Knowledge Exchange

# Knowledge Exchange approach towards Open Scholarship

Report dated August 2017

DFG CSC Jisc CNRS SURF Deff Denmark's Electronic Research Library

Title: Knowledge Exchange approach towards Open Scholarship

Authored by: Based on contributions from the Knowledge Exchange Open Scholarship Advisory Group (see page 10) and edited by Cameron Neylon (cn@cameronneylon.net)

DOI: 10.5281/zenodo.826643

Report dated: August 2017



# Contents


Executive summary 4

Glossary 6

Chapter 1: Introduction 7
Background 8
Present situation 9
KE Advisory Group and this paper 10

Chapter 2: Navigating a transition to open scholarship 11
Motivations for open scholarship 12
The challenge of scale and granularity 13
Obstacles to open scholarship 14

Chapter 3: Towards a KE open scholarship framework 18
Existing Knowledge Exchange work and its categorisation 19
The changing process of research 20
Interactions and arenas 21
A draft Knowledge Exchange Open Scholarship Framework 22

Chapter 4: The economy of open scholarship 24
Issues for the economy of open scholarship 25
Research questions for KE open scholarship work 30

Chapter 5: Output and evaluation from the researcher's perspective 33
Issues for output and evaluation from the researcher's perspective 36
Research questions for KE open scholarship work 38

Chapter 6: Proposal outline for KE work on open scholarship 41
A framework for open scholarship 42
Economy of open scholarship 43
Output and evaluation from the researcher's perspective 45
Conclusion and synthesis 47

References 48

# Executive summary

A core goal for Knowledge Exchange (KE) is that the European Research community more fully realises the opportunity for networked, collaborative, and digital scholarship

This agenda has many strands - open access, open data, open (or digital) science (or research), citizen science, data science (with its many meanings) - but can also include open education and open government. Knowledge Exchange has chosen the term "open scholarship" to embrace the broad range of efforts to make scholarship, with a focus on research, more inclusive, more accessible, more networked, and more effective.

To support this, Knowledge Exchange convened the KE Open Scholarship Advisory Group (KEOSAG) to examine progress towards open scholarship and the challenges of implementation. This report is the first output of that group. It provides a new perspective on the challenges of open scholarship and suggests possible actions that Knowledge Exchange and other stakeholders might take to support progress towards it.

## Motivations for open scholarship

The ecosystem of scholarship is complex, made up of many stakeholders and actors with differing motivations. Our current understanding of these motivations is often limited to caricatures and generalisations. In particular, there is a tendency to conflate organisational, or stakeholder, motivations with individual motivations. There is broad support for the high level aspirations of open scholarship, and agreement that the community as a whole should be motivated to achieve these "macro" objectives, with objections to actual implementation based on issues for individuals (micro), or organisations (meso).

At the same time, we see individuals (micro) seeking change that is prevented by the incentives and culture of the communities (meso) they work in. A key to making progress is a deeper understanding of how the motivations of different actors are affected by the interactions between system (macro), individual (micro) and communities/organisations (meso).

## A framework for open scholarship

To organise the work of Knowledge Exchange and others effectively this paper proposes an organisational framework. It has three dimensions: the stage of the research process, the "arena" of interest, and the level of organisation (micro-meso-macro). To give an example, the shift to earlier publishing of "working papers" or "pre-prints" in some disciplines can be described as shifting this activity to an earlier point in the traditional research life-cycle. This shift has implications in several arenas, so can be examined through questions of policy (macro-political), questions of sustainability models for traditional publishers and new infrastructures (meso/macro-economic), social practice of communities (meso-social), and implementation of technology (at many levels).

## The economy of open scholarship

One way of framing the challenges of understanding the complex motivations of actors and their groupings is a (political) economic lens. In addition, an analysis of existing Knowledge Exchange work suggests a relative lack of work in the economic arena. The complexities of goods and their exchange mechanisms are not well captured by classical economic analysis. Simplistic analogies of financial exchange can lead to simplistic political positions, for instance hardening a false public-private dichotomy when the focus should be on organisational governance and trust.

To develop economic analyses that are useful in building an ecosystem of open scholarship will require a more sophisticated understanding of the actors, their interactions and their incentives, and the value and goods being created, including value that is not readily quantifiable. Open scholarship has been hampered by the use of economic analogies to bolster existing political positions. It is time to build an economic understanding of what is achievable and how to build it, to develop new financial and sustainability models, new systems of funding and, where appropriate, new and improved regulation of the goods and services that are critical to the scholarly ecosystem.

## Output and evaluation from the researcher's perspective

It is often observed that the key to changing scholarly practice lies in incentives and therefore in the evaluation mechanisms that scholars experience. However, just as with our economic understanding there is only a superficial understanding of how scholars disseminate their work and how it is evaluated, how this differs across disciplines, organisations and geographies, and finally how all of these affect each other.

Practical interventions intended to improve the process of evaluation are rarely assessed for their effects, while critical work on research evaluation has generally been highly abstract. To move beyond "we need to fix the incentives" to questions of **how** and **where** this can be done will require a much greater understanding of how evaluation systems affect both the behaviour of individuals and the culture of communities.

## Recommendations for Knowledge Exchange work on open scholarship

This report identifies a range of challenges and opportunities for progress towards open scholarship. Knowledge Exchange can play a specific supportive role in promoting progress towards open scholarship, acting as a convenor of expertise, a commissioner of research and a developer and implementer of new approaches and best practice in using them.

KEOSAG recommends that Knowledge Exchange develops three strands of work, focusing on strategic interventions where the strengths of KE in terms of knowledge and community are greatest. These are:

1. Supporting the refinement and development of the Knowledge Exchange open scholarship framework as a model for describing, monitoring and implementing work on open scholarship

2. Supporting, encouraging and coordinating work that develops a substantially more sophisticated view of the economy of open scholarship by supporting the work of other funders on theoretical developments and building case studies. Sharing experiences and data on the development and sustainability of KE services and infrastructures

3. Building a rich body of information on the experiences of researchers in evaluation. Use existing KE contacts with researchers, communities, organisations and evaluators to develop a deeper understanding of what evaluation is taking place, by whom, for what purpose, and what effect this has on the behaviour of individuals and the culture of communities

# Glossary

**Appraisal:** An assessment or estimation of the worth, value, or quality of a person or thing (Collins by Reverso).

**Assess (assessment):** To judge the worth, importance, etc of; evaluate (Collins by Reverso).

**Evaluate (evaluation):** To judge or assess the worth of; appraise (Collins by Reverso).

**Indicator:** Something that provides an indication, esp. of trends (Collins by Reverso).

**Quantitative indicator:** An indicator expressed by a figure, not necessarily a true measure.

**Measure:** (noun) A figure assigned to a phenomenon within a theoretical framework. The latter must have defined a unit, set up a standard, and designed an adequate measuring device. A proper measure can of course be used as an indicator. (verb) The act of obtaining data that can act as a measure.

**Metrics:** A synonym of measure (noun).

**Open scholarship:** Here intended as an inclusive synonym for open science, open research, science 2.0 and other similar terms.

**Proxy:** An indicator that is used (whether advisedly or not) as a representation of another quality eg *"The number of citations is a poor proxy for the quality of an article"*.

**Public good:** Used primarily in the strict economic sense of goods that are neither excludable nor rivalrous. A common alternative use that refers to "the good of the public" ie acts, regulations goods that serve the public interest.

**Research impact:** An assessable change in the world that can be described as a consequence of a research outcome. Often restricted to such changes that take place outside the research community eg "*The impact of the change in treatment guidelines following this research was to reduce deaths from this health condition by 20%"*.

**Research outcome:** Consequences and changes that can be described as a consequence of a research output eg *"Following the publication of this article we changed the treatment guidelines for this condition."*

**Research output:** The objects produced in the process of research. It includes, but is not limited to, articles, books, data, software, presentations, samples and physical archives.

**Scholarly communication:** Communication between scholars. If open, can usefully be accessed and reused by non-scholars as well. Not to be mistaken here with general purpose communication.

# Chapter 1:
# Introduction

# Background

## KE interest in open scholarship

Knowledge Exchange was created in 2005, by national organisations that wanted to exchange expertise and combine forces to enhance higher education and research by using the potential of an open and transparent internet. They were inspired by the declarations on open access aiming to make information widely accessible to society. Now in its 11th year, Knowledge Exchange has a proven track record of work on open access, research data, research software and open research. In 2015 Knowledge Exchange (KE) held the "Pathways to Open Scholarship" event to celebrate its tenth anniversary and to inspire its new vision: "to enable open scholarship by supporting an information infrastructure on an international level".

Although it is not Knowledge Exchange's intention to define, or redefine, open scholarship, it is useful to state what KE means when the term is used in this document. Different organisations have used the term, sometimes emphasising the scholarly communication process and other times encompassing themes such as open education, open access, citizen science and open data. Since Knowledge Exchange is largely focused on supporting research and researchers our intended meaning is broadly one of "opening up the way research is carried out and communicated"[1]. This explicitly includes opening up access to the processes, including decision-making processes, within research, alongside progress towards greater access to the outputs of more traditional research processes. We do not focus on open education (either resources or processes) although we acknowledge their importance.

While there is considerable support for open scholarship internationally, with some major national and international initiatives taking place (eg the European Open Science Cloud, OpenAIRE and more), there are also many obstacles to the adoption of open scholarship in the development of information services and infrastructures as well as in the workflow of researchers. This is clearly a challenge for Knowledge Exchange to work on.

## KE approach to open scholarship

Enabling open scholarship is at the heart of the Knowledge Exchange mission statement and a significant part of KE activity will aim directly at improving conditions for practising (or the practice of) open research. Knowledge Exchange has a unique ability and is in a unique position to contribute significantly to the establishment and enhancement of a well-functioning open scholarship ecosystem.

Knowledge Exchange will achieve this in ways that proved successful in previous years: by engaging experts, sharing knowledge and best practices, and facilitating exploration around how new technical and organisational possibilities and solutions can be applied in open research practice.

Based on the outcomes of the KE "Pathways to Open Scholarship" event and consultation with a wider network of experts, two topics were selected to be taken forward by Knowledge Exchange: "the Economy of Open Scholarship" and "output and evaluation from the researcher's perspective". How these two activity areas will fit in the bigger picture will be explained in the coming pages.

### Footnotes

1 This definition is derived from the Enhancing Open Scholarship initiative. This initiative is no longer active but the definition aligns with other similar definitions that tend to be umbrellas for existing agendas, or broadly use the term "opening up" to cover a wide range of agendas.

# Present situation

## Changes in research practice and expectations

Research has changed in many ways and it keeps on changing. Increased technology and communication possibilities, more complex and interdisciplinary questions and overwhelming growth in data generation provide opportunities and challenges for better research. At the same time these opportunities and challenges involve changes in the roles and behaviour of actors, the nature and results of processes, and in how research sits in society.

Research is becoming increasingly costly and complex and so the value of research outputs and other research outcomes is increasing as well. This, in turn, drives assessment of the value, and the need to evaluate and enhance efficiency at various levels, and in comparable ways.

There is a need to link the community's broad motivations to improve research with a belief that investing effort towards these goals will make valuable progress, and be appreciated by peers. The aim of this paper is to take a new view across the research landscape, to map actors and stakeholders within it, and seek to better understand their context and motivations. This will help to define a programme of work that aims to bring the high level aspirations for open scholarship closer to the incentives for individual actors, and for stakeholder communities and groups.

## The Knowledge Exchange effort to frame open scholarship

To meet the parallel challenges mentioned above (better research, better assessment) open scholarship as a concept or ecosystem needs to be collaborative, transparent and accessible to actors and stakeholders engaged in all research related processes and across all disciplines. It should be based on open scholarly communication, open research data, and open access to publications. The quality and results of open scholarship should be evaluated in a meaningful way.

The above is a generic description of an ideal situation because open scholarship is currently an ambition and not a reality. Current research practice, at different locations, in different disciplines and for various processes and actors, has not yet fully adapted to the new challenges. This makes the change towards open scholarship as the default reality difficult and it is not easy to keep oversight.

With this in mind Knowledge Exchange has – aside from identifying topical priorities - worked on a framework to bring together processes, phases and other dimensions that have an influence on, or hold a stake in, the overall functioning of open scholarship.

# Paper produced by KE Advisory Group and KE Group

In order to approach the complex open scholarship work, Knowledge Exchange has established the Knowledge Exchange Open Scholarship Advisory Group (KEOSAG), which includes open scholarship experts from both inside and outside of the KE partner organisations.

These experts act as a "think tank", inspiring and advising Knowledge Exchange and providing expertise and ideas that can initiate and shape activities for KE to undertake within the open scholarship area. They will also evaluate Knowledge Exchange proposals and activity outcomes.

The first result of working with this group is the paper you are now reading. It aims to inform the Knowledge Exchange community about the intentions of Knowledge Exchange and its approach to open scholarship.

Knowledge Exchange hopes that this paper will secure your interest and solicit your feedback on the way Knowledge Exchange plans to work on open scholarship to help in achieving its vision "to enable open scholarship by supporting an information infrastructure on an international level".

The Open Scholarship work was kicked-off by the Knowledge Exchange representatives, or KE Group. They transformed the outcomes of the Pathways to Open Scholarship event and the directions provided by KE Senior Management at the Strategy Forum 2016 into an action plan, and drafted the first version of the current paper.

Members of the Knowledge Exchange Open Scholarship Advisory Group:

- Martin Fenner, DataCite
- Sascha Friesike, Alexander von Humboldt Institute for Internet and Society, Germany
- Cameron Neylon, Curtin University, Western Australia
- Serge Bauin, CNRS-DIST, France
- Wilma van Wezenbeek, Delft University of Technology Library, the Netherlands
- Laurents Sesink, Leiden University Libraries, the Netherlands
- Jessica Parland - von Essen, University of Helsinki, Finland
- Mogens Sandfær, Technical University of Denmark
- Magchiel Bijsterbosch, SURF, the Netherlands
- Michael Svendsen, Copenhagen University Library, Denmark

Members of Knowledge Exchange:

- Matthias Katerbow, DFG
- Christian Hagen Thomasen, DEFF
- Masha Garibyan/Verena Weigert Jisc
- Riina Salmivalli, CSC
- Herbert Gruttemeier, CNRS
- Karin van Grieken/Melanie Imming, SURF
- Bas Cordewener, KE

# Chapter 2:
# Navigating a transition to open scholarship

It is generally accepted within the research community and among related stakeholders that a transition towards greater transparency and openness would be a good thing. However, this overall support in principle can mask profound differences in goals and motivations amongst various groups. Broad support in principle can also be confounded by more concrete and specific obstacles that, again, may be of differing importance to different stakeholders.

In this chapter we address both the different motivations that provide support for a transition to open scholarship and the varying obstacles that act as barriers. In doing this we will see a pattern, that motivations operate at the large scale of improving scholarship as a shared enterprise, while barriers often appear as concrete practical obstructions with impacts on individuals or communities. This pattern can help to inform an overall programme of work where we identify how global macro level opportunities are blocked by individual (micro level) and group (meso level) issues.

# Motivations for open scholarship

While there is broad support for greater openness in scholarship, and the reasons for this are generally articulated in policy and advocacy documents (European Commission Open Science Policy Platform, 2017; Kiley, 2016; Office of Science and Technology Policy, 2013), the differences in the underlying motivations and agendas have received less attention.

The literature that addresses motivations tends to either be advocacy-focused (sometimes pro- and sometimes anti-openness), descriptive (Pomerantz and Peek, 2016), or highly theoretical (Tkacz, 2012; Neylon, 2017a).

Arguably the most successful effort at finding a practical middle ground is **Open Science: One Term, Five Schools of Thought** (Fecher and Friesike, 2014). Fecher and Friesike analyse the discourse in a wide range of documents, identifying five different strands which, in turn, can be aligned with differing motivations and agendas.

- **Public school:** Research processes should be accessible and comprehensible to wider audiences
- **Democratic school:** The products and benefits of research should be distributed equitably to increase agency
- **Pragmatic school:** The research enterprise could be made more efficient and effective through greater openness and collaboration
- **Infrastructure school:** Improved tools and services are needed to support science
- **Measurement school:** Better measurements and evaluation approaches can improve science

The first three of these discourses can be linked to motivations to achieve the transition to open scholarship whereas the last two can be seen as discourses focused on mechanisms to support the transition. For instance, one argument associated with the measurement school – that increasing the diversity of indicators used to evaluate research outputs will increase the diversity of communication practice – could be deployed as a means of achieving the goals of the public and democratic schools.

These motivations sit alongside other motivations for various actors. They include basic needs such as the survival of groups, organisations and communities, or an individual's continuing success as an academic, as well as more sophisticated, but still self-interested motivations such as seeking prestige and influence. Sometimes such self-interested motivations align with the motivations for open scholarship, such as when government articulates policy goals for increased openness. Sometimes they are at odds, as in for instance the interests of incumbent commercial providers with a sustainability model that depends on controlling access and use.

It is not our purpose to completely describe all the motivations for different actors in the progress towards open scholarship, but to note that different actors have different motivations. These motivations may interact in complex ways and for some actors may result in net negative motivation. Analysis of the political and social movement towards open scholarship has generally not taken a sophisticated approach towards understanding motivations. It has taken a broad-brush approach characterising whole classes of actors as pro-or anti-change.

# The challenge of scale and granularity

While this paper does not claim to have made a complete analysis, the three motivations drawn from Fecher and Friesike's work (public, democratic and pragmatic) appear to capture many of the strands of top-down argument for open scholarship. These motivations sit at a global level, describing aspirations for the research system as a whole, or indeed for society as a whole.

Looking at the contradictory and self-interested motivations mentioned above it can be seen that they generally apply at the individual or organisational level. For instance, an objection that is often raised to open scholarship practice is that an individual does not receive individual career reward for pursuing these lofty collective aspirations. A company that is dependent on a sustainability model built around restricting access to content has an organisational interest in acting to restrict progress towards open scholarship. Importantly, these individual and organisational (or group level) motivations can co-exist with opposing global level motivations.

Therefore, to understand motivations it is not sufficient to simply examine the actors associated with them. It is also necessary to consider whether specific motivations and incentives act at the micro, meso, or macro level. Discussions of research evaluation (see Chapter 5) often describe how the benefits for society as a whole from greater open scholarship practice (macro level) are often countered by the incentives perceived by individual researchers to adhere to traditional practice (micro level). However, much less attention has been paid in these discussions to community – or **cultural** – practice and how traditional conceptions of "excellent research" as defined by communities and groups slows the transition to open scholarship. We therefore need to pay more attention to the meso level.

**Table 1. The differing levels of granularity for analysis of research objects, actors and processes**

| Level | Actors | Objects | Motivations |
|---|---|---|---|
| **Macro** | Population | "The literature" | Policy |
| **Meso** | Communities/ organisations | Journal, publisher, repository | Culture |
| **Micro** | Individuals | Single article/ single dataset | Incentives |

Similarly, in economic analyses attention has traditionally focused on macro-economic assessment of the production of global collective goods or micro-economic analysis of markets providing private goods (Gans, 2017). The challenges of public-good (in the strict economic sense) provision and the limitations of markets (that are supported by production of private goods) are well established, forming one of the key political divides in the scholarly communication space. However, there has been growing interest in how the (political) economic behaviour of groups is capable of delivering collective goods for those communities and how the patterns seen in the management of community-governed resources differ from those required to produce public and private goods (Neylon, 2017b; Potts et al., 2016).

# Obstacles to open scholarship

To this point we have discussed broad systemic motivations towards open scholarship and general systemic issues that limit progress, such as the motivations of differing actors and the challenge of conflicting motivations at the micro/meso vs macro levels. Here we present a set of more specific challenges and then seek to categorise and organise them.

## Open scholarship is a confusing change

Open scholarship is often presented as a fundamental change in practice (Royal Society, 2012; 2016). It is not just an additional layer on top of existing practice. In some views it is a shift from a hierarchical and administrative culture to one of more agile and adaptive collaborations. Some views focus on increasing sharing between communities, but for others it is about community and group collaboration. It can be about completely changing the research life cycle with, for instance, research data being both a shareable result and a shareable input.

At the same time there is a differing narrative, that open scholarship is simply the realisation through new technology of very old values in scholarship. This narrative suggests that while we may be proposing radical changes in practice, these are merely realising the values articulated by Aristotle, Boyle, Spinoza, Kant or Merton.

The changes in practice are (potentially) profound and the ecosystem of scholarship, its actors, stakeholders and users is becoming more complex. The complexity, playing out at the different scales with many actors, makes change challenging. Big efforts with big money, aiming to make changes at a large scale, may in fact slow down smaller scale change by motivated sub-communities.

## Open scholarship is not easy for researchers to engage with

The disparity between the two narratives described above ("everything is changing" vs "nothing is really changing") leads to confusion amongst researchers. As we have noted, open scholarship is a complex ecosystem where the benefits are only fully realised when a critical mass of stakeholders are fully engaged and sufficient open processes are in place. Before this is the case, individual efforts may not directly be rewarded with benefits. This "tragedy of the commons" shows how self-interest (micro level incentives) may not be aligned with engaging in open scholarship.

The practice of researchers is bound up in community (disciplinary, organisational, geographical) cultures. The differing narratives, represented by the schools identified by Fecher and Friesike, with their global, macro-level motivations, have very different appeal to differing communities and their meso level social processes. These in turn play out differently at micro-level in individual behaviours. Finding clear ways to talk about the "why" of open scholarship with researchers broadly, or with specific communities, remains a challenge.

## Open scholarship can be complex for researchers in practice

Even where the narrative is clear the actual practices of open scholarship can be (or can appear to be) complex for individual researchers and research communities. Differences in language and practice between communities mean that finding consistent ways to enhance and describe openness is a challenge. "Open" itself is a fraught term with highly contested political connotations and complexities. "Open access" and the terminology around different paths to achieving it are so confusing now that it is no surprise that many researchers

consider it a burden to deal with. Inconsistencies across institutions, funders, and publishers cause further confusion, in some cases deliberately.

In the area of data, the FAIR Data Principles – that data should be findable, accessible, interoperable and reusable – (Wilkinson et al., 2016) have gained a great deal of support (European Commission, 2016; G20, 2016). Because the question of implementation details are generally managed at a local level, and because there is a series of qualities implicit in the term "FAIR" itself, this seems to be easier to engage with and therefore easier to practice than the question of whether something is "open" or not (Mons et al., 2017). Clarity of the process to be applied, connected with motivations that make sense to the researcher and their community, seems associated with successful change. By contrast where the required practice is unclear, or not well connected to existing practice, it seems easier for researchers to continue with the status quo.

## Missing career opportunities and reward systems

As pointed out before, actors' roles have changed and will change in open scholarship, and the performance in these roles needs to be evaluated to allow actors to be rewarded, demonstrate competence and achievements, and ultimately develop their career. The current evaluation system, essential for researchers (and indeed other stakeholders) who need to develop their careers, does not acknowledge achievement in these new roles. Contributions to open scholarship, defined as all efforts made to open-up research data, software, publications and methodologies, should be evaluated – not just for the researchers themselves but for all professionals active in scholarship.

## A fragmented ecosystem with multiple players

So far, the focus of this discussion has been on a researcher and research community perspective and the challenges raised by differing incentives at macro, meso, and micro levels. Another important challenge is the complexity of the ecosystem beyond that of researchers. As noted, open scholarship implies a more "open" and less hierarchical ecosystem, with an increasing number of participants. It also implies a more globalised research system.

By contrast governments, research councils, universities (and private business) are focused on local issues, and are in general not developing interoperable systems. Their systems are usually aimed at a single group of researchers and a single (set of) research question(s), in a predefined discipline, working on a start to-finish research project. What's more, funding is fragmented and existing infrastructure, tools, regulations and policies are all different, making it hard to change research practices. Trying to compare between countries in a nationally fragmented landscape is challenging. At the level of multiple countries on the global scale it is much more so.

As noted above, open scholarship is a collective action problem. The benefits are only realised if sufficient people are contributing resources. We have already seen this issue with respect to the researcher perspective where it appears through the issue of the levels of granularity (macro-meso-micro) discussed above. The additional complexity that arises from many stakeholders seeking broadly aligned - but not identical - change, due to their differing motivations, makes the problems of collective actions even more challenging.

Institutions, such as governments, funders, infrastructure providers, and research organisations, can support collective action by providing structures that drive consistency and reliability. For instance, consistent regulations and policies can mitigate the issues that this complex landscape of motivations creates. Shared and interoperable information technology systems can also support collective action. However, the efforts to standardise regulation or technology provision suffer from their own collective action challenges as well.

## Increased drivers for public-private (and public-public) cooperation

There is a frequent and generally unproductive argument that commercial providers are by definition bad (and that, conversely, non-commercial providers are always good). The reality is that for-profit providers exist within the ecosystem, and that the motivations of different forms of organisation will be different. Sometimes these differing motivations can create real value for research communities that they would be unable to provide for themselves. The increasing pace of change in research, and the need to leverage further resources, means that this diverse landscape of large and small, public and private, for profit and not-for-profit will be with us for some time.

This raises key challenges for productive interactions - how to move on from the unproductive ideological debate, and also how to manage and regulate the interactions between different players so as to maximise the overall benefits? How can the community harness competition and market investment to support a choice of products and services with higher quality but not give up collective control over the assets we create? Is it inevitable that outside investment is required to build user-facing technologies for disseminating scholarship or are there new forms of financing from within the community that could provide the same advantages? Above all, how can we build an ecosystem in which commercial players are confident that they can benefit from investing in solving the problems of researchers, while the research community remains confident that we will not lose control of assets and be locked into a vendor monopoly.

Another related issue, although it may seem quite different, is citizen science. It is similar in the sense that interacting with “the wider public” raises issues of how those relationships should be managed. What is ethical? Does it require regulation? Do we need standards, or should we be discussing more general principles or values with regard to how these projects operate? More generally how do we bring the wider community into decision-making in research in a principled fashion? The engagement of citizens requires a whole new perspective on how research is directed and conducted, and it is essential that their role and contribution as part of open scholarship is understood.

## Assessing progress towards open scholarship is currently not possible

The issue of incentives for researchers and their communities was discussed above. The complexity of the environment creates a further challenge. It is challenging or impossible to track progress towards open scholarship because there are no comprehensive sources of accessible and reusable data and no agreed indicators based on them.

Current evaluation systems are dominated by citation-based indicators that hinder the transition to open scholarship practice. These traditional systems are stable and their importance (if not the way they are calculated) is widely understood, in contrast to open scholarship practices. Developing indicators for progress is, once again, a collective action problem. It requires the pooling and management of data, and an agreement on motivations. What is it that open scholarship is meant to achieve?

There is a range of initiatives that aim to improve the quality of assessment of researchers, groups, projects and institutions; DORA (DORA Signatories, 2013), Leiden Manifesto (Hicks et al., 2015), Responsible Metrics Forum (Responsible Metrics Forum), RISE Report (RISE High Level Group, 2017a), EU Altmetrics Report (European Commission Expert Group on Altmetrics, 2017). However little work has been done on the broader question of what success looks like and whether it can be assessed. The European Commission Open Science Monitor (European Commission, nd) is one small step in this direction but is very limited both in its scope and in its capacity to grow. It is largely built on proprietary data

and is limited to the data available on a subset of the processes of interest.

The complexity of the system means that indicators of progress agreed by the broad research community may be necessary to achieve our goals. The broad outlines of what shared indicators need to look like have been defined, but little progress has been made towards actually building them. We also need to understand how the evaluation process itself changes what is being appraised. We need concrete case studies that explore the impact of interventions based on (changing/new) indicators. Without those it will be even harder to propose indicators and appraisal methods to monitor and enhance open scholarship.

## Summary

The challenges in making progress towards open scholarship can be characterised broadly into a small number of categories. There are challenges that result from the differing (and sometimes opposed) motivations of stakeholder groups. There are challenges that result from the differing motivations that arise at different scales: individual/micro, group/organisation/meso, global/macro. For both of these sets of challenges the question of the finding which narratives appeal to which groups is central. What are the aspirational stories that will capture the imagination and attention of differing groups and engage them with change? Where an individual, group or community does not have an engaging narrative for changing practice, inertia will favour the status quo. Such narratives might be general, speaking to many communities, or they might be specific, relating to the concerns of one community.

Alongside these systemic issues are the concrete and specific problems that contribute to inertia for individual practice. The structure of incentives, both for individuals and communities, is backwards-looking and it promotes traditional practices and culture. The tools for easy – and affordable – adoption of open scholarship practice are often missing. These tools are also missing at the global level. The complexity of the research ecosystem requires that we find ways of summarising and assessing progress towards community goals, and means for doing this analysis at both the micro and meso level. The underpinnings required for this don't exist, particularly tools for assessing group and community level assessment.

In many ways this is not a new problem. Scholarship as a practice and a community is built on institutions and infrastructures that have evolved over time to solve similar collective action problems. Our systems of publication and communication, our research institutions, have been built up to solve challenges similar to the ones we now face but at a smaller scale. Perhaps the most promising route to take is recognition that the values of open scholarship have deep roots.

Our motivations have not changed, but our infrastructures and institutions were built for a different age. The central challenge is therefore that the infrastructures and institutions for open scholarship are missing. However, we cannot simply build these; such systems evolve over time. The task is to better understand our existing institutions and infrastructures, and consider how they can be changed and sustained over time to support open scholarship practice as simply good research practice.

# Chapter 3:
# Towards a KE open scholarship framework

Research is changing. An important aspect for Knowledge Exchange work on open scholarship is therefore to develop a framework to organise its activities to promote this change. A framework could assist in planning and prioritisation of activities as well as understanding how KE's work on this relates to the work of others. Our modest goal for this report is to present a programme of work within a draft framework and to identify any necessary tasks that aren't being carried out. The further development of such a framework could in the future contribute to a deeper theoretical model of open scholarship.

This chapter offers a framework that provides organisational principles we can use to describe changes in scholarship. It then describes a specific version of this framework that can categorise specific activities that have been (or might be) undertaken by Knowledge Exchange, its partners or other actors in the space. Finally, it identifies issues that, if resolved, might help to refine the framework into a model that can provide deeper insights into current processes of change within scholarship.

This framework emerges from the observation that open scholarship involves an expansion of the forms of research outputs that are shared, and an aspiration for more effective sharing of these outputs to a wider set of communities and groups. It is built around the idea that we need to examine how researchers' investment in the accessibility and usability of research outputs at different stages in the research process are encouraged or discouraged by the interactions that they have with different stakeholders in various contexts. The basic dimensions of our framework, which comes in the form of a canvas, are therefore a representation of the research process, and a categorisation of the various contexts or "arenas" in which interactions play out. The challenge, of course, is that these are always in flux.

# Existing Knowledge Exchange work and its categorisation

Existing work by Knowledge Exchange and each of the partners covers many areas. It includes the provision of information infrastructures that support researchers at different stages of the research process.

The Knowledge Exchange community supports policy development and regulation for national and European funders across a range of areas and throughout the research process. It supports specific communities and seeks to guide them to best practice and in some cases provides direct funding mechanisms and supports economic decision-making. Across all of these Knowledge Exchange develops and provides expertise and advice.

Knowledge Exchange partners are broadly committed to the transition to open scholarship and a great deal of their work can be seen as related or directly engaged with these issues. Knowledge Exchange also operates at all three levels of granularity we have described, supporting individual researchers (micro), building communities of practice and supporting stakeholder groupings (meso), and advising government and systems level players (macro). There are many ways to categorise and organise these various pieces of work. It seems logical that the framework should be organised around the research process, some sort of categorisation of the activities into "arenas" where they are carried out, and the level of organisation/scale (micro-meso-macro). The challenge is in developing a schema that provides a set of categories that span each of these dimensions in a way that allows us to define gaps.

### Table 2. Characterisation of a small sample of Knowledge Exchange activities

| KE activity | Stage of RLC | "Arena" | Scale |
|---|---|---|---|
| **SHERPA/RoMEO** | Publication (outputs) | Technology, regulation | Macro |
| **SURF research data services** | Data, experiments | Technology, social | Meso |
| **RDM training** | Data production | Social | Meso, Micro |
| **Subscription negotiations** | Discovery | Economic | Macro |
| **OA infrastructure sustainability** | Discovery, publication | Economics, regulation/ policy | Macro |

# The changing process of research

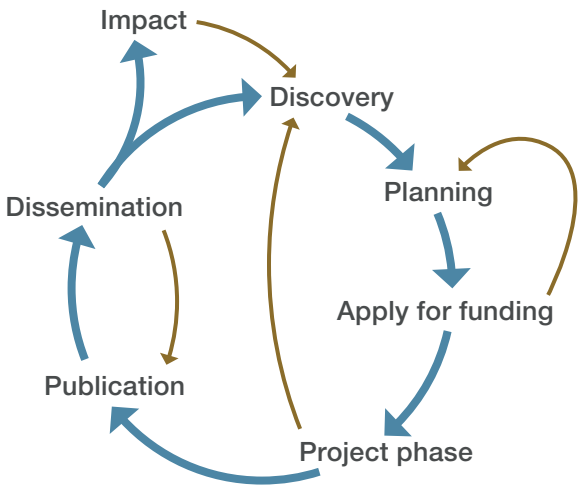
While the basic nature of research may not have changed over the years, the Research Life Cycle (RLC) as a whole, and its different phases, have changed or will change dramatically.

While there are various reasons for this change, the most notable is the advancement of technology. For example, the speed and the dynamics of communication between researchers are changing the pace of research. The preliminary sharing of results and data is one example of this.

One way of seeing this change is in the proliferation of RLC diagrams that seek to represent the complexities of modern research. New sets of tools challenge old divisions of work. Another view is that the changes we are seeing are better characterised as a departure from cycles altogether towards a more dynamic network of interactions and communications that can take place at any time. Finally, there is the view that the "cycle" should be simplified down to its simplest parts "think-do-share" (Treloar, 2014) which repeat.

For our current purposes it is important to have a representation that sufficiently covers the research process. We have therefore adopted a simple generic RLC as a starting point. Each phase of the RLC also has a subset of steps, which might be added to the framework - if needed - to structure and select Knowledge Exchange activities. For example, the project phase might be divided up into **experiment, data production, data management, data analysis, writing**. It is obvious that this rough outline of the RLC is a conceptual model to help with structuring Knowledge Exchange work; the linear presentation doesn't reflect the reality where steps are repeated or undertaken in parallel.

**Figure 1. A simplified research life cycle**
The main stages used in the KE framework are shown along with some indications where the cycle is often not strictly followed.




It is also important to note that mapping against a generic research lifecycle may not work universally as different disciplines and subjects follow differing processes. For example, subjects in the humanities may have research outputs that are different (such as archives) to those of subjects in the life sciences. The way that research is conducted across different disciplines is also not the same. For example, some disciplines deal commonly with sensitive data while others do so only very rarely.

# Interactions and arenas

The ultimate object of our framework is to map activities. In a first draft of the proposed framework "challenges and issues" were mapped as the second dimension.

Discussion within KEOSAG suggested that issues and challenges (and their counterpart, opportunities) could better be seen as arising from specific interactions in specific contexts. For instance, challenges and opportunities around early sharing of data can be seen as the result of interactions arising from the outputs of the project phase in a set of different "arenas".

