In 2020 the research environment is increasingly global and interdisciplinary with collaboration and supporting infrastructure crossing these boundaries. Researchers sharing data and universities supporting its management is now business as usual. Likewise open access is now the default for articles, and increasingly for monographs and other outputs, including data, workflows and software. Most publications have moved away from re-creating print in an online world. Peer review remains the cornerstone of research publication, though a number of methods are becoming common, include post and open peer review, just one of a number of innovations which are reducing the time to publication.

Openness and collaboration is becoming recognised as critically important to research. A new generation of open systems and services are enabling a more efficient and transparent environment. Information is shared and often automatically gathered or generated. Indicators and statistics are available to all, and used by decision makers and researchers alike to inform their work. Data intensive research drawing on multiple sources is becoming the norm in many disciplines and infrastructure support virtual and machine access.

Researchers use virtual machines across networks allowing access to and analysis of secure and very big data. Teams including researchers, data scientists and research technologists are now common place across disciplines from the arts to bio-science.

Applying for funding is supported by tools and open systems. Much of the information required is automatically gathered and submitted. Post award reporting needs are met with minimum intervention.

Publication doesn’t just mean a PDF. By bringing together the underlying components of research, such as data, charts, formula and software, researchers and learners have access to richer information.

Research and publication systems are inter-connected to share information in an open environment, saving the time of researchers and support staff, while ensuring services and reporting are accurate and current.

Researchers and funders use a new generation of indicators and metrics to help them assess and review research. These indicators are built on an emerging new open infrastructure supporting a more transparent research environment.

Publication doesn’t just mean a PDF. By bringing together the underlying components of research, such as data, charts, formula and software, researchers and learners have access to richer information.

Research outputs in some disciplines increasingly contain the underlying data, methods, and software used by the researcher. Tools are available to automatically process the output and re-create the process, either to confirm the result, or using different inputs.

New big datasets are available, many of which from sources outside of academia such as commercial organisations. New rights and access arrangements need to be agreed and adhered to. Privacy and security continue to be critical aspects.

The outputs of research are increasingly disseminated beyond the academy. New services enable those in industry, government and the knowledge economy to easily discover and consume highly relevant research for their requirements, resulting in informed policy decisions and new partnerships and commercial opportunities.
2030

The Research Environment has the researcher at the centre though is now highly complemented by the power of advanced digital technologies which can help mine and process information, in quantities unthinkable before, but with a sophistication previously only thought possible by humans.

Underpinning this is a vast field of research data. Discovery tools understand each dataset's structure and implicit relationships with other sources of data. Finding relevant data, customised for the researcher's needs, is no harder than a simple Google Search today.

Digital research assistants support the researcher through every stage of the research process, from suggesting potential collaborations - sometimes in diverse disciplines - to marking up outputs with metadata and suggesting reviewers; saving the researcