the parallel issues in the technical arena to return to the economic argument. As services with network effects continue to grow in size and improve over time (for example, as a result of user interface design), it becomes increasingly difficult for local solutions from the academic system to compete.

As with the Silicon Valley examples, the value that is being created and captured in these networked systems attracts those with free capital who can invest in enhancing them further. These are systematically commercial providers who combine free capital and the freedom to deploy it.

Footnotes

34 https://en.wikipedia.org/wiki
Facebook%E2%80%93Cambridge_Analytica_data_scanda

35 https://en.wikipedia.org/wiki/Jeff_Hammerbacher

Commercial providers are consolidating the most diverse services, not just offering solutions but developing complete ecosystems that the academic institutions and communities are finding increasingly difficult to escape. Even if parts of the academic system decide not to participate in these ecosystems, they soon realise the serious consequences of this decision. Those who do not participate in the ecosystem have a smaller reach, are evaluated less favourably and have fewer opportunities for collaboration: all important for scientists.

Consequently, researchers are dependent on ecosystems, which in turn empowers the operator of that system to systematically increase the cost of staying in the system and maximise the cost of leaving. The user-friendliness for researchers is significantly improved. They have digital tools that they often don't even have to pay for, their research has a wide reach and they get an extensive look at what other scientists produce. However, the increased cost of either staying or leaving established systems creates a dependency with no real alternative.

What is a major concern is that services founded without commercial interest, that have grown organically within scholarly communities, change ownership essentially overnight, and thus the value accumulated in the networked services can be leveraged for increased market control and commercial purposes. One example of this we have already covered is SSRN. Though the service is operating largely unchanged for end-users, giving full power and control of the service and its data to the largest commercial publisher ensures that the service policies and future development do not form a threat to commercial interests.

Another example highlighting that large academic publishers are seeking to buy up and monopolise the digital platforms that scholars use for their work is Elsevier's acquisition of US-based Aries Systems[36].

Aries Systems offers workflow tools for academics, and the acquisition is seen by some observers as the latest step in a strategy by big publishers to create an end-to-end platform on which academics do everything from devising a research question all the way to tracking how many citations the resulting paper garners. In many ways, such a platform could make life easier for academics – but it could also lock them into a particular publisher's system. If that happens, some fear, large publishers with a captive audience could raise prices at will and also gain even more power over the research process. Acquisitions like this can also be interpreted as defensive moves, where potential threats of emerging alternative practices are extinguished before they become negative impacts on the bottom line.

The challenge here is to not simply observe and bewail that things have gone wrong, but to ask how we can collectively design institutions that are capable of achieving scale and delivering on our aspirations for greater openness. It is through a rigorous application of our understanding of the way in which institutions can solve collective action problems that we will be able to identify the possibilities and design principles that preserve academic autonomy, while solving the ever-larger problems we face in a globalised, networked world.

The institutions that make up the rich tapestry of the scholarly world (journals, conferences, societies etc) are bit by bit eroded by platforms that favour homogeneous services that can be used by the widest range of users. For example, the humanities are perhaps the discipline most strongly resisting the long-term trend toward journal articles and citation metrics being the homogeneous form of scholarly communication and evaluation, and the platforms and services that underpin

Footnotes

36 elsevier.com/about/press-releases/corporate/elsevier-closes-its-acquisition-of-aries-systems

that form. In other disciplines, societies have either become indistinguishable from commercial publishers, or have contracted their journals to those publishers, making those journals profit centres rather than institutions that act in the best interest of scholarship. In order to deal with this, we must understand how the organisational structure of the academic system functions and what form of action is actually possible within it. Therefore, in the following section we will discuss why collective action is such an important method to make the science system capable of operating in its own best interest.

Institutional capital and the governance of hubs

The solution to the challenge of these gravitational hubs is strong community institutions that can act to preserve community autonomy and agency and to limit the accumulation of capital by non-community actors. There is, however, a problem here. For such an institution to be able to act in such a way it must itself have sufficient critical mass, and therefore capital, to be an effective economic actor. It must, in fact, be a gravitational hub in its own right.

If this is true, then what principled stance can be taken to define which of these hubs is 'good' and which 'bad'? One approach, championed by many in the community, is to define not-for-profit organisations as good, and for-profit organisations as bad, or at least to require that for-profit players have their areas of action limited. Another common argument is that small organisations are preferred over large ones. However, many of our examples illustrate that this criterion is, at best, a poor heuristic. It could be argued that Crossref and ORCID (both not-for-profits) only exist due to the actions of large for-profit publishers. Both are valuable because of their scale and domination of the identifier space. Both have raised concerns due to the same issues. In addition, examples like **bepress** (bepress.com) and **HighWire Press** (highwirepress.com)

– where not-for-profit operations were sold to for-profit operators – show that local tax status does not prevent acquisition. Equally, not for profit status does not prevent an organisation operating alongside and with the same motivations as for-profit entities.

These are largely well-worn arguments. A new insight arises out of the idea that community institutions need to act as pools of capital. That is, in many jurisdictions a not-for-profit status can prevent a community from investing in those institutions. While we may invest time, effort and attention into these institutions we are, in many cases, legally prohibited from investing financially in them. This creates an asymmetry which empowers financial capital, and therefore commercial organisations without these restrictions, to exercise greater leverage. The growing interest in organisational forms such as Benefit Corporations (USA)[37] and Community Interest Companies (UK)[38] is a response to this.

Some of the initiatives taken by **Ubiquity Press** (ubiquitypress.com/), a privately held for-profit UK company, to seek community trust provide a mirror to this approach. The development of community contracts and other approaches to create strong commitments on future strategy and behaviour, but not limiting investment and capital growth, are interesting in this respect. **Hindawi Publishing** (hindawi.com), another for-profit entity, has similarly sought to articulate principles by which for-profit entities can interact with scholarly communities, while still retaining the advantages of for-profit status and still being motivated by financial returns.

Footnotes

37 https://en.wikipedia.org/wiki/Benefit_corporation
38 https://en.wikipedia.org/wiki/Community_interest_company

Alternative approaches to creating pools of financial capital amongst more traditional scholarly community organisations are also emerging. The Global **Sustainability Coalition for Open Science Services** (**SCOSS**) (**scoss.org**) is one example of an organisation set up to enable the pooling of capital. Funding initiatives including the **German National Research Data Infrastructure (NFDI)** (**dfg.de/en/research_ funding/programmes/nfdi/index.html**), **OA2020** (**https://oa2020.org**), and the **ELIXIR Core Data Resources** for the life sciences initiative (**biorxiv.org/ content/10.1101/598318v1**) are examples of funders and other partners pooling capital – partly financial, partly social – to collectively move an agenda forward.

These initiatives are social and political institutions focused around governance. Some commercial entities, particularly smaller and less well-capitalised ones, see benefits in gaining greater community trust, itself a form of network capital, through voluntarily constraining their actions. Such constraints will only engender community trust if they are based on community-defined governance requirements. Such requirements are institutions in their own right, requiring their own network capital to have power.

Elinor Ostrom in *Governing the Commons* (Ostrom 1991) notes that the surface solution to many problems of collective action is the existence of a supporting institution – such as agreed governance framework requirements. One example the Nobel Prize-winner points to is the existence of the court system for dispute resolution. However, such a supporting institution creates this form of 'second order provisioning problem'.

One conclusion for Open Scholarship is that, if we are to purposely design new institutions, we must avoid an infinite regress of such provisioning problems, and build on existing institutions, such as shared norms, existing pools of capital and prestige.

Even if our goal is radical change in practice, we must build it on foundations that currently exist.

This points us to a more sophisticated answer to the question of how we recognise the 'good' institutions. The answer lies in the forms of governance and the role of community in that governance but this can easily become circular. If the answer to 'what is a good institution?' is 'one with good governance' then we have simply shifted the problem to one of what constitutes good governance. This is also another example of the second order provisioning issue.

The logic of this book is to seek an answer based in economic analysis; one that utilises our understanding of markets, collective action and capital in the context of globalised networks of scholarship. Gravitational hubs collect capital and network connections to themselves. This is true whether they are 'good' or 'bad'. The critical question is how that capital is reinvested. Does it return to a community, a structure in the broader network, or is it extracted? This allows us, in principle, to judge a non-commercial vs a commercial institution. What is the return on investment? What proportion of attracted capital flows to strengthening network connections beyond those directly linked to the hub? What is the outflow to external investors beyond the community? Fundamentally, what value is being created that is meaningful to us?

Another way to ask this question is, what are the goods that are being created? Are they private goods? Are they rivalrous and excludable and therefore not accessible to the community that funds them? Or are they more public-like? In practice, as we have noted, in the academic landscape many of the important goods will fall in between these extremes, being variously common pool resources or club goods. The goals of Open Scholarship in a networked context can be framed as an effort to ensure that gravitational hubs are managed effectively as common pool resources or club

goods, with efforts and institutions put in place that aim to make them more public-like, taking full advantage of the reduction in rivalry in the digital space.

The governance of scholarly common pool resources

We have referred already to the core work on the governance of common pool resources, Ostrom's *Governing the Commons*. Other important pieces of classical economic theory include Mancur Olson's *The Logic of Collective Action* (Olson 1974) and James Buchanan's *An Economic Theory of Clubs* (Buchanan 1965). Olson and Buchanan developed the now standard economic approaches to demonstrate that large groups will not generate collective (ie non-private) goods. Both then examine the conditions under which groups can overcome this problem, Olson starting from an observational set of case studies and Buchanan working through a mathematical model.

Hardin would later sharpen the mathematical point in his essay *The Tragedy of the Commons* (Hardin 1968) using game theory to make the claim that collective property could not be successfully managed. Ostrom's (Ostrom 1991) contribution, for which she was awarded the Nobel Prize in Economics, was to show how Hardin had got it wrong. In common with Olson and Buchanan, Ostrom's work (Ostrom 1991) – a rich combination of case studies, mathematical reasoning and game theory, and psychological experiment – showed that the critical factor for the successful management of common pool resources was the architecture of the managing community and its institutions.

While we defined institutions earlier in this book, basing that definition on Ostrom's, we have not (to this point) defended the need for what might appear to be a rather woolly definition, "a set of shared rules, practices and systems shared by a set of agents". One of Ostrom's (Ostrom 1991) key insights[39] was that the shared rules that could successfully underpin community

management of common pool and collective resources could be explicit or implicit, formalised in the existence of some organisation (like the Californian court system in her case study of ground water resources) or embedded in cultural practices (as is the case for several of the natural resource commons she described). In our framing, this means institutions are community capital.

Ostrom identified eight principles of communities[40] that enabled them to successfully manage collective goods (such as Common Pool Resources and Club Goods, see page 77, Table 5.1):

Footnotes

39 In the context of knowledge creation it is worth noting that the root of this insight came from observing and valuing the way in which non-western communities were successfully managing resources, and many western communities were not. Hardin, by contrast, was a racist who ignored or discounted the success of what he saw as primitive societies in managing collective goods.

40 An updated version of these rules adopted for digital commons in the 21st century by German Sommerschool on the Commons is presented as a series of points of orientation, or commitments to be made, which makes a useful counterpoint.

Table 5.1 Ostrom's eight principles of communities

1.	Define clear group boundaries
2.	Match rules governing use of common goods to local needs and conditions
3.	Ensure that those affected by the rules can participate in modifying the rules
4.	Make sure the rule-making rights of community members are respected by outside authorities
5.	Develop a system, carried out by community members, for monitoring members' behaviour
6.	Use graduated sanctions for rule violators
7.	Provide accessible, low-cost means for dispute resolution
8.	Build responsibility for governing the common resource in nested tiers from the lowest level up to the entire interconnected system

While we have argued that there are aspects of the markets in the scholarly landscape that are peculiar, there is no reason to expect that the extensive literature on commons and their successful management cannot be applied directly. This is because the goods in the scholarly landscape are not private goods, but are collective. That is, they are common pool resources and club goods, and therefore market competition is not a good mechanism to manage them, but approaches that are suited to these kinds of goods should be. The questions will relate to identifying how specific common pool resources and institutions are related, where competitive markets may be useful and the forms of community capital that are in play.

Not all of Ostrom's (Ostrom 1991) principles are a neat fit for scholarly communities, or for top-down policy agendas. Some of them – including the first rule, to clearly define community boundaries – seem at odds with the aspirations of Open Scholarship to foster inclusion.

It should also be noted that these are rules for sustainability and stability, not for managing change. There are, however, some clear implications for policy implementation that arise from these principles.

Firstly, that successful management of the production of collective resources happens at the level of communities, who need sufficient autonomy to manage their own processes. The role of top-down processes should (ideally) be to enable, to guide and to provide institutions that achieve these goals where appropriate. Secondly, that monitoring should ideally be a side product of what the community is doing anyway. In Ostrom's (Ostrom 1991) work there is a great deal of attention applied to how the day to day use of a common pool resource gets coupled to monitoring the observance of rules. As scholars we observe, critique and integrate our colleagues' and competitors' work and behaviour all the time, but how can that be harnessed to efficiently guide us to monitor each other's Open Scholarship practices?

Ostrom's (Ostrom 1991) work is also a challenge for those who like standardisation. It is clear from her work, and an enormous body of work that follows from it, that local community processes for defining standards are crucial. Global standards are institutions, but for them to become global they need to follow a bottom-up adoption process. The success of FAIR (Wilkinson et al. 2016; Mons et al. 2017) as an aspirational narrative provides a strong example. FAIR, standing for 'findable', 'accessible', 'interoperable', and 're-usable', is an institution. It is not an institution in terms of technical standard but a shared aspiration and narrative that is guiding the development of practice, technology and policy, at least in the sciences. Efforts to define a global definition of precisely what each term means have failed. So have efforts to restrict its scope to only 'data'. However, community-based efforts are rallying around FAIR as a way to organise changes in practice and to develop local standards. In that sense, FAIR is acting as

a shared institution across many parts of the sciences, supporting the development of local standards and practice that have the potential to build into hierarchical systems of practice and governance. If the tooling around local FAIR standards is part of the day to day work of a community then the monitoring of compliance with community standards will be straightforward. Failure to adhere to those standards will likely be attached to graduated sanctions: not having articles accepted, not being invited to give presentations, perhaps being publicly called out for lax practice, and ultimately being ejected from the scholarly community.

One implication that arises from this analysis is that it is important that there are appropriate mechanisms for dispute resolution. Arguably, our current systems for managing the breaching of community standards are far too costly and this should be addressed, while simultaneously seeking to build trust and reliability in those processes. Clearly there is a tension here.

Again, perhaps the most challenging implication for those of us who would like to see strong global standards imposed is a clear signal that the implementation of FAIR needs to be carried out at the local community level. The question that we have not resolved in quantitative terms is precisely what that level is.

Managing for change

As we noted above, *Governing the Commons* provides little guidance on how to manage change. Olson's (Olson 1974) work helps us to identify ways to agree on processes of change. In particular, *The Logic of Collective Action* provides three examples of how groups can act to generate a collective good even if they are too large to act collectively in a simple analysis. These approaches have been discussed in the context of data infrastructures previously (Neylon 2017) so will only be covered in outline here.
In essence, there are three approaches that enable action. In one, the collective good is provided as a side product of generating a private good, so standard

market analysis driven by the competitive self-interest of agents is sufficient. Relatively little attention has been focused on mechanisms by which we can couple self-interested behaviour of actors in the scholarly landscape to greater public-making of scholarly goods. The second approach is enabled where there is a small number of large players amongst the group. In the scholarly landscape publishers provide an example of this. An effective oligopoly of between five and eight players dominates the market, enabling this group to act collectively to create public-like goods. The development of both Crossref and ORCID provides examples of this.

The final approach is compulsion. At one level this takes us back to the role of government and taxation in the generation of truly public goods. We defined macro-actors as those with sufficient power to compel such behaviour. However, Olson (Olson 1974) notes a different route, observing examples where groups voluntarily agree to bind themselves to contribute to the production of a collective good. As Crow (Crow 2013) has noted, this has distinct similarities to the development of 'assurance contracts', a form of agreement where individual agents sign up to contribute to a collective good, if a sufficient number of other agents agree to do the same. **Kickstarter** (**kickstarter.com**) and **Patreon** (**patreon.com**) are examples of such assurance contracts[41].

There has been relatively little effort, beyond crowd-funding of some research projects on a relatively small scale, in examining how these approaches might be scaled up.

Footnotes

41 Another example is the collective agreement of some US states to assign the electoral college votes from their state according to the national vote share for presidential candidates. Several states have enacted legislation that only comes into effect if a specified number of other states enact similar legislation.

More generally, the lesson that a community can agree to bind itself to be compelled to certain action, provided the community as a whole signs up, is an important one for our analysis. We know of examples where such agreements have failed. The original **Public Library of Science (PLOS)** (**plos.org/**) petition was signed by 28,000 people who pledged not to publish in venues that would not allow them to deposit copies of their work in **PubMed Central** (**ncbi.nlm.nih.gov/pmc/**), but the evidence is that few of the signatories actually followed through on that commitment. Again, we can turn to Ostrom's (Ostrom 1991) observations on monitoring and sanctions, and Olson's (Olson 1974) on the structure of the commitment at a community level, to provide at least part of the explanation.

Fundamentally Olson's (Olson 1974) lesson combined with Ostrom (Ostrom 1991) is that change needs to be negotiated by small groups who are empowered to make decisions. By empowered we don't simply mean that they hold power over the communities that they represent but that they are trusted. This means that the individuals at the table hold networked capital. In a commercial setting such networked capital may simply be financial capital, or perhaps market share, but will also require seniority within the organisation they represent. Anyone who has negotiated an agreement amongst technical staff only to have it overturned by more senior strategic staff has observed this distinction. In a community setting that capital will be less clear, harder to measure and demonstrate, and easier to lose. Where these come together the risk of motivational clashes being compounded by clashes in different forms of capital is significant.

We can't state with confidence what scale is appropriate, or where we can be confident that a community leader or representative has the confidence of those that they represent. We don't know in detail how capital interacts across the different types we have noted. These interactions, and the non-fungible nature of the assets and goods in play, go beyond classical economic analysis. What we can say with confidence is that the institutional forms of community representation, both for professional academics and for other key stakeholders including professional staff, wider publics and others, have been weakened by the concentration of capital driven by network effects.

Change can be led through encouragement, through strong narrative, and by well-designed support mechanisms. It can also be compelled. But compulsion requires high levels of coordination, monitoring and ultimately sanctions. Both approaches can be applied, but the fundamental message is that the process will be messy. Building up communities of practice will take time and changing culture is slow. The balance between compelling change and encouraging it through strong institutions, such as funding rules, is not clear. The problems are not technical, they are political and social, but economic analysis and economic approaches have promise in helping to bring the opportunities, costs and challenges together for analysis.

Consequences for stakeholders

While there are limitations in what our analysis can tell us about the specific actions that will best deliver change, we can describe the consequences the principles articulated by Ostrom and the analysis of Olson and others have for specific stakeholders. Some of these are obvious, and some are radical. Most involve some rethinking of the roles that specific stakeholders, both meso- and macro-level, take on in creating the supporting structures for scholarship.

Scholarly and professional communities

Considering Ostrom's (Ostrom 1991) principles in the light of the role of communities, both those defined by a formal organisation and more informal ones, the importance of community definition becomes clear. Stable communities will have clearly defined group boundaries, including those formalised through membership requirements. They will also be sustainable clubs, generating collective goods that members benefit from. Successful communities will act to maintain a level of local control over the rules that govern the production and use of those goods and ensure the rule-making rights of the community are respected. They will also provide community mechanisms that ensure those affected by those rules can participate in modifying and evolving them. There is a clear tension here between clearly defined communities and those seeking to question boundaries, including interdisciplinary research, research from the perspective of disadvantaged groups including most of 'area studies', and the development of new fields and approaches. There is a significant literature on the challenges of building new research communities and supporting interdisciplinary research that might gain from being seen through the lens of collective action and political economy.

In the context of publishing activities this may mean regaining control over the options and choices available to the community. Where community policy has been driven by the business requirements of existing publishing models there is a clear potential clash between the business imperatives and the community needs. The community goal is communication but business needs have (at least in the past) tended towards restricting access. This is true whether publishing services are an in-house operation, for example as found in the **American Chemical Society** (acs.org/content/acs/en.html) and the **Royal Society of Chemistry** (rsc.org), or whether they are sourced from a third-party provider as is the case for many other, usually smaller, scholarly societies. If the capital and

financial flows of publishing are outweighing the voice of the community itself then that is an issue regardless of the organisational form. More than this, it is possible for the community to become dependent on, and not infrequently defensive of, specific forms of financial flows to support community activities.

Another point of guidance from Ostrom's (Ostrom 1991) principles is collective action amongst the meso-actors of scholarly and professional communities. Principle eight states that responsibility for governance of collective resources should be built into nested tiers. The organisation amongst scholarly and professional communities to develop a stronger voice in change will be an important goal. Currently it could be argued that large societies, many with a dominant income from publishing, have a stronger voice than the many smaller societies that exist. National Academies do seek to articulate a voice for scholarly communities but building structures that allow groups of societies, for instance in the humanities and social sciences, to come together at national or regional levels to identify common ground will be valuable.

Equally, scholarly and professional communities will have to engage effectively with the changes required by our changing world and demanded by the changing societies that fund them. We need to note the concerns, that 'stronger' societies may lead to greater conservatism and rigidity due to their significant financial interest in preserving the status quo. There is certainly a correlation between scholarly societies' reaction to Open Access and Open Scholarship more generally, and their dependence on traditional publishing income to support activities. What systems and institutions would balance the conservatism that is necessary for clear community definition with incentives to change and innovate that deliver new communities and new institutions?

Publishers

In many debates around Open Scholarship there is a tendency to conflate 'publishers' with 'commercial service providers'. Our analysis shows that there are two distinct activities here; one that involves publishing as community building (setting standards of peer review, quality assurance and defining identity) and, separate to this, the provision of services that support these activities. As we noted in Chapter 3 these activities became combined in the entities we call publishers during the 20th century.

Ostrom's (Ostrom 1991) analysis challenges this conflation of community building and generic service provision. Community building involves clearly defining the boundary of the community. In turn this means defining the set of actors that are subject to the governance of the community. There is a strict 'in or out' binary and those who are 'in' are subject to the rules, norms and sanctions of that community. Those who are outside are not subject to the rules. The purpose of market-driven services, provided by self-interested actors, is to set up conditions where those who are not subject to those rules, norms and sanctions have opportunities to create value. That value may be purchased by the community but it does not make the provider part of the community. Such a service provider cannot simultaneously be a member of the community. This damages the community by reducing the strength of the rules of membership. It reduces the value of the market by overly restricting the range of action of the provider.

One conclusion of this analysis, therefore, is a need to define carefully which parts of the publishing process are community activities, which are appropriate to be left to a market of service providers, and what the relationship between those should be. This is a complex question. It is not enough to ask whether an organisation is 'part of a community'. Groups of commercial service providers may also have their own

communities, including the provision of their own collective goods. Scholarly community members may also have roles within commercial service providers. This complex overlapping set of communities makes it critical for the scholarly community to clearly define its boundaries and scope of governance, rules and norms.