There is a **political or regulatory** context, defined by requirements imposed by funders and institutions. There is an **economic** context; the cost of data sharing, or preparing data for sharing can be prohibitive and in some cases is not funded. There is a **social** context; some disciplines share early by default as a matter of course while others do not, or do so at a different phase of the research process. And there is clearly a **technological** context. Is the data collected in a form appropriate for sharing, is its transformation and deposition easy or is it too complex or large for our existing technologies to cope with?

Existing frameworks seek to identify which contexts or arenas are important. We propose to adopt the PEST framework (Aguilar, 1967; Wikipedia Authors, 2017) from environmental scanning in business strategy as a starting point. PEST stands for "political, economic, social, technological" and is also sometimes expanded to PESTLE by including "legal" and "environmental" contexts. Whether additional categories are necessary is still to be investigated. In addition, the PEST model is intended as a tool for scanning macro-factors. As noted in the previous chapter we wish to consider also the micro (individual) and meso (community/group) scales. An argument can be advanced that the "social" aspect of the PEST model is in fact the expression at the meso level of "political" which is a macro level context. This will need further analysis and theory building.

# A draft Knowledge Exchange Open Scholarship Framework

The draft framework is represented in Table 3, with the incorporation of various existing activities and their aims. For clarity we do not note the scale dimension in this representation.

Overall we can see that these examples of Knowledge Exchange work are concentrated in the project, publication and dissemination phases, with some support for underpinning infrastructures and discovery. The arenas cover all four of the PEST areas with perhaps less of a historical focus on the economic arena. There is a concentration at the meso level with respect to activities and services, and the macro level with respect to policy. Activities targeting the micro level seem to be mainly those focused on training.

It is valuable to briefly consider the two new topics that will be discussed in the next chapters. These topics did not emerge from the framework itself but can be described within it. They can be described as taking a first step towards using the framework as a map to guide integrated programmes of work.

The first package of work, **The Economy of Open Scholarship**, can be seen as addressing the relative absence of existing Knowledge Exchange activities in the economic arena. For the second topic **Output and Evaluation from the Researcher's Perspective**, Knowledge Exchange will address the "publication" and "impact" phases of the RLC from the researcher's perspective. That is, Knowledge Exchange with input from KEOSAG and the community will develop a programme of work to examine how researchers' choices are driven by the real or expected interactions across all arenas. Again the interactions will play out across the levels of micro-meso-macro. For instance, it is important to understand how community level social expectations (meso social) influence individual decisions made by specific researchers to commit time and resources to specific modes of communication (micro economic) and how the availability of technology affects this (macro technological).

## Table 3. A first draft of the KE Open Scholarship Framework and a categorisation of some existing pieces of work

| Arena | Political | Economic | Social | Technology |
|---|---|---|---|---|
| **Phase** | | | | |
| **Discovery** | National implementations of ORCID and ISNI (http://bit.ly/1QSHk0o) | Subscription negotiations | National implementations of ORCID and ISNI (http://bit.ly/1QSHk0o) Authority Files (http://bit.ly/2twL0RX) Snapshot Digitisation (http://bit.ly/2gQgYmj) | National implementations of ORCID and ISNI (http://bit.ly/1QSHk0o) Authority Files (http://bit.ly/2twL0RX) Snapshot Digitisation (http://bit.ly/2gQgYmj) |
| **Planning** | | | RDM Training and Skills (http://bit.ly/2gQhH75) | RDM Training and Skills (http://bit.ly/2gQhH75) |
| **Apply for funding** | | | | |
| **Project phase** | | | Surfboard for Riding The Wave (http://bit.ly/2uixCxG) | Surfboard for Riding The Wave (http://bit.ly/2uixCxG) |
| **Data gathering** | | | | |
| **Data management** | RDM Policy | Funding RDM (http://bit.ly/2vrzX9O) | RDM Training and Skills (http://bit.ly/2gQhH75) | RDM Training and Skills (http://bit.ly/2gQhH75) |
| **Data analysis** | | | Research Tools use Cases (http://bit.ly/2gPZJ4y) | Research Software Sustainability (http://bit.ly/1VTvDGJ) |
| **Writing** | | | | |
| **Publication** | OA sustainability index (http://bit.ly/2tmFZHA) OA Policy Dependency work (http://bit.ly/2vlnrST) | OA sustainability index (http://bit.ly/2tmFZHA) Subscription negotiations | OA sustainability index (http://bit.ly/2tmFZHA) OA Policy Dependency work (http://bit.ly/2vlnrST) Motivations and Incentives (http://bit.ly/2tn67BU) The Value of Research Data Metrics (http://bit.ly/2tmRgHD) | OA sustainability index (http://bit.ly/2tmFZHA) |
| **Dissemination** | National implementations of ORCID and ISNI (http://bit.ly/1QSHk0o) | National implementations of ORCID and ISNI (http://bit.ly/1QSHk0o) The Value of Research Data Metrics (http://bit.ly/2tmRgHD) Price of keeping knowledge (http://bit.ly/2vsfGB6) | National implementations of ORCID and ISNI (http://bit.ly/1QSHk0o) The Value of Research Data Metrics (http://bit.ly/2tmRgHD) Motivations and Incentives (http://bit.ly/2tn67BU) | National implementations of ORCID and ISNI (http://bit.ly/1QSHk0o) |
| **Impact** | | | Making Data Count (http://bit.ly/2tNANvB) | Making Data Count (http://bit.ly/2tNANvB) |

# Chapter 4: The economy of open scholarship

As described in Chapter 3 two potential sets of work have been identified that use the overall design of the KE Open Scholarship Framework as a guide. The first of these is to examine how the outputs and activities of the full research life cycle are affected by economic concerns. Issues that arise in the economic arena will not be limited to economics and will touch on social, political and technological issues. In addition, issues in these other arenas can have economic consequences. For instance, a common argument is that "open" movements have arisen because technological changes, primarily the web, have changed the economics of communication (Björk and Solomon, 2014; Eve, 2014; Gans, 2017; Suber, 2012). That is, the impetus for open scholarship is the economic opportunities arising from technological change. The intent of this package of work is to apply an economic lens to identify and examine opportunities and hindrances to the adoption of open scholarship practices.

Most of the discussion of economic issues in scholarly communication has focused on macro level issues (framing them as a dichotomy between private and commercial interests and the creation of knowledge as a public good) and the micro-level (the incentives for individual researchers). One aspect of the Knowledge Exchange open scholarship work will be to expand our understanding of meso economic aspects, such as the sustainability of groups (Neylon, 2016; Potts et al., 2016), and communities, as well as the opportunities for new models that such a view provides, including community level organisational forms such as cooperatives and community infrastructures, as well as the risks that these might entail (Bilder et al., 2015; Neylon, 2017b).

Any discussion of the economics of scholarly production must also address the question of what goods are being produced and how (and whether) they are being exchanged. Many scholars have observed that there are various economies of scholarly production - financial economies, prestige economies and labour economies - and that these may operate separately from each other (Eve, 2014). Key to any discussion of the goods being created is that the process of scholarship creates many things that are difficult or impossible to exchange and frequently impossible to value in financial terms. Moreover, the apparent value of specific goods may differ radically from one community to another. At best, in these situations assumptions that come from classical market economics will be suggestive rather than reliable.

The purpose of this strand of work will be to improve our economic understanding of the processes, supporting services, and organisational forms that underpin the full research cycle. In doing this, our goal is to understand how best to use the full range of economic and organisational strategies, including commercial for-profit providers, to maximise the overall collective and public good that arises from investments in scholarship.

# Issues for the economy of open scholarship

Scholarship is a complex system. Open scholarship increases that complexity by explicitly increasing the number of relevant players to include wider publics, new technology and service providers (and their investors), and a broader inclusion of the users of research, alongside traditional players.

All of these players interact across the arenas – political, economic, social, technological – that the Knowledge Exchange Open Scholarship Framework identifies.

To give a loose analogy: consider the transition from fixed telephones (originally in public places) to today's mobile technology. Shifts in technology (themselves made possible by economics that reduced the costs of some components) led to changes in social interactions on a massive scale. These in turn led to new economic and sustainability models with a shift from fixed company owned infrastructure in phone booths, which is "rented" on a per-call basis, to portable infrastructure which is "owned" by the user (albeit generally subsidised through a contracted subscription). All of this in turn has led to new regulation including, for instance, the European Commission requirement to allow "roaming" across the European Economic Area.

In a similar way, new markets for digital services and infrastructures have evolved to support researchers. The digital research life cycle offers the potential for dramatic changes, and for the collection of unprecedented quantities of data on the activities of researchers. The parallels with the example above are imperfect. However, the key point is that technical developments, supported by existing economic models, led to social changes that enabled new economic models and required a political and regulatory response. All of the arenas are intertwined.

As noted in Chapters 2 and 3 this raises challenges for creating a clear framework to work with. Framing the challenge as one of understanding the economic arena, and its interactions with other arenas played out across the process of research, is one way to parse the problem. Who are the actors? How do changes in the research process and in the players coming into it, affect the economics of existing relationships and create new opportunities? Who are those opportunities available to? What makes them accessible? And what are the consequences that arise? The core issues with using an economic lens as a tool for helping us to design improved systems is that we know very little about the research system in economic terms.

## We don't know who the actors are…

If the premise of this work is that a better understanding of the economics of the system will enable us to design for change, then we need to map the economic actors. Most economic analysis of scholarly communications has been simplistic. The complexities of multiple stakeholder groups, as well as their differing interactions at the micro-meso-macro levels, will need to be explicitly modelled.

This means understanding the full set of relevant actors, from individual researchers to disciplinary communities, departments to research institutions to university groupings, governments, publishers, scholarly societies (which are not the same as disciplinary communities). It also means understanding technology providers and investors, libraries (not just within institutions) and archives, both public and private. What are the important differences? Are disciplinary differences really more important than geographical and cultural ones? Is the public-private dichotomy important or just associated with forms of

governance? These differences, of the stakeholders and their interactions, are complex, and to date have been poorly modelled in economic terms.

Another set of "actors" to consider are the differing layers of infrastructures, services and systems that play a role enabling a digital open scholarship ecosystem. What are the characteristics of existing providers, what economic incentives do they have, and do these serve the community? We have a base layer of physical infrastructures (networks, storage) as well as social/technical infrastructures such as identifiers and standards. On top of these we have user services such as search, databases, content and finally user-facing tools. We should have a complete picture of who provides which services on which level; how different layers should be governed; what we are buying on which level (eg service, data, prestige); and how payment is organised (eg money or data). It is also necessary to explore how hybrid solutions of public and commercial providers can work together. Examples include the HNSciCloud Tender (Helix Nebula, 2016), European Open Science Cloud (Commission high level expert group on the European open science cloud, 2016). What relationships can rest on trust, and which need formal governance?

## …or what motivates the choices that actors make

To build an economic understanding of progress towards open scholarship we need to know more than who the actors are, we need to know how they interact (at the varying different levels of organisation) and what their incentives and motivations are. Even at a basic level our understanding of motivations, incentives and choices is based on incomplete, contradictory and often unreliable evidence.

What motivates a researcher to publish in a particular journal, or media form? What choices do they have? How are they driven by local institutional context or disciplinary cultures? Why is it that universities seem to make poor, short-term decisions in purchasing services rather than considering investment on the timescales that characterise their history? What are the issues that prevent institutions from working more effectively together to produce underpinning infrastructures?

Similarly, on the provider side, what motivates the complex mixture of public and private, for-profit and not-for-profit, community governed and third party organisations offering services? How do the incentives for a new service change as it scales up and requires further investment, what are the interests for investors and are they unbalanced towards large sales and big exits? How are service offerings limited by the financial and other incentives in the system?

What are the positive and perverse incentives in the system? Where can markets be relied upon and where should regulation or collective provision be imposed? We have no good theory or decision models to understand what should be controlled by the community and what should be left to a market. What are the trade-offs between market and community provision and what arrangements will allow the best results of interactions between all the players in the ecosystem? Without this information crucial design and procurement choices, such as for the European Open Science Cloud (Commission high level expert group on the European open science cloud, 2016) or Jisc research data shared service pilot[2] (Jisc, nd) may be taken without a full understanding of the consequences.

**Footnotes**

1 jisc.ac.uk/rd/projects/research-data-shared-service

## A false political dichotomy between public and private

There is a political issue that is related to the two above. Naïve economic arguments can easily turn to equally naïve political arguments where progress is defined as shifting the balance in an apparent dichotomy between public and private provision. The true tensions here are issues of control and governance mechanisms, which can be completely separate from organisational form and funding. What can we learn from non-venture capital and public funding models? Where may cooperative, collective, stakeholder value driven solutions be appropriate for the services that support collaborative, transparent and accessible research? What is needed to leverage growth and efficiencies, and safeguard investment?

The assumption that all commercial players are bad actors (and by extension all not-for-profit or public organisations are good actors) can easily derail conversations that are already difficult enough. Issues of how to structure markets, and provide the right assurances, of agreeing where regulation is appropriate and required, and where public financial intervention is merited are difficult. Understanding the motivations of different actors is a crucial first step but building frameworks that allow for productive negotiations beyond the public-private divide are also crucial. The lack of good templates for governance and regulation, particularly ones that can operate across the whole ecosystem, is a substantial challenge.

## We don't know how to value many of the goods and services across the research ecosystem

It is often stated that it is impossible to place a value on (at least some of) the outputs of the scholarly process. However, this claim seems too frequently to lead to a situation where those outputs are not valued, the opposite of its intention. The scholarly ecosystem generates a wide range of "goods" which are exchanged in many different settings. Some of these exchanges are financial, some are not, some involve goods that also have a place in wider consumer markets, many do not. Efforts to estimate financial value have focused on particular forms of financial return from investment in large scale infrastructures to provide lower bounds (Beagrie and Houghton, 2016; Gruen et al., 2014; Houghton and Gruen, 2014).

There is generally a failure to appropriately value (whether or not that means placing a value on) the assets of research communities and institutions. Sustainability models tend to focus on revenue sources, not asset management. Many of the assets of the scholarly community are collective, in that their value is only realised when combined. Because those assets are not collectively valued service providers have been able to take control of them and deliver back only a small part of the potential community value.

There are examples where all stakeholders – public and private – have been able to set rules with mutual understanding in a way that delivers value for all. In the case of identifiers (such as Digital Object Identifiers [DOI] or ORCID) there appears to have been success in developing shared infrastructures. Here, a necessity felt by all ultimately resulted in a revenue model that seems to have met approval from many (albeit not all) stakeholders for usage and maintenance. In contrast, the data underpinning evaluation, an asset generated in large part by the scholarly community, has been more difficult. The core data aggregations are proprietary. Similarly, the historic literature is owned in large part by a small number of players (Larivière et al., 2015). Is this merely an accident of history, or are there fundamental characteristics of literature and citation data that are different to those of identifiers? What does this tell us about the management of data?

Related to the question of valuing assets is the issue of community investment in infrastructures that can house and manage such assets. Claimed costs, for example for data infrastructures, vary wildly ranging from those based on a naïve application of consumer cloud hosting

costs, to over-specified and unaffordable systems. Without understanding how we value (again not necessarily in a quantitative fashion) our research data assets and realise their full potential value it is difficult or impossible to make principled arguments for the appropriate level of investment in community based or institutional infrastructures.

## The community has lost control of core goods and services

The discussion above focuses on the missing information that is needed to guide action using economic models. However, even with this information the research community has limited capacity to act because it has given up control of many core assets. Historically the research community has given up control of much of its output, specifically that contained within traditional research articles and books. The commercial control of citation data is another example of this lack of control, and this cycle seems to be repeating with the new indicators being developed from social media analysis. In this space of "altmetrics" providers there are players that remain separate from the large publishers. One of these, the market leader Altmetric.com, is a portfolio company of Digital Science, which is separate from but connected to Springer Nature through their common major owner Holtzbrinck. The main commercial competitor, Plum Analytics, was recently bought by Elsevier. The not-for-profit ImpactStory has not historically gained sufficient investment to compete with these commercial players (although see [Clarivate Analytics, 2017)]). With a very small number of market participants this leads to a conflict between commercial interests and the need for added value tailored to (discipline) specific needs.

Finally, the provision of data services is increasingly in the hands of providers outside the research community. Here there has been progress made on licensing but for example with providers like Figshare the mass recovery of data assets is forbidden by general terms of service (Figshare, nd). Again, the ability of the research community to insist on specific terms of engagement, or to apply regulation is steadily reduced. The move towards the application of open licensing is a step forward but it is not enough to enable the research community to specify terms. At the same time, the lack of clarity on requirements and the potential for future regulation is an issue for commercial providers, who above all require confidence in their understanding of market conditions.

Equally the problem of emerging oligopolies and the increasing concentration of power in the hands of a small number of commercial players across the whole research life cycle is a potential problem. Market and capital concentration will tend to limit the desirable effects of market competition and unbalance the negotiations between many relatively small institutions and a small number of large scholarly service providers. In other markets buying consortia set standards of service for critical services and infrastructures. This can include conditions that enhance market competition and reduce barriers to market entry for new players. It might also include regulation that encourages and supports provision for smaller communities with specific needs (such as citation data for scholarly books). A critical question is why the scholarly community is so poor at developing and imposing such regulatory frameworks.

## We need frameworks to guide action

Two particular dangers are apparent in digital science when the public research sector fully relies on commercial offerings: (a) horizontal integration, the situation where a few suppliers control the market and create an oligopoly that takes control of community processes (eg functionality, pricing, criteria); and (b) vertical integration, when research organisations purchase entire management systems from one supplier and eventually become completely dependent on that supplier (who in the worst case has a monopoly), which means that community control is lost.

Institutions go to commercial suppliers to reap the benefits of competition and innovation that lead to better products and services. But in many specific markets proper competition is non-existent. There are limited economies of scale, or near monopolies of the market meaning there is no real competition, leading to lack of innovation. In such cases an intervention is needed.

The way to intervene is not to offer the same services as a company would. It is highly unlikely that the research community could be a successful market player in providing services compared with companies whose primary goal and competence is offering attractive services at the lowest possible price while making the highest possible profit. A public service provider should know more, offer more appealing services and offer higher education and research specific expertise to support the use of existing public or commercial offerings. The value it offers will be different.

So an issue regarding the economy of open scholarship is how, with what kind of interventions can we organise competition to ensure the best service to the end user? And how can we avoid being locked in, and lose control, when engaging with commercial providers?

# Research questions for KE open scholarship work

## How can we understand "the economy" of the open scholarship space?

It is common to talk about the research enterprise in terms of "markets", including the pejorative use of terms such as "subsidy" or "unfunded". However, from a strict economic perspective market economics is unlikely to apply even in theory. The markets are either highly dysfunctional, or fragmented, or not markets in any useful sense at all. But despite these objections there has been limited work on how to frame the (political) economic systems of the research enterprise. Work in this area is expanding but it is still in its infancy. There is a need to develop a sound theoretical footing for further work and policy development.

This would help to address fundamental questions. How big is the scholarly economy? Who are the players? Where does it overlap with broader consumer markets? Where are markets appropriate and where are markets currently applied? Are they currently functional? And is dysfunction structural and systemic or a result of issues that can be solved? Rather than simply stating that aspects of research outputs "cannot be valued" we can point to the assets that are created and how they are used and valued by different communities.

**What is the economic lens on this question?**
These questions bring an economic sensibility to the essentially political questions of resource allocation in the research enterprise. They tackle the complexity of the ecosystem by applying economic thinking and models. It may also contribute back to economics by developing new models that support meso level thinking. Thinking about how assets are created and where they are used will help us to better frame the interactions between stakeholders. In the end we may be able to address the overall question of how to make the research enterprise sustainable as a whole.

**Should Knowledge Exchange contribute? If so, how?**
Knowledge Exchange is not able to directly fund the development of new economic research but it could act as a coordinator for other directly relevant funders. Knowledge Exchange is uniquely placed to provide information and data to support and test economic modelling of systems.

## Are new governance and financial models needed to support open scholarship?

This is a more concrete version of the previous question. Many different players are working on governance and the management of public-private partnerships is a significant issue. The sustainability of infrastructures is a major current concern with work ongoing by the OECD, European Commission (European Commission, nd) and SPARC Europe amongst others. All of this is tied to questions of governance and trust amongst stakeholders, returning us again to a question of political economics.

Some argue that all the necessary systems are in place whereas others argue that new approaches are required, both in terms of funding and sustainability models (Anderson, 2017; Anderson et al., 2017), and governance structures (Bilder et al., 2015). Arguments also continue about centralisation vs federation of systems and architectures with little understanding of which design options are best suited for different situations.

There is a need to model, design and test new approaches to develop both investment and asset management strategies and their relationship to necessary regulation of the scholarly ecosystem. How can we build frameworks in which the diverse set of actors interact productively to create value for all? What forms of regulation, and what forms of incentives are needed? What are the trade-offs? And how can we evaluate different possibilities against each other?

**What is the economic lens on this question?**
A valuable lens to probe these questions is that of sustainability. What makes services, infrastructures and communities sustainable over the long term, and how can they be sustained throughout a natural life cycle of growth and decline? These questions, which relate to issues of financial sustainability but also stable governance, regulatory frameworks and the trust of stakeholders can all be linked by economic modelling. The relationship between governance models, revenue sources, and community trust are questions that can be treated through an economic lens, either strictly through applying or developing (political) economic models or through analogy by comparing and contrasting within those models.

**Should Knowledge Exchange contribute? If so, how?**
Knowledge Exchange is well placed to contribute to these questions through its direct engagement as a funder and provider of these kinds of services. Existing work engages with these questions and Knowledge Exchange can provide both expertise and information as well as supporting expert consideration of these issues.

At a very concrete level Knowledge Exchange can support and conduct case studies of what has worked (and not) and what is working (and is not). Such a critical analysis will not only be broadly valuable but can directly support the work of Knowledge Exchange and its partners in this space.

## How do stakeholders view the economy of research and open scholarship?

Alongside the challenges of understanding the economic landscape is the question of how that landscape is perceived by different players. It is frequently observed that researchers are blissfully unaware of the expenditure made on their behalf, and indeed when confronted with it the response can be to regard it as misguided, albeit generally from a grossly uninformed position. Such partial perspectives are not limited to researchers, however. It is unclear whether funders, governments, publishers, libraries or research organisations have any significant appreciation of how their interventions play out across different parts of the overall ecosystem. Discerning how different stakeholder groups understand the economic ecosystem they inhabit, and how the perception of different scales and motivations is linked to this, will aid in effective communication between stakeholders and effective models for advocacy to stakeholders.

**What is the economic lens on this question?**
The economic lens here is the use of economic models as a framing device to communicate across stakeholder groups the ways in which they affect each other. Firstly, by probing how different stakeholders view the economic ecosystem they inhabit and what they see, and secondly by seeking to use an economic framing to translate from one stakeholder group to another. This analysis may also be supported by incorporating the scale questions and economic models that relate to different scales.

**Should Knowledge Exchange contribute? If so, how?**
As a coordinator and service provider to many of these players Knowledge Exchange is in an ideal position to engage with stakeholder groups. The work on communications and framing models builds on existing work by Knowledge Exchange and individual partners on effective communications amongst stakeholders on related issues.

## Are there specific interventions that can drive progress to open scholarship?

The ultimate goal in understanding the economic system of research is to identify economic interventions that can drive progress towards open scholarship. We have identified the question of why there is an economic driver towards commercialisation and privatisation of services and infrastructures. The further question is: what interventions can be made in the current system that use the characteristics of the system to drive towards open scholarship?

Frequently this question is framed as “how can funders intervene?” but the question is also appropriate for other stakeholders including institutions, research communities, individual researchers and governments. Shifting the economic basis of motivations for stakeholders is one angle, providing new funding models and systems that are better suited for an open scholarship environment is another. Agreeing templates for governance models that are a precondition for funding might be another, as would examining regulatory models and systems that can provide the degree of certainty required for sustainable interactions between all actors in the long term.