Another conclusion is that the expectation that 'publishing' is a consistent activity across the scholarly community is an illusion. 'Publishing' and 'peer review' may be shared institutions that many scholarly communities see as important, but the rules and norms that govern them are, and should be, matters for specific communities to govern and adapt. These communities may be disciplinary, geographical or have other common factors. At high levels of granularity we need mechanisms for negotiating what is shared and what is different but, as the many groups who have tried to regularise and describe the myriad variations of peer review have found, any attempt to describe the entire space and define a universal quality standard is doomed to failure.

Commercial service providers

If scholarly communities are to gain the most from the ability of third party providers to innovate, raise capital and provide competitive services, those potential providers need clarity and consistency on the service requirements, the appropriate space for competition and the terms of engagement. In many ways this is simply an application of best practice in procurement; clear definition of requirements, clarity on the process for selection, and transparency and trust in the probity of the process.

Little of this is the responsibility of providers, current or future, but of those that wish to procure services – generally funders, research performing organisations or scholarly communities. Deliberate efforts to foster competition and innovation, and to support the ability of providers to raise capital through providing stability and

predictability, are required. Close attention needs to be paid to how purchasing arrangements play a role in enhancing market competition where appropriate. Current publishing service arrangements are an example where, as we have seen, the current state of the market would require radical change to foster a competitive service-based market. Indeed, the ideal arrangements to create a functional market are far from clear.

A significant part of the challenge is the mismatch between a potentially global market for services, national and regional policy and funding arrangements, and the number and diversity of universities and research performing organisations that make actual purchases. Clear frameworks for engagement and market relations between commercial providers and 'the scholarly community' require that community to have clarity on common norms and structures, as well as purchasing arrangements. Once again, of course, this is a collective action challenge.

Universities and other research-performing organisations

Universities emerge at the centre of our analysis as long-standing formal institutions (in the Ostrom sense) (Ostrom 1991) that organise scholarship and provide many of the key platforms that coordinate the activities of actors. They are important gravitational hubs that collect a range of capital. It seems likely that they compete productively with scholarly communities, both formal and informal, creating a balance that prevents either from becoming too powerful.

At the same time universities are numerous and heterogeneous, making it difficult for them to act collectively. Many of the stories throughout this book can be told from the perspective of universities as a group failing to act due to the challenges of coordination amongst such a diverse group.

For universities, a critical result of our analysis is the necessity to work more effectively together, through coalitions and alliances, mission groups and regional associations. These groupings, the 'nested tiers' that govern collective resources, need to be themselves coordinated. Identifying how this can be achieved, while not raising regulatory issues, will be crucial.

Within universities a challenge is supporting the diverse internal communities that they hold. There has been much discussion of the problems of the 'neoliberal' or 'new public management' university. The guidelines we discuss above emphasise a role for universities and research-performing organisations as platforms for activities that are not managed and controlled, but supported. At the same time, effective support creates challenges of appropriate resource allocation and consistency. Centralised decision-making is necessary for consistency and effective deployment of limited resources. Such decisions impose limitations on the freedoms for the communities that comprise the university. Balancing that tension internally, while forging alliances externally (which will in turn raise similar issues of alignment and common ground), is clearly a significant challenge.

Funders and other 'macro' actors

Throughout this book we have generally described funders as macro-actors and treated them as part of the environment in which meso-actors operate. However, at the beginning we also noted that this wasn't a clean distinction. Smaller funders are more properly seen as meso-actors and even national and regional funders need to collaborate with other agencies and communities to make change. The distinction is perhaps clearest when we consider 'business as usual', where funder systems and policies are most clearly part of the environment in which others operate (macro), compared to their efforts to drive change in research practice, such as towards Open Scholarship, where persuasion and collaboration are critical (meso).

Arguably, one of the significant challenges we face is that policy design often bridges these two roles without sufficient consideration given to the different approaches in communication and persuasion, versus control and compulsion, required for each phase.

Applying Ostrom's (Ostrom 1991) dictums to funders, in their role as macro-actors and proxies of government, suggests that their role should be limited. They should provide mechanisms for dispute resolution, support the nested tiers of governance, and will have an important role at the severe end of a system of graduated sanctions. But they should also enable those affected by rules to make them as far as is possible, and ensure that the rule-making rights of communities are respected by outside authorities, not least the funders themselves.

But funders are also the main instruments for changing scholarly practice. Ostrom's (Ostrom 1991) conception of community governance of common pool resources (of which research funding can be considered an example) is evolutionary. A conservatism of the communities in the various nested tiers is part of the model. In several of the case studies in *Governing the Commons* it is noted that those communities are not always able to deal with rapid change. Funders play a critical role in many places as the main institution that protects the rights of scholarly communities to make their own rules against short-term interventions by government, particularly in democratic and market-oriented systems. In turn, they do this by mediating demands from government, and ultimately from society at large, to make changes in scholarly practice. In this role funders are more properly seen as meso-actors, and as one tier in the set of governance arrangements for scholarship.

However, that mediation requires a balancing of roles, including taking a leadership position, articulating aspirations for change and guiding communities

towards it. It may involve horizon-scanning and strategic analysis to prepare for future changes, including political, technical, economic and social change. In these roles as peak bodies funders would be serving as macro-actors.

In their role as meso-actors, funders are part of the broader scholarly community, negotiating with other meso-actors to enable change and preserve continuity. But as macro-actors they necessarily sit outside it. This complexity of the role underpins many of the issues that funders face and many of the arguments between funders and other stakeholder groups result from the potential confusion that arises. Issues over policy are a good illustration. Funders will seek to make policy as part of an aspiration for change. The response to such policy change may be antagonistic because it is seen as changing the environment in which other micro- and meso-actors need to operate. From the perspective of meso-actors policy looks like law, whereas from a funder perspective it may be intended as direction-setting.

Policy can, in fact, have at least three roles. One is to articulate aspiration and seek to create a narrative. This is direction-setting or signposting. The second role is to enable or support change, often through resource allocation or the setting of guidelines, and sometimes through monitoring of progress. The third role, which is quite distinct, is to maintain standards through formal rule-setting and limitations. A significant problem in our space is that we use the same instruments in all three roles and there is often confusion about the intention and design of specific policy instruments. Internally and externally it would be helpful to articulate clearly which role is connected to any specific action, alongside a clear framework for how they relate to each other.

From the perspective of funders, other stakeholders may seem to ignore direction-setting statements until

such time as they are tied to resources or compliance measures. Other stakeholders often complain that funders (and other macro-actors) move too quickly in setting new frameworks and requirements. Frustration on both sides can frequently lead to the middle step (supporting and collaboration on change) being forgotten. As will have become familiar by now, this is a collective action problem, requiring frameworks and systems that support negotiation, while enabling funders and macro-actors to modify the economics of the environment in a planned way so as to enable change.

While it may be possible to envisage an ideal state in which a set of systems and institutions balance these tensions, we also need to deal with the real work. Some path dependencies are very deep, and some system risks can become acute. Frameworks and systems that support negotiation can be used as barriers to change. In the end, funders act as guardians of the system as a whole and may find it necessary to drive more rapid and urgent change. We may argue about whether this directional and regulatory role should be coupled to the disbursement of funding, but in practice the power that the funding role creates makes this a natural place to locate that role.

In the final part of this chapter we will explore an example of this through an analysis of the changes involved in Plan S.

Plan S through the lens of collective action

The development, motivations for, responses to and implementation of Plan S provide an excellent example to illustrate the use of collective action and collective good governance. Plan S is a policy initiative, supported by an international consortium of research funders called **cOAlition S** (coalition-s.org), originally from a set of European funders to accelerate progress towards full and immediate Open Access to formal research publications. Firstly, Plan S is an example of collective

action amongst funders as meso-actors. It was supported by a coordinating institution, **Science Europe** (scienceeurope.org), through which a range of European funders collaborate. The existence of such a coordinating institution is an important part of how those funders worked together.