**What is the economic lens on this question?**
Interventions have generally been political in nature or based on the idea of “driving incentives”. By bringing a more sophisticated economic lens to the analysis of interventions we can make progress on difficult questions and reach a better understanding of why some interventions have failed. Such analysis may also contribute to a better understanding of the role of different stakeholders and the responsibilities that different stakeholder groups need to take. In common with the other questions this economic modelling also offers a way to better understand, frame, and ultimately control the relationship between commercial providers and the broader community of the research enterprise, and to describe the unique value that they can bring.

**Should Knowledge Exchange contribute? If so, how?**
Again, Knowledge Exchange is uniquely placed to use its network to both gain access to information and case studies and to test ideas and models in trusted spaces. As a nexus for existing work on governance there are opportunities for identifying and supporting work that communicates good models and best practice and to support case studies on the range of interventions being attempted.

# Chapter 5:
# Output and evaluation from the researcher's perspective

The research enterprise is a normative system containing many players with complex economic and political relationships. It is also a system that is expected to generate a range of outputs, outcomes and impacts. Different stakeholders place different values on different outcomes over different timeframes. In addition, optimising the research system as a whole may be in tension with the interests and performance of groups and individuals. Finally, the system itself is evolving in response to outside pressures and internal change. Evaluating the research system (macro), specific organisations and groups within it (meso) and individual researchers (micro) is therefore an ongoing challenge.

The goal of Knowledge Exchange is to understand, and through understanding speed up, the transition to a research system that fully harnesses the potential of today's digital scholarship. It is common to start from the position that perverse incentives, driven by traditional research evaluation processes, are a barrier to change. This view implies that creating "the right incentives" would drive behaviour change, ie micro level changes. In turn this leads to attempts to drive change through policy (macro level political and economic interventions). There is however less documented evidence that such shifts result in long-term positive change. In particular, there is limited evidence of shifts in cultures of research communities (social meso).

The alternate view that many researchers take is that we should abandon evaluation (or sometimes more narrowly quantitative evaluation) altogether. While rarely examined deeply this view can be tied to a narrative of Mertonian norms where evaluation itself has damaged the "natural" and presumably open behaviour of researchers. This view fails to take account of the way research communities self-police behaviour, membership barriers and prestige in ways that tend to reinforce exactly the same behaviours (selective publication in prestigious venues, bias towards established institutions, bias against under-represented minorities) that are usually blamed on quantitative indicators.

This package of work is focused on examining how researchers experience the decisions that they make in communicating outputs, and the evaluation processes that they experience. It is intended to address questions of how behaviour is driven by incentives (micro level) and also how the normative assessment of groups (meso level) affects and is affected by evaluation systems, both internal and external to the group. A key question is how **culture** affects (and effects) **behaviour**, and how external regulation and assessment affects **culture**.

As this is a large topic, it is proposed to focus on two elements of the research life cycle in the first instance: outputs, such as articles, books, preprints, protocols, software, shared data, etc. and the evaluation of these outputs, their outcomes and impacts.

The aim of this activity is to follow the line from the researcher's own experiences and perception. There are many assumptions made about what obstacles and tempting detours researchers experience on their pathway to open scholarship, but these are not always underpinned by evidence. Often the importance of open scholarship is advocated, however requirements and expectations are set by policy makers on the macro level and do not engage with the motivations of researchers and their communities.

Having a thorough understanding of how researchers feel about the current systems of research evaluation, including their attitude towards the impact of open scholarship in this field, would help in identifying priority areas for improvement and support, and improve the much needed close cooperation between (among others) researchers, librarians, research managers, leaders of academic institutions and policy makers. Therefore, for this activity it would make sense to concentrate on a **bottom-up** investigation of what research evaluation and indicators are actually being used **for**, on how they affect researchers' actions, and on how openness may contribute to research benefits for both new and experienced researchers. This might be emphasised by using a case study approach to form a basis for the bottom-up investigation. After all, it is the combined actions of researchers that constitute the academic field and the possibilities for development towards open scholarship.

## Evaluation, indicators and "those metrics"

We cannot address research evaluation without engaging in the debate in this field over "metrics" and indicators, particularly quantitative indicators. Simple indicators, such as output or citation counts, have been used for some time in the research enterprise alongside more subjective assessments of prestige.

The terms "metrics" and "measurement" have been avoided as much as possible in this text. They both convey the idea that there exists an analytical theory describing scholarship, with a proper metrology and well established standards whose figures can be used in meaningful calculations. This is of course not the case. These terms are often used lazily to refer to (quantitative) indicators in research assessment processes. But "indicators", while potentially being numeric, are not necessarily measurements; they just **indicate** something. Even simple calculations based on them are meaningless in most cases.

While there is often an assumption that quantitative indicators lead to more objective and better decisions, in reality the picture is complex and uncertain. Indicators are used on different levels by the research sector and governments to demonstrate value for money. Funders use indicators to help with the efficient allocation of research funding and to demonstrate public accountability. Academic institutions use indicators for rankings and performance appraisal. However, without proper understanding of how they work and without proper statistical caveats, indicators can be at best meaningless and at worse harmful. Poor indicators can distort incentives and damage career prospects, even damage the mental health of researchers. In several disciplines researchers may prefer a wider range of "indicators" rather than the narrow set of publishing-related figures that are most commonly used. Currently used indicators can leave some researchers at a disadvantage, such as those working on innovative topics or across disciplines, and reward those who play the system. There are also concerns over how effective current indicators are in gauging the impact of collaborative research.

Objections to indicators generally fall into two categories:

1. An objection to specific indicators based on shortcomings in their methodology, the data on which they are based or a lack of transparency and integrity. This can include objections to indicators that are applied at the wrong level of aggregation (such as application of journal-based indicators to assess individuals)

2. An objection to all numerical assessments and linear rankings as a matter of principle

Given the complexity of the system a total rejection of aggregate and abstracted indicators is untenable. Nonetheless, given the complexity of the system a sophisticated understanding of methodology supported by transparent underlying data seems necessary. The development and publication of indicators and university rankings is becoming a growing source of profit and interest by the commercial sector outside the research community. Being forced to use closed data in research output evaluation poses a number of risks for universities and funders: it encourages costly purchase of near monopoly products, results in unaccountable/un-auditable allocation of public funds and means that benchmarks are not seen as legitimate or useful.

On the positive side, there are some important initiatives that aim to improve the situation. The European Commission's report on next-generation metrics (European Commission Expert Group on Altmetrics, 2017) suggests that quantitative indicators can be useful in driving progress towards open scholarship. However, they need to be used appropriately and with respect for the specificity of disciplines. Existing indicators need to be supplemented and/or replaced by measures that fully reflect the value of open approaches. The **Metric Tide** Report (Wilsdon et al., 2015) was commissioned by UK's Higher Education Funding Council for England (HEFCE) to support the design of the next UK's Research Excellence Framework (REF). The report, written by an international expert group has started a debate on more "responsible metrics" which have the following qualities:

- **Robustness:** base metrics on the best possible data in terms of accuracy and scope
- **Humility:** recognise that quantitative evaluation should support - but not supplant - qualitative, expert assessment
- **Transparency:** keep data collection and analytical processes open and transparent, so that those being evaluated can test and verify the results.
- **Diversity:** account for variation by field, and using a range of indicators to reflect and support a plurality of research questions, approaches and researcher career paths across the system
- **Reflexivity:** continually consider the potential for, recognise and anticipate the systemic and unintended effects of indicators – including gaming – and updating them in response

This package of Knowledge Exchange work should support this agenda and help to inform the broader community on practical ways forward.

## The researcher's perspective

Most of these initiatives on improving indicators focus at the system (macro) level. While some interventions can be seen as an effort to influence cultural norms (meso level) amongst relevant groups relatively little focus has been applied to the view of the individual researcher. Where behaviour has been examined, it has been studied at an aggregated level, for instance in studies of the relative proportions of books vs articles submitted to the UK's Research Excellence Framework or of studies examining how simplistic appraisals of productivity are affected by the imposition of quantitative indicators.

An example of work focused on individual responses to evaluation is that carried out by Rathenau Institute in the Netherlands (van Drooge, 2016). This study engaged with researchers to find out what value they place on societal impact and asked them to explain the impact of their work through selecting their preferred indicators. The study found it was difficult to engage with researchers to identify what parts of their research is of value, as they did not recognise the same value in their own work as did the study. This raises important questions about how external views of impact and value relate to the researcher perspective. What kind of support do researchers need in evaluating their own societal impact and how does evaluation affect their practice?

# Issues for output and evaluation from the researcher's perspective

For this package of work, there is a zero order question that we must address to avoid falling into the trap of immediately moving to questions of indicators. That is: how does evaluation affect the behaviour of individual researchers and the culture of research communities?

There are many anecdotes of the negative effects and perverse incentives created by existing evaluation mechanisms, but very little work on how these processes occur. Given a set of goals, can changes in evaluation process actually achieve them?

The objectives of the open scholarship agenda, both for Knowledge Exchange and for the research enterprise more generally are changes in **practice** of researchers (micro economic) and changes in **culture** of research communities (meso social). Evaluation systems can combine economic (funding), political (regulation) and social aspects (normative community views of prestige and importance and how they are determined) and are clearly affected by technological change, particularly the greater ability to track people's actions throughout the research cycle. Understanding these interactions and their ability to drive positive change, as well as the risk of unintended consequences, are key.

## Research indicators (eg for funding decisions) require re-thinking …

If open scholarship represents a substantial cultural change, a change in paradigm, or even simply significant changes in practice then the processes we have evaluated in the past are going to change. That means that evaluation processes must also change. These changes may be subtle, or they may be profound. We have an opportunity to ask fundamental questions. Does open scholarship actually need indicators? For whom, and for what reason? What does it mean and what should it actually mean to researchers? One may also question current funding practice: what research needs to be funded and how should research evaluation be linked to research funding?

A system without any evaluation, or even without quantitative indicators, is probably unrealistic and undesirable. Some forms of large scale assessment are needed. But the indicators that are currently widely used such as citations counts or the H-index are backward looking, meaning grants are often awarded based on previous results of the researcher or research group and not on the future research potential. Can we develop indicators that inform future potential at the project or community level? Publications in articles are only a part of the total research output. How can open datasets, books, metadata and software be assessed as relevant research outputs in their own right? For new forms of research, particularly new forms emerging from open scholarship practice, such as citizen science, this need for decision making to be based on new forms of evaluation is critical. New opportunities cannot be assessed on the basis of past achievements within traditional outputs. How can evaluation criteria be defined to guide the development of services that will help drive this change?

## … and incentives for quantitative evaluation require re-thinking as well

But given that we need indicators, we will need to design incentives to ensure that appropriate ones for the evaluation of research will become available. This presents a wide range of challenges: to define the evaluation criteria and indicators; to define a transparent data foundation; to define the incentives; to design the services that can help building them, and to find ways to visualise how

evaluation and funding are related. Should incentives focus on driving the use of existing alternatives? Or should they drive new forms of evaluation and indicators? What is currently being evaluated and why? The rising importance of data, and in the future of research data, may be an opportunity to explore this.

## Convincing researchers to change is not easy

Many researchers are afraid of a transfer from traditional publishing with its (at least theoretically) well-understood systems of evaluation to new models that might be evaluated in new and unexpected ways. What can convince researchers that they will benefit from this change? It is not certain, from the perspective of traditionally successful researchers, that implementing new indicators in an open scholarship environment will ensure that the best researcher (ie the person most like them) gets the grant, gets the recognition, and has a successful career. How can traditional power structures that emphasise the influence of these backwards looking indicators be disrupted? Does an entire parallel system of evaluation need to be put in place before a shift can take place? Or can progress be made piece by piece and community by community? What would need to be in place to support that gradual shift and how best can it be provided?