The original funders are a group that have worked collectively together over a long period and have similarities in scale and motivations. They are the European funders that have set the strongest Open Access policies in the past. An important part of the motivation behind Plan S has been a frustration amongst these funders about the pace of change. With respect to Olson's (Olson 1974) modes of achieving collective action, this is an example of a small group that seeks to have the influence and capital to drive action by others. Collectively, by coordinating policy and implementation they seek to both accelerate change within their own fundees, and more importantly, perhaps, to draw in additional funders to their agenda. The question of how rapidly progress is made may depend on the extent to which the funders could be thought of as an oligopoly in their space. While they do not control the majority of global or even European funding they could be argued to have significant prestige capital and influence, and within specific countries (most notably the UK) Plan S signatories do amount to an effective oligopoly on project-based funding.

It is not an accident that Plan S started in Europe. The central coordinating role played by Science Europe and the greater coordination amongst European meso-actors more generally play an important role in supporting collective action. The existing policy agenda set out through the Commission and its funding programmes has created conditions where there is a broad alignment on pursuing an Open Access agenda. By comparison, coordination in the USA is generally not amongst agencies but driven by top-down policy agendas.

This is exacerbated by various key US funding agencies being located in quite different government departments. Existing coordination institutions that support negotiation are an important contributor to collective action and the difference between those institutions in each location has significant effects. In Europe these include Science Europe, the European Commission and European Union, and various university groupings including the **League of European Research Universities (LERU)** (**leru.org**) and the **European University Association** (**EUA**) (**eua.eu**). In the US, the National Academies and mission groupings such as Ivy+, **Big 10** (**https://en.wikipedia.org/wiki/Big_Ten_Universities**), **Association of Land Grant Universities (ALGU)** (**aplu.org**) and others play similar roles.

Responses
From the perspective of collective action the more than 600 responses to the Plan S implementation consultation (cOAlition S 2019) are also interesting. Firstly, essentially every response starts with an affirmation of support for Open Access. This is a substantial shift in the narrative from a time when many organisations would have been dismissive of Open Access as an agenda. Open Access is mainstream, even inevitable, and the Plan S announcement played a significant role in driving that shift.

Secondly, virtually every response follows up its support with a 'but' and it is of course these objections where the majority of the implementation challenge lies. A detailed analysis of those responses is out of the scope of this book but it is helpful to note that challenges are broadly divided into technical (arising mostly from repository providers and advocates), financial/economic (arising from those with significant financial stakes in the transition, primarily incumbent publishers and publisher income-dependent organisations), and social (usually describing concerns around 'quality' from organisations with social and prestige capital, primarily scholarly societies, or concerns about career paths and how

shifts in practice might play into perceptions of quality and how they relate to funding and appointments, mainly from early career researcher groupings). These concerns are generally expressed at the meso-level, in terms of the sustainability of an organisation or community of practice, or in terms of the resourcing needed to achieve these goals. Strategic and system level (ie macro-level) responses are relatively rare. These primarily focus on the question of infrastructure provision, funding, coordination and therefore on collective action.

The collective action challenges of implementing Plan S
Achieving the kind of cultural change that Plan S aspires to requires many things to shift in a coordinated way. The challenge and opportunity for a coordinated initiative like Plan S (and many initiatives for Open Scholarship) is the disparate communities that need to be aligned. Focusing purely on disciplinary communities, it is clear that some are already very engaged in Open Access, and Open Scholarship more broadly, and receptive to increasing the pace of change. Some disciplinary communities are resistant, in both passive (not engaging with their options for Open Access) and in some cases active (objections to specific aspects of the implementation plan such as licensing) ways.

Other communities, including incumbent publishing services providers, may be interested in either channelling implementation into specific pathways (such as APC-based services), or simply slowing implementation down. The latter puts them precisely at odds with the funders seeking to drive change as rapidly as possible. Scholarly societies that are dependent on publishing income, as we have noted, have a tension to resolve if they are to both be representative of their scholarly communities' interests and to maintain their financial sustainability.

The argument around Plan S, and Open Access more generally, has a tendency to devolve to one of simple dichotomies: green vs gold, APCs vs subscriptions, invest in publishing services or in 'infrastructure'. A collective action framing suggests a different model for deciding on investment. Success ultimately depends on communities (disciplinary, geographical, stakeholders) deciding for themselves to adopt an Open Access agenda. This means investing in enabling systems, but also with limited resources it may mean selecting those communities that are strategically positioned to lead change. Investment in systems and institutions that support a broad range of communities (for instance, national or regional read and publish funding agreements, or technical platforms for publishing) may be useful but such systems will need to be infrastructural (ie invisible to end-users) or a case will need to be made that these are relevant to the broad range of communities they are intended to serve. A significant problem with many of these institutions, including repositories, publishing platforms and various types of funding arrangements, is that they have been (rightly or wrongly) rejected by a range of disciplinary communities.

A logical tactical response to this situation is for those wishing to slow down implementation to make a case to such communities that 'one size does not fit all' and that 'systems from the sciences are no use to humanities and social sciences'. Viable responses to this tactic include making a strong case for seeking to engage fully with these disciplines, and also actively investing in projects and systems that support those communities that are working for change in otherwise unengaged disciplinary groupings. One advantage of a focus on humanities and social science disciplines is that these remain tight communities that are small enough to reach and support through change, and the relevant scholarly societies are not as dependent on subscription publishing income. This makes those that are, or can be, convinced of the value of a shift towards

Open Access better placed than many groupings in the sciences to plan and coordinate the collective action necessary.

A final consequence of the collective action view is to see the implementation process as a negotiation. The implementation will not be easy or comfortable, and it is unlikely to go smoothly. Those actors with an interest in derailing or controlling the process will seek to amplify the challenges as collective action and coordination are easy to block. The necessary response is a tight tactical focus on communities that are well placed for change and laying the groundwork to make change for a broader set of communities easy in the future. The global aspirations for Plan S are a challenge to delivering collective action. At the same time the expansion of the narrative and aspiration beyond Europe is important for many European scholarly communities. This line may be challenging to tread and communicate effectively. Alliances with other regional initiatives may be valuable here, mirroring again Ostrom's (Ostrom 1991) prescription for nested hierarchies of governance.

Conclusion

A collective action framing offers no neat and clean solutions to the challenges of implementing Open Scholarship. It focuses our attention on what appears to be a contradiction. To make change we need to recognise that communities are different, while seeking to bring them into alignment. It does offer explanations for why many of these changes are hard. It can also help us to understand why some groups seem more able to enact change than others.

A collective action framing guides our attention to the importance of coordinating institutions. This can be community or missions groupings, loose networks or collaborations, or shared sets of rules and practices. At the highest level, peer review and publication are two such coordinating institutions that we share across the

scholarly landscape. Changes to these pose substantial challenges because the local differences in practice amongst scholarly communities are the bedrock of how those communities define and identify themselves. Culture change is therefore hard and requires evolving our existing institutions and – where necessary – building new.

Amongst the weakest collective actors are universities. They are effective perhaps at blocking change, but not generally at enacting it. Acting effectively both financially (for instance with respect to negotiations with publishing service providers) and politically (for example in addressing the challenge of collectively shifting evaluation criteria), will require strengthening of mission groups, national and regional groupings and international coordination. As we have noted, for scholarly societies to act in a more coordinated and progressive fashion, rather than being defensive, will require coordination mechanisms that are currently weak or non-existent.

There is also an element of realpolitik to be addressed. If our communities are disparate, they will nonetheless sometimes need to change faster than is comfortable. This requires coordinating institutions with a role, and the power, to drive change. We have suggested that funders, and particularly publicly supported funders, should consider a role that is more enabling than driving. But as the intermediaries between government and society, and as the holders of purse-strings, they are also appropriately placed to take this role where necessary. This is not new in itself. What perhaps is new, is the implication that such actions will create damage that will need to be addressed, and that trust for these kinds of actions will need to be built and rebuilt.

Chapter 8

Understanding the landscape

'We started this book with three stories about communities, publishing, infrastructures and their support. Does what we have discussed in the course of this book answer the questions they raised?

The final story raised the question of third party suppliers providing the platforms through which data and software are shared. Is this sustainable? Is it safe?

From our discussion we can see that the shift to digital tools and data has changed the economic characteristics of research outputs. These are collective goods with public-like characteristics. They are largely non-rivalrous. But they are also somewhat exclusive, only usable by specific communities with specialised knowledge. Platforms like **GitHub** (**https://github. com/**), **Mendeley** (**mendeley.com**) and **Zenodo** (**https://zenodo.org**) enhance their public-like good characteristics, reducing exclusivity and making them more easily discoverable by broader communities.

These platforms can act as gravitational hubs, enhancing network effects, and this is part of their benefit. At the same time, the motivation for commercial providers of these platforms to enhance those network effects is not necessarily aligned with that of the research community. But smaller and more localised hubs focused on research community needs will not be able to attract the same levels of investment in a market setting.

If we choose to gain the benefits of these third-party platforms we can take three routes. The first is to accept the benefits alongside the risks, including the loss of content or future enclosure. The extreme risk is the complete removal of players with knowledge of the scholarly landscape from service provision, or disintermediation by global corporate players. This approach tends to be our default. The result of doing nothing is to accept the consequences of those risks. We could invest properly in community infrastructures,

including a capability to ingest content from third-party platforms for appropriate preservation. But based on history this is unlikely. Because this is a default position of doing nothing, it is equally the case that intentional mitigation of the risks will also be missing. The level of investment required is challenging to obtain, based on the past investment in these efforts.

The middle ground involves setting community standards and norms and requiring third party providers to reach them. This may involve requiring guarantees on preservation (which will require investment in platforms to back it) on sustainability and on the ability to access, examine and re-use content. It may require guarantees on adoption of community standards of interoperability, or place requirements for community governance over some aspects of the service provision. Setting such requirements is a collective action problem on its own, but similar to ones that research communities have solved in the past.

Key questions to ask are how are these third parties leveraging external investment, what promises are they making to those investors, and how can the non-financial value that the research communities need access to be maintained while enabling external players to recoup their investments? Ironically, it may be the very largest players, for whom the research market is relatively unimportant, that are the easiest to work with. The relatively smaller players, who need to recoup their investments from the research community, may be more challenging.

The second story, which sought to identify the optimal level of investment in underpinning software infrastructures that enable transparency, reproducibility

and the re-use of code, remains hard to answer in quantitative terms. However, we can reframe the problem. The challenge is supporting more transparent analysis and communication of research claims. That is, we are investing in the infrastructure of 'public-making', converting club goods into more public-like goods.

While we do not yet have the quantitative apparatus to generate numbers we can ask how this underpinning investment in infrastructure, of re-usable and accessible software systems, supports that process. What new communities gain access? How valuable is that? Is code actually being re-used across projects, across groups or across disciplines? What are the critical pieces of the software infrastructure that support that code? What are the costs of research that cannot be validated and therefore the benefits of research that can?

But it is the first story where we may have made the most headway. We can understand that the incumbent publisher seeks to be a gravitational hub, holding the intellectual property of a journal masthead as a core value. We can also see that the decision of the editorial board to exit and set up a new journal was a collective action problem. In this case, that problem is solved through a small group, holding the respect and prestige of a community taking the authority to act, and being granted the authority to act by their community.

But on top of this we see the critical role of infrastructure. Firstly, the availability of a low-cost platform that reduced the risk of failure for the editors and the community they represent. But also the presence of intellectual property (IP) law and contracts that would be respected by both sides and that substantially clarified the nature of the disagreement. It is likely that, without the institutions underpinning the legal frameworks that made up the old journal, the decision to part ways, and the arguments over how that was to occur, would have left both parties bogged

down, possibly leading to the failure of both journals. This is Ostrom's (Ostrom 1991) seventh principle, 'provide accessible, low-cost means for dispute resolution', in practice.

For both the new journal and the old we have a clearer view of what has been lost and what must be recaptured to achieve success. **Glossa** carried the asset of the community with it but not the name recognition and records of registration; these would have to be made anew. **Lingua** maintains the prestige, at least in terms of outward metrics, but would need to create a new community and sense of purpose to thrive as a journal. But not necessarily to continue to deliver as a financial asset. As part of a broader journal package it is unlikely that library subscribers will seek to recoup their subscription costs for the single journal, and as a contributor to the page views and page counts that justify those subscriptions its value continues. Different assets, different roles, different targets.

Perhaps the critical question for progress to Open Scholarship is what we can learn from this transition. We can see that this specific scholarly community has made a successful transition, even without control over the intellectual property of the journal. This shows such a transition is possible provided the conditions of the community and the provided infrastructure are right. The crucial role of a low-cost publishing infrastructure, including initial subsidies and credible long-term funding arrangements, meant that **Glossa** could appear as simply a continuation of **Lingua** under a different name.

For policy makers, funders, and others seeking change the message is quite clear. The infrastructure that enables communities to choose to shift is the key. Particularly in the social sciences and humanities – where communities remain strong, relatively small and well-defined – the constellation of infrastructures, motivation and opportunity provide a template that can work.

Turning this into detailed quantitative analysis, and understanding how the very different values placed on particular goods by different stakeholder groups can be understood and compared to predict outcomes, remains a challenge. But the models presented here, and the cases examined, provide examples of successes and, indeed, failures.

Where next?

In some ways, the analysis of this book has led us to conclusions that we already knew. Academic communities will need to act together if we want control over our processes and systems. Markets on their own will not support the creation and dissemination of knowledge. The structures that define scholarly communities matter, and the infrastructures that support them are important.

But in some ways it is radical. If we take seriously the idea that important parts of our community are not well served either by markets or by top-down regulation, then we need to reconfigure our relationships with external players. We may need to question the roles of funders, and perhaps most controversially draw a bright, sharp line between actors that are part of the community and those third parties with which we have a market-based relationship. Where our meso-organisations contain internal 'markets' we may need to ask whether they function effectively and, if so, whether such bright lines need to be drawn internally as well as externally.

Core to our analysis is that groups matter, and that the messiness of these groups is important. If capital and prestige accrue around the 'good' gravitational hubs that represent community-governed institutions and we need these to counter the natural accumulation of capital and control by 'bad' gravitational hubs – those outside of community control – then we need much greater collective responsibility, alongside new systems that provide the freedom to groups and communities to develop their own rules.

If the role of macro-actors requires some re-balancing to set aspirations and provide support for change, then we may need to radically reconsider the way in which policy is designed and implemented. Indeed our entire politics of change in the academy may not be fit for purpose. The part that depends on a multicentric world, with the gravitational hubs representing scholarly communities and research performing organisations, in a kind of continual competition for attention, allegiance and capital, may need to accept that it is the tensions between these different centres that provide the checks and balances that a complex system needs.

At the same time, if we are to build a system that is capable of change in response to the needs of the societies that support us, we need mechanisms and institutions that build consensus for that change. This needs to be timely and responsive to (but not completely in train with) our changing societies. Certainly it is no longer acceptable for scholarship to change 'one funeral at a time'. We also need actors that will drive necessary change when 'we' won't do it 'ourselves'. The position of funders as gatekeepers of the flow of resources makes them a logical holder of this role. Their role as mediators between the ultimate funders of research, government and society, and scholarly institutions strengthens this case. But do we have the configuration and separation of roles right?

The institutions of western scholarship, in particular universities and scholarly societies, are old. Most modern nation states host a university older than themselves, and there are universities and societies that are older than most corporations. Age tends to make the institutions of scholarship conservative, but it also makes them survivors. The university as an institution has changed radically over the millenium or so in which those institutions have existed. Yet, dramatic revolutions have been rare. Slow change and belated reform have been more common.