## The interactions are complex and so is the variation in roles, communities and motivations at different levels

Focusing on the researcher in open scholarship is not trivial. How can evaluation recognise if the research task is mostly done by an individual, a group or even a research community? And will it be necessary to establish in what phase and to what type of outcome the actor(s) contributed? Open scholarship depends on a wider diversity of contributions and a wider diversity of outputs to attract those contributions. These contributions are not supported by traditional evaluation processes with their focus on a single form of contribution and point of output.

More than this, evaluation at the individual level does not provide incentives for collaboration. Could evaluation at different levels, or at different points in the research life cycle offer opportunities to create these incentives? Related to questions in the previous chapter, how can the incentives for institutions, communities and researchers, and also third party service providers be aligned so as to promote open scholarship practice?

We have examples of efforts in these directions such as the taxonomy enabling journals to document open scholarship contributions, Inspire (INSPIRE HEP, nd) for High Energy Physics; and DORA (DORA Signatories, 2013), as well as efforts to track data and software citation and usage (Starr et al., 2015; Kratz and Strasser, 2015; Smith et al., 2016). Some initiatives exist on alternative evaluation systems for open scholarship but there is little consistency, even in Europe. Collecting individual use cases at a micro level on how assessment in open scholarship is done in different disciplines could give a first indication of the opportunities and challenges.

# Research questions for KE open scholarship work

All KE partners are in one way or another working for the research community, have the objective to improve research and believe that an open scholarship approach is the way forward.

Some are funders of research, others are responsible for building and maintaining an infrastructure to enable open scholarship. The research community, for all partners the constituency that they work for, must be able to make decisions on funding; to receive, produce and provide quantitative and qualitative information on the actual outputs of open scholarship, be able to evaluate a single research output as well as aggregated output (per grant program, per institution, per country). We therefore must be able to make, mark and rank all types of outputs in an open scholarship environment – not just publications – on the basis of transparent indicators.

We aim to understand a set of interrelated questions. How do researchers perceive evaluation and how does it change their behaviour? What best practice in evaluation mitigates the risks of unintended side effects, gaming, and perverse incentives? How does this relate to the goals for open scholarship discussed above? How do communities differ and how can evaluation systems both capture diversity of practice as well as guiding it towards the goals of greater transparency, sharing and openness?

In the context of work on "responsible metrics" and better "top down" practice, specific questions will address how this good practice relates to open scholarship both at the individual and the group level. This could involve specific case studies as well as theory and model development.

### How may "responsible metrics" capture the progress towards full open access to research publications? Or can they?

The European Commission goal of achieving full open access to all Commission-funded research publications by 2020 is driving numerous considerations of how to facilitate this change. However, without a reliable, responsible and consistent appraisal of the actual level of open access, all such initiatives will be operating blind. Ideally, such indicators should be available at various levels of granularity such as global, European, country, research institution, research funder, research grantee, etc. This will enable the various actors to review their performance in this respect and to receive the associated recognition and reward.

The recent **Recommendations** on **Open Science Publishing** states as part of its first recommendation:

> *"Implementation plans should be supported by publishers, funders and research institutions. They should include appropriate adjustments in evaluation systems for researchers, learned societies and research institutions to ensure adequate recognition for the publishing of outputs using OA models."*
>
> European Commission Open Science Policy Platform, 2017

How can the community ensure that these "appropriate adjustments" are based on responsible and open indicators based on common and best practice?

Finally, we need to consider the "zero order" question raised above. Can we demonstrate that traditional approaches to changing behaviour, through policy and funding systems, can actually have a positive effect? A substantial quantity of our work is based on the assumption that it can, but this should be directly addressed.

**How can we relate this to the researcher's perspective?**
While the ambition of open scholarship generally has researchers' sympathy, their communication behaviour is evaluated through a range of indicators of which almost none give credit to open access achievements. Thus, establishing responsible and commonly accepted modes of evaluation in this area will be appreciated by those making an effort today and inspire those that, as yet, do not. What has been missing in many efforts is a deep understanding of how researchers perceive these changes and the systems of evaluation that affect them. Understanding how evaluation processes affect behaviour and differences across disciplines, geographies, organisations and cultures will be crucial.

**Should Knowledge Exchange support this development - and if so, how can it contribute?**
Knowledge Exchange already plays an important role in most of the significant attempts to establish open scholarship indicators. (cf. the series of Knowledge Exchange workshops on OA monitoring). KE seems ideally suited to play a prominent role in this area by examining and disseminating best practice, widening the circle and proposing responsible indicators. Knowledge Exchange can directly support work that engages with researchers on how they perceive and respond to evaluation systems and it can coordinate similar work supported by others.

## How may responsible evaluation capture open scholarship contributions that are currently ignored?

The diverse range of contributions that will support open scholarship are largely ignored by today's evaluation processes. There is a range of efforts seeking to expand our understanding of broader contributions to traditional outputs (such as the CRediT taxonomy) as well as to value and track the use of non-traditional outputs (Data and Software citation, use of the term "outputs" in documentation requirements by funders). How are these efforts proceeding and what can we learn from them in aggregate? Where are similar efforts missing and are there specific opportunities to move things forward?

**How can we relate this to the researcher's perspective?**
Journals such as PLOS and Cell Press have implemented the CRediT taxonomy (Allen et al., 2014) in their article submission systems. This enables researchers to report in detail on the contributions of specific authors to the research work and article preparation. The researcher uptake and reaction has been reported (Atkins, 2016; Harp, 2016). How can efforts like this be expanded into other environments?

**Should Knowledge Exchange support this development - and if so, how can it contribute?**
Precise documentation of researchers' open scholarship contributions is a pre-condition for integrating them in a new, responsible evaluation system that may support incentives and rewards. KE partners and their institutions may raise awareness and drive adoption of appropriate initiatives as well as leading and coordinating on the assessment of how these affect research behaviour and perceptions.

## How may current indicators become responsible and open scholarship aware?

This question is central to the recent report by the European Commission Expert Group on Altmetrics (European Commission Expert Group on Altmetrics, 2017). Current indicators include: publication output (volume); publication accessibility (Open Access, though not common); publication impact (citations); collaboration (co-authorship); usage (downloads, book sales and lending); social media attention (altmetrics). Proposing how these various indicators may be made "responsible" in a way that supports open scholarship practice will be important to determine on a case by case basis. Equally important will be the subsequent implementation of the concepts in a dynamic landscape of public and private players.

**How can we relate this to the researcher's perspective?**
The lack of recognition and reward for open scholarship efforts is often identified as a major hindrance for researcher uptake. Having these efforts adequately reflected in evaluation is one approach to achieving this. The lack of transparency and accountability in some current evaluation systems is similarly demotivating from a researcher perspective. Clearly identifying the concepts and requirements of responsible indicators and clearly identifying the systems that adhere to these will be very helpful from a researcher perspective.

**Should Knowledge Exchange support this development - and if so, how can it contribute?**
The Knowledge Exchange partner nations represent strong competences in the various evaluation dimensions and thus KE seems well suited to contribute to development of responsible and open science aware standards and to facilitate their uptake in practice - in wider European and global collaboration.

## How may responsible and open scholarship aware evaluation systems be used to generate incentives and rewards?

In parallel with the design and implementation of open scholarship aware evaluation systems, the research community should establish a best practice for the responsible implementation of research assessment, incentives and rewards. This need is currently identified in several contexts - for example in the Mallorca Declaration on Open Science:

> *"For career assessment and advancement, and for evaluation generally, metrics such as numbers of publications and journal impact factors should not substitute for the meaningful assessment of an individual's work. Assessment criteria should also explicitly and directly reward reagent and protocol sharing, data sharing, and open resource development"*
> **RISE High Level Group, 2017b**

**How can we relate this to the researcher's perspective?**
Introducing incentives and rewards based on responsible metrics is likely to be highly appreciated - as long as they remain aligned with the conditions and best practices of the research disciplines and in dialogue with active researchers. As noted above, work on how researchers perceive and operate within evaluation systems, and how changes in those systems actually affect behaviour, will be valuable.

**Should Knowledge Exchange support this development - and if so, how can it contribute?**
The Knowledge Exchange and its partner countries seem well placed to initiate a pan-European answer to the invitation of Commissioner Carlos Moedas:

> *"I am inviting you to continue to take part in the development of the European Open Science Agenda. Help us decide how to provide incentives for open science. Help us reflect on new ways to reward open scientists"*
> **Moedas, 2016**

This initiative could aim at a European code of conduct for open research assessment and incentives or similar.

# Chapter 6:
# Proposal outline for KE work on open scholarship

## Strategic role of KE and focus of work

In considering a possible programme of concrete projects for Knowledge Exchange the broader set of issues raised in this report, the interests of Knowledge Exchange and its partners, and the possible scale of the programme all need to be considered. Knowledge Exchange and partners are relatively small players in the Open Scholarship space in financial terms. However, they have substantial leverage due to their credibility, experience, and importance in infrastructure provision. In considering and prioritising work by Knowledge Exchange it is valuable to focus on work that is directional and strategic. That is, work that takes a leadership position, that can be built on by others including reuse to define and fund further work, and opportunities missed by others or that are particularly close to Knowledge Exchange and partners' strengths.

## Strands of possible work

This paper has identified a broad set of issues with progress towards open scholarship. The issues identified by Knowledge Exchange and KEOSAG are complex and intertwined. As Chapter 3 noted, no complete and well-theorised framework of needs or change currently exists. Based on the outline of this current paper the following categorisation and some proposals are offered as potential ways to proceed. Further input from the community and more refinement will be required to ensure that this overall organisation is the best way forward and to advise on prioritisation at the detailed level.

# A framework for open scholarship

The work by the Knowledge Exchange Group (KEG) and Advisory Group (KEOSAG) in developing this paper and refining the KE Open Scholarship Framework suggests that there could be real value in developing a deeper understanding of how different efforts and challenges in open scholarship can be related to each other.

The proposed framework in its current form is adequate for organisation but has a number of clear deficiencies. In particular, there are questions as to how changes in, and diversity of, research processes can be represented better. The relationship between the "arenas" and the interactions of communities could be further developed, and greater clarity is needed on how the issue of scale (micro-meso-macro) relates to the two dimensions of framework.

The discussions within KEG and KEOSAG, the recurring theme of confused narratives and a desire for improved communications all suggest that a well articulated framing of the changes occurring in scholarly work could be highly valuable. Testing and refining the proposed framework, and comparing its usefulness to other models and framings could provide a strong basis for better communicating both **what** is happening and **why** there are challenges.

## Develop and refine the KE Open Scholarship Framework as a tool

In terms of concrete work, it seems valuable to consider work to further develop its potential as a model and its inter-relationships with other models. Specific options to explore this include:

- Develop a white paper fully articulating and refining the KE Open Scholarship Framework for community criticism
- Test the framework against a range of use cases, including describing change, organising bodies of work, identifying gaps and critiquing interventions
- Bring together stakeholders working on these framing issues in order to seek to integrate the wide range of related work, possibly through a mechanism like a book sprint
- Consider how a refined framework might assist in tracking and assessing progress towards open scholarship

# Economy of open scholarship

In examining the issues in the strand on economics of open scholarship a range of themes emerge. There is concern about the structural characteristics of our current economic and financial systems, and also about the potential mismatch with the underlying goal of achieving open scholarship.

Related to this is a desire to learn from history so as to avoid the mistakes of the past in giving up community control of core assets involved in research communication.

Tackling these issues will involve a theoretical strand, focusing on political economy and understanding the problems and challenges of sustaining scholarly communities, groups and their assets, particularly when the value of those assets is non-financial in nature. In particular, it will be important to shift debates away from a private-public dichotomy to understand the roles of communities and groups.

A second strand of work will be case study based. It will involve historical case studies, but could also potentially include "experimental" interventions, intended to test ideas and approaches. This work will need to develop from coordinate with, and support the theoretical strand as far as is possible.