During the 20th century the old institutions of scholarship had to adapt to the needs and priorities of new nation states, and new institutions of scholarship have sought to find a niche for themselves. For the older institutions, learning to compromise with governments – and public funding bodies – has sometimes been uncomfortable, but has had clear benefits for universities. Accepting research funding represents a pact, implicit perhaps, that somewhat constrained the actions and freedoms of universities. As Olson (Olson 1974) would show, one solution to the collective action problem is for members of the collective to agree to bind themselves to a set of rules, provided all the other members agree.

The agenda here is therefore both radical and conservative. Radical in seeing a need for change, for new institutions and new systems that can support timely and efficient reform to guide the transition to Open Scholarship. Conservative in that it recognises the value of institutions and systems that are already in place, and that change will be most effective and most sustainable if it is based on evolution and not revolution.

References

▸ Anderson, Warwick, Rolf Apweiler, Alex Bateman, Guntram A. Bauer, Helen Berman, Judith A. Blake, Niklas Blomberg, et al. 2017. "Towards Coordinated International Support of Core Data Resources for the Life Sciences." BioRxiv, April, 110825. https://doi.org/10.1101/110825.

▸ Baldwin, Melinda. 2015. Making "Nature": *The History of a Scientific Journal*. University of Chicago Press.

▸ Bilder, Geoffrey, Jennifer Lin, and Cameron Neylon. 2015. "Principles for Open Scholarly Infrastructures-V1." Figshare. http://dx.doi.org/10.6084/M9.FIGSHARE.1314859.

▸ Bryant, Rebecca, Annette Dortmund, and Constance Malpas. 2017. "Convenience and Compliance: Case Studies on Persistent Identifiers in European Research Information Management." Dublin, Ohio: OCLC Research. oclc.org/research/publications/2017/oclcresearch-convenience-compliance-rim-europe.html.

▸ Buchanan, James M. 1965. "An Economic Theory of Clubs." *Economica* 32 (125): 1–14. https://doi.org/10.2307/2552442.

▸ Cartwright, Jon. 2010. "Net Widens for Funding OfarXivpreprint Server." *Physics World* 23 (03): 8–8. https://doi.org/10.1088/2058-7058/23/03/15.

▸ Knowledge Exchange. Andrea Chiarelli, Rob Johnson, Stephen Pinfield, and Emma Richens. 2019a "Practices, Drivers and Impediments in the Use of Preprints (Phase 1 Report)." May 1. https://doi.org/10.5281/zenodo.2654832.

▸ Chiarelli, Andrea, Rob Johnson, Stephen Pinfield, and Emma Richens. 2019b. "Preprints and Scholarly Communication: Adoption, Practices, Drivers and Barriers." *F1000Research* 8 (June): 971. https://doi.org/10.12688/f1000research.19619.1.

▸ cOAlition S. n.d. "Plan S - About." n.d. coalition-s.org/about/.

▸ cOAlition S. 2019. "Feedback on the Draft Implementation Guidance of Plan S." Zenodo. https://doi.org/10.5281/zenodo.3254637.

▸ Cobb, Matthew. 2017. "The Prehistory of Biology Preprints: A Forgotten Experiment from the 1960s." *PLOS Biology* 15 (11): e2003995. https://doi.org/10.1371/journal.pbio.2003995.

▸ Crow, Raym. 2013. "Sustainability of Open Access Services. Phase 3: The Collective Provision of Open Access Resources." Sustainability of Open Access Services. Knowledge Exchange. http://repository.jisc.ac.uk/6206/1/Sustainabililty%2Bof%2BOA%2BServices%2Bphase%2B3.pdf.

▸ Csiszar, Alex. 2018. *The Scientific Journal: Authorship and the Politics of Knowledge in the Nineteenth Century*. University of Chicago Press.

▶ David, Paul A. 2003. "The Economic Logic of 'Open Science' and the Balance between Private Property Rights and the Public Domain in Scientific Data and Information: A Primer." In *The Role of Scientific and Technical Data and Information in the Public Domain: Proceedings of a Symposium.*, edited by Julie M. Esanu and Paul F. Uhlir, 19–34. National Academies Press (US). ncbi.nlm.nih.gov/books/NBK221867/.

▶ Dempsey, Lorcan. 2005. "Systems in the Network World." *Lorcan Dempsey's Weblog* (blog). April 6, 2005. http://orweblog.oclc.org/systems-in-the-network-world/.

▶ DORA Signatories. 2013. "San Francisco Declaration on Research Assessment." ascb.org/dora/.

▶ Durinx, Christine, Jo McEntyre, Ron Appel, Rolf Apweiler, Mary Barlow, Niklas Blomberg, Chuck Cook, et al. 2017. "Identifying ELIXIR Core Data Resources." *F1000Research* 5 (March): 2422. https://doi.org/10.12688/f1000research.9656.2.

▶ Egbahl, Nadia (2016) "Roads and Bridges: The Unseen Labor Behind Our Digital Infrastructure" fordfoundation.org/media/3179/roads-and-bridges.epub

▶ Erway, Ricky, and Amanda Rinehart. 2016. "If You Build It, Will They Fund? Making Research Data Management Sustainable." Dublin, Ohio: OCLC Research. https://www.oclc.org/content/dam/research/publications/2016/oclcresearch-making-research-data-management-sustainable-2016.pdf.

▶ Fenner, Martin, Consol Garcia Gómez, and Gudmundur A Thorisson. 2011. "Key Issue Collective Action for the Open Researcher & Contributor ID (ORCID)." Serials: *The Journal for the Serials Community* 24 (3): 277–79. https://doi.org/10.1629/24277.

▶ Knowledge Exchange. Gwen Franck. 2019. "Insights into the Economy of Open Scholarship: A Look into the Open Library of Humanities with Martin Paul Eve, Co-Founder." https://doi.org/10.5281/zenodo.2586862.

▶ Friesike, Sascha, and Benedikt Fecher. 2016. "Collaboration, Participation and Transparency: The Promise of Digitizing Academic Research." *In Research Handbook on Digital Transformations*, by F. Olleros and Majlinda Zhegu. Edward Elgar Publishing. https://doi.org/10.4337/9781784717766.

▶ Fyfe, Aileen, Kelly Coate, Stephen Curry, Stuart Lawson, Noah Moxham, and Camilla Mørk Røstvik. 2017. "Untangling Academic Publishing: A History of the Relationship between Commercial Interests, Academic Prestige and the Circulation of Research." Zenodo. https://doi.org/10.5281/zenodo.546100.

▶ Gans, Joshua S. 2017. *Scholarly Publishing and Its Discontents: An Economist's Perspective on Dealing with Market Power and Its Consequences*. S.l.: Core Economic Research.

▶ Gordon, Gregg. 2016. "SSRN—the Leading Social Science and Humanities Repository and Online Community—Joins Elsevier." *Elsevier Connect* (blog). May 17, 2016. **elsevier.com/connect/ssrn-the-leading-social-science-and-humanities-repository-and-online-community-joins-elsevier.**

▶ Greco, Albert N. 2015. "Academic Libraries and the Economics of Scholarly Publishing in the Twenty-First Century: Portfolio Theory, Product Differentiation, Economic Rent, Perfect Price Discrimination, and the Cost of Prestige." *Journal of Scholarly Publishing* 47 (1): 1–43. **https://doi.org/10.3138/jsp.47.1.01**.

▶ Hardin, Garrett. 1968. "The Tragedy of the Commons." *Science* 162 (3859): 1243–48. **https://doi.org/10.1126/science.162.3859.1243**.

▶ Hartley, John, Jason Potts, Lucy Montgomery, Ellie Rennie, and Cameron Neylon. 2019. "Do We Need to Move from Communication Technology to User Community? A New Economic Model of the Journal as a Club." *Learned Publishing* 32 (1): 27–35. **https://doi.org/10.1002/leap.1228**.

▶ Holbrook, J Britt. 2015. "We Scholars: How Libraries Could Help Us with Scholarly Publishing, If Only We'd Let Them." *In Getting the Word Out: Academic Libraries as Scholarly Publishers*, edited by Maria Bonn and Mike Furlough, 43–54. ACRL.

▶ Houghton, John. 2002. "The Crisis in Scholarly Communication: An Economic Analysis." Melbourne: Centre for Strategic Economic Studies. **vala.org.au/vala2002/2002pdf/16Houton.pdf**.

▶ Khoo, Shaun Yon-Seng. 2019. "Article Processing Charge Hyperinflation and Price Insensitivity: An Open Access Sequel to the Serials Crisis." *LIBER Quarterly* 29 (1): 1. **liberquarterly.eu/article/10.18352/lq.10280/.**

▶ Kling, Rob, Lisa B. Spector, and Joanna Fortuna. 2004. "The Real Stakes of Virtual Publishing: The Transformation of E-Biomed into PubMed Central." *Journal of the American Society for Information Science and Technology* 55 (2): 127–48. **https://doi.org/10.1002/asi.10352**.

▶ Knowledge Exchange. Cameron Neylon. 2017. "Knowledge Exchange Approach towards Open Scholarship." Europe. **https://doi.org/10.5281/zenodo.826643**.

▶ Knowledge Exchange. Gwen Franck. 2019. "Insights into the Economy of Open Scholarship: A Collection of Interviews." Europe. **https://doi.org/10.5281/zenodo.2840171**

▶ Krishnan, Armin. 2009. "What Are Academic Disciplines? Some Observations on the Disciplinarity vs. Interdisciplinarity Debate." Working Paper 03/09. NCRM Working Paper Series. Southampton: ESRC National Centre for Research Methods. **http://eprints.ncrm.ac.uk/783/1/what_are_academic_disciplines.pdf**.

▶ Larivière, Vincent, Stefanie Haustein, and Philippe Mongeon. 2015. "The Oligopoly of Academic Publishers in the Digital Era." *PLOS ONE* 10 (6): e0127502. **https://doi.org/10.1371/journal.pone.0127502**.

▶ Lawson, Stuart, Jonathan Gray, and M Mauri. 2016. "Opening the Black Box of Scholarly Communication Funding: A Public Data Infrastructure for Financial Flows in Academic Publishing." *Open Library of Humanities* 2 (1): e10. **https://doi.org/10.16995/olh.72**.

▶ Lee, Sooho, and Barry Bozeman. 2005. "The Impact of Research Collaboration on Scientific Productivity." *Social Studies of Science* 35 (5): 673–702. **https://doi.org/10.1177/0306312705052359**.

▶ Lewis, David W., Lori Goetsch, Diane Graves, and Mike Roy. n.d. "Funding Community Controlled Open Infrastructure for Scholarly Communication: The 2.5% Commitment Initiative | Lewis | College & Research Libraries News." Accessed July 14, 2019. **https://doi.org/10.5860/crln.79.3.133**.

▶ Mons, Barend, Cameron Neylon, Jan Velterop, Michel Dumontier, da Silva Santos, Luiz Olavo Bonino, and Mark D. Wilkinson. 2017. "Cloudy, Increasingly FAIR; Revisiting the FAIR Data Guiding Principles for the European Open Science Cloud." *Information Services & Use* 37 (1): 49–56. **https://doi.org/10.3233/ISU-170824**.

▶ Merton, Robert K. 1973. "The Sociology of Science: Theoretical and empirical investigations, University of Chicago Press, Chicago"

▶ Montgomery, Lucy. 2015. "Knowledge Unlatched, A Global Library Consortium Model for Funding Open Access Scholarly Books." *Cultural Science Journal* 7 (2): 1. **https://doi.org/10.5334/csci.68**.

▶ Nagel, By David. 2016. "Elsevier Stirs Up Controversy with SSRN Acquisition -." Campus Technology. May 18, 2016. **https://campustechnology.com/articles/2016/05/18/elsevier-buys-up-ssrn-stirs-up-controversy.aspx**.

▶ Neylon, Cameron. 2017. "Sustaining Scholarly Infrastructures through Collective Action: The Lessons That Olson Can Teach Us." *KULA: Knowledge Creation, Dissemination, and Preservation Studies* 1 (1). **https://doi.org/10.5334/kula.7**.

▶ OECD Global Science Forum. 2017. "Business Models for Sustainable Research Data Repositories." OECD Science, Technology and Industry Policy Papers 47. **https://doi.org/10.1787/302b12bb-en**.

▶ Olson, M. 1974. *The Logic of Collective Action: Public Goods and the Theory of Groups*. Revised edition. Princeton, N.J.: Harvard University Press.

▶ Ostrom, Elinor. 1991. *Governing the Commons: The Evolution of Institutions for Collective Action*. Unknown edition. Cambridge ; New York: Cambridge University Press.

▶ Potts, Jason, John Hartley, Lucy Montgomery, Cameron Neylon, and Ellie Rennie. 2017. "A Journal Is a Club: A New Economic Model for Scholarly Publishing." *Prometheus* 35 (1): 75–92. **https://doi.org/10.1080/08109028.2017.1386949**.

▶ Reiser, Leonore, Tanya Z. Berardini, Donghui Li, Robert Muller, Emily M. Strait, Qian Li, Yarik Mezheritsky, Andrey Vetushko, and Eva Huala. 2016. "Sustainable Funding for Biocuration: The Arabidopsis Information Resource (TAIR) as a Case Study of a Subscription-Based Funding Model." Database 2016 (January). **https://doi.org/10.1093/database/baw018**.

▶ Schonfeld, Roger C. 2008. "The Value of Scholarly Journals in a Two-Sided Market." *The Serials Librarian* 54 (1–2): 121–26. **https://doi.org/10.1080/03615260801973927**.

▶ Siler, Kyle, Stefanie Haustein, Elise Smith, Vincent Larivière, and Juan Pablo Alperin. 2018. "Authorial and Institutional Stratification in Open Access Publishing: The Case of Global Health Research." *PeerJ* 6: e4269. **https://doi.org/10.7717/peerj.4269**.

▶ Stichweh, R. 2001. "Scientific Disciplines, History Of." *In Nternational Encyclopedia of the Social & Behavioral Sciences*, 13727–31. Elsevier Science Ltd. **fiw.uni-bonn.de/demokratieforschung/personen/stichweh/pdfs/19_34stwdisciplines1.pdf**.

▶ Tennant, Jonathan, Serge Bauin, Sarah James, and Juliane Kant. 2018. "The Evolving Preprint Landscape: Introductory Report for the Knowledge Exchange Working Group on Preprints.," May. **https://doi.org/10.31222/osf.io/796tu**.

▶ Tobin, Victoria, Taylor Martin, Michayla Bea Damon, Nicole Crate, Andrew Godinez, and Kayleigh Bennett. n.d. "The History of the Academy and the Disciplines." *In Interdisciplinary Studies: A Connected Learning Approach*, edited by Christine McElreavy, 25. Montreal: Rebus Community. **https://press.rebus.community/idsconnect/chapter/the-history-of-the-academy-and-the-disciplines/**.

▶ Vance, Ashlee. 2011. "This Tech Bubble Is Different." *Bloomberg Businessweek*, April 14, 2011. **bloomberg.com/news/articles/2011-04-14/this-tech-bubble-is-different**.

▶ Wenzler, John. 2017. "Scholarly Communication and the Dilemma of Collective Action: Why Academic Journals Cost Too Much | Wenzler | College & Research Libraries." **https://doi.org/10.5860/crl.78.2.183**
.

▶ Wilkinson, Mark D., Michel Dumontier, IJsbrand Jan Aalbersberg, Gabrielle Appleton, Myles Axton, Arie Baak, Niklas Blomberg, et al. 2016. "The FAIR Guiding Principles for Scientific Data Management and Stewardship." *Scientific Data* 3 (1): 160018. **https://doi.org/10.1038/sdata.2016.18**.

Knowledge Exchange Office
C/O Jisc,
One Castlepark,
Tower Hill,
Bristol, BS2 0JA

t: 0203 697 5804
e: office@knowledge-exchange.info