## Theoretical work on political economy of open scholarship

A programme of theory building is probably beyond the scope of Knowledge Exchange. However, Knowledge Exchange could work with other funders who are developing an interest in better models of the scholarly enterprise and potentially act as a bridge between these funders and those needing advice on how to proceed towards open scholarship:

- Identify and potentially collaborate with funders supporting theoretical work on open scholarship, particularly where that work has an economic focus. Seek to encourage work that provides strong models of economic interactions that can identify gaps for the provision of support

- Maintain a watching brief on the development of data and resources that can support theoretical work and model building and seek to guide their development for maximum usefulness to the broader community

## Case studies: Successes and failures in supporting open scholarship

Knowledge Exchange partners have acted as developers and funders of many key pieces of open scholarship infrastructure and have additionally worked specifically on questions of sustainability. It is therefore in a good position to identify, analyse, and seek internal data and insight on both successes and failures of supporting open scholarship infrastructures. This could be widened to include other case studies, including commercial players, service providers and other players:

- Undertake, or where they exist collate and compare, case studies of the successes and failures of sustainable open scholarship infrastructures with a focus on those where Knowledge Exchange has inside information. Such work could include defining the life cycle and development paths as well as how sustainability models have developed
- Develop a wider set of case studies looking at the development and growth of services, infrastructures and systems. Consider means of examining who creates value and who captures it. What models appear to work? What funding instruments are missing?
- Based on existing studies in the space, seek to build a broader resource containing data and information that can support the work of others

## Direct interventions

Knowledge Exchange partners fund and support the funding of a range of key services and infrastructures. There is an option to consider using that position to leverage attempts at experimental interventions. One approach might be to incorporate into funding choices an assessment of what new information on these issues would be gained by supporting one proposal over another. Are the choices of communication strategy novel or is the project taking a conventional path? Are new audiences for research outputs specified or new approaches for reaching them suggested? More broadly, how can funding decisions be structured so as to maximise the information that arises from assessing project performance?

Knowledge Exchange already contributes to work that is improving the infrastructure and the ability to track and assess progress on many aspects of open scholarship. It will be valuable to identify specific gaps, perhaps building on the refined framework for services, infrastructures and information gathering.

# Output and evaluation from the researcher's perspective

The question of perverse incentives, cultural change, and how these relate to the choices researchers make in what, when and how to communicate, is well established as an important area.

The distinctive contribution that KE can make is to use its network amongst researchers to conduct case studies of successes and failures in seeking to shift practice and culture and combine this with a deeper understanding of the motivations behind indicator developments. Again, the appropriate strategy will be to go deeper, in terms of model building and theory development, and to be more specific in examining real case studies and building evidence to support practical interventions that work.

## Examining the "why" (and the "who") of research evaluation

Situating work in terms of the motivations behind research evaluation from the perspective of funders, researchers, and research organisations may help to surface some of the different perspectives in play. As noted in Chapter 2, it is important to consider motivations from the perspective of both stakeholders' identity and level of scale. There is remarkably little work on the internal motivations and justifications for research evaluation or on the specifics of why negative consequences occur, even when entire communities view the evaluation processes they experience with scepticism:

- Conduct (or coordinate) work looking at the underpinning motivations for research evaluation, both formal and informal, and whether processes in use are fit for purpose
- Examine how incentives, resource allocation, and culture of research stakeholder communities interact. Aggregate and organise data that can support further research on these theoretical aspects.

## Examining the "what": case studies exploring how research evaluation plays out

There have been numerous interventions using research evaluation as a lever. Some are related to open scholarship (prizes, changes in grant submission guidelines) and some are not (most national research evaluation processes). Some are large scale, and some are localised. There is an opportunity to gather data on these experiments and systems to provide examples of good and bad practice and to use these to support theoretical work and policy formulation:

- Build on the KE network to develop a deeper understanding of how evaluation actually is playing out amongst researchers by conducting targeted case studies. Where have evaluation processes demonstrably enhanced the diversity of research outputs or open scholarship practice more generally? What interventions work, and in which circumstances?
- How have "best practice" standards such as DORA, the Leiden Manifesto, and "responsible metrics" been received? What about interventions such as the CRediT taxonomy? Are they affecting practice? By researchers? Institutions? Indicator providers?
- Identify KE initiatives that may further the uptake and implementation of these "best practice" standards
- Examine the training aspect (what is the average training of a researcher for open publishing, revealing the unspoken rules and practices?), socialisation process of young researchers, common denominator, value outside the traditional science community

## Direct interventions

Knowledge Exchange can encourage the adoption and take-up of specific initiatives that can be shown to improve practice or raise the quality of evaluation. These include encouraging adoption of high quality identifier infrastructures that can support more comprehensive evaluation, driving uptake of information sources on more diverse contributions, and supporting best practice groups and their recommendations as well as working to make those more easily implementable.

# Conclusion and synthesis

Across all these pieces of work the concrete proposals show a strong parallel. There is a gap in work that addresses the high level issues – theory, models and deep understanding of the broad research enterprise as a system – and there is a gap in work that looks beyond single case studies and interventions to try and build understanding from the bottom up. These two strands need to be coordinated, and KE can play a role beyond commissioning work to act as a coordinator and aggregator.

# References

**Aguilar, J.F. (1967).** Scanning the business environment (New York: Macmillan).

**Allen, L., Scott, J., Brand, A., Hlava, M., and Altman, M. (2014).** Publishing: Credit where credit is due. Nature 508, 312.

**Anderson, W.P. (2017).** Data management: A global coalition to sustain core data. Nature 543, 179–179.

**Anderson, W., Apweiler, R., Bateman, A., Bauer, G.A., Berman, H., Blake, J.A., Blomberg, N., Burley, S.K., Cochrane, G., Francesco, V.D., et al. (2017).** Towards Coordinated International Support of Core Data Resources for the Life Sciences. bioRxiv 110825.

**Atkins, H. (2016).** Author Credit: PLOS and CRediT Update.

**Beagrie, N., and Houghton, J. (2016).** The Value and Impact of the European Bioinformatics Institute (EMBL-EBI).

**Bilder, G., Lin, J., and Neylon, C.** (2015). Principles for Open Scholarly Infrastructures-v1.

**Björk, B.-C., and Solomon, D.J. (2014).** Developing an Effective Market for Open Access Article Processing Charges (Wellcome Trust).

**Clarivate Analytics (2017).** Clarivate Analytics announces landmark partnership with Impactstory to make open access content easier for researchers to use.

**Commission high level expert group on the European open science cloud (2016).** Realising the European open science cloud.

**DORA Signatories (2013).** San Francisco Declaration on Research Assessment.

**van Drooge, L. (2016).** Valorisatie: onderzoekers doen al veel meer dan ze denken.

**European Commission (nd).** Open Science Monitor.

**European Commission (nd).** ERIC | Research Infrastructures - Research & Innovation - European Commission.

**European Commission (2016).** Guidelines on FAIR Data Management in Horizon 2020 v 3.0.

**European Commission (2016).** Open innovation, open science, open to the world: a vision for Europe (Luxembourg: Publications Office of the European Union).

**European Commission Expert Group on Altmetrics (2017).** Next-generation metrics:Responsible metrics and evaluation for open science (European Commission).

**European Commission Open Science Policy Platform (2017).** Recommendations on Open Science Publishing.

**Eve, M.P. (2014).** Open access and the humanities: contexts, controversies and the future (Cambridge: Cambridge Univ. Press).

**Fecher, B., and Friesike, S. (2014).** Open Science: One Term, Five Schools of Thought. In Opening Science, S. Bartling, and S. Friesike, eds. (Heidelburg: Springer), pp. 17–47.

**Figshare (nd).** figshare - Terms and conditions.

**G20 (2016).** G20 Leaders' Communique Hangzhou Summit.

**Gans, J.S. (2017).** Scholarly Publishing and its Discontents: An economist's perspective on dealing with market power and its consequences (S.l.: Core Economic Research).

**Gruen, N., Houghton, J., and Tooth, R. (2014).** Open for Business: How Open Data Can Help Achieve the G20 Growth Target (Lateral Economics).

**Harp, G. (2016).** Authors reflect on the CRediT taxonomy.

**Helix Nebula (2016).** HNSciCloud PCP Tender Results Announcement Ceremony & Design Phase kick off.

**Hicks, D., Wouters, P., Waltman, L., de Rijcke, S., and Rafols, I. (2015).** Bibliometrics: The Leiden Manifesto for research metrics. Nature 520, 429–431.

**Houghton, J., and Gruen, N. (2014).** Open Research Data (Australian National Data Service).

**INSPIRE HEP (nd).** INSPIRE Project Overview.

**Jisc (nd).** Research data shared service.

**Kiley, R. (2016).** Why we're launching a new publishing platform | Wellcome.

**Kratz, J.E., and Strasser, C. (2015).** Making data count. Scientific Data 2, 150039.

**Larivière, V., Haustein, S., and Mongeon, P. (2015).** The Oligopoly of Academic Publishers in the Digital Era. PLOS ONE 10, e0127502.

**Moedas, C. (2016).** Open science: share and succeed (Amsterdam).

**Mons, B., Neylon, C., Velterop, J., Dumontier, M., Santos, da S., Bonino, L.O., and Wilkinson, M.D. (2017).** Cloudy, increasingly FAIR; revisiting the FAIR Data guiding principles for the European Open Science Cloud. Information Services & Use 37, 49–56.

**Neylon, C. (2016).** Communities need journals. Notes Rec. 20160032.

**Neylon, C. (2017a).** Openness in Scholarship: A Return to Core Values? In Expanding Perspectives on Open Science: Communities, Cultures and Diversity in Concepts and Practices, (Limassol), pp. 6–17.

**Neylon, C. (2017b).** Sustaining Scholarly Infrastructures through Collective Action: The lessons that Olson can teach us. bioRxiv 116756.

**Office of Science and Technology Policy (2013).** Expanding Public Access to the Results of Federally Funded Research.

**Pomerantz, J., and Peek, R. (2016).** Fifty shades of open. First Monday 21.

**Potts, J., Hartley, J., Montgomery, L., Neylon, C., and Rennie, E. (2016).** A Journal is a Club: A New Economic Model for Scholarly Publishing (Rochester, NY: Social Science Research Network).

**Responsible Metrics Forum Responsible Metrics.**

**RISE High Level Group (2017a).** Europe's future: Open Innovation, Open Science, Open to the World - Reflections of the Research, Innovation and Science Policy Experts (RISE) High Level Group.

**RISE High Level Group (2017b).** Mallorca Declaration on Open Science (Mallorca).

**Royal Society (2012).** Science as an Open Enterprise (London: Royal Society).

**Smith, A.M., Katz, D.S., Niemeyer, K.E., and FORCE11 Software Citation Working Group (2016).** Software citation principles. PeerJ Computer Science 2, e86.

**Starr, J., Castro, E., Crosas, M., Dumontier, M., Downs, R.R., Duerr, R., Haak, L.L., Haendel, M., Herman, I., Hodson, S., et al. (2015).** Achieving human and machine accessibility of cited data in scholarly publications. PeerJ Computer Science 1, e1.

**Suber, P. (2012).** Open Access.

**Tkacz, N. (2012).** From open source to open government: A critique of open politics | ephemera. Ephemera: Theory & Politics in Organization 12, 386–405.

**Treloar, A. (2014).** The life-sciences as a pathfinder in data-intensive research practice. 2014 Winter School in Mathematical & Computational Biology

**Wikipedia Authors (2017).** PEST analysis.

**Wilkinson, M.D., Dumontier, M., Aalbersberg, Ij.J., Appleton, G., Axton, M., Baak, A., Blomberg, N., Boiten, J.-W., Santos, L.B. da S., Bourne, P.E., et al. (2016).** The FAIR Guiding Principles for scientific data management and stewardship. Scientific Data 3, sdata201618.

**Wilsdon, J., Allen, L., Belfiore, E., Campbell, P., Curry, S., Hill, S., Jones, R., Kain, R., Kerridge, S., Thelwall, M., et al. (2015).** The Metric Tide: Report of the Independent Review of the Role of Metrics in Research Assessment and Management. Higher Education Funding Council for England.

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

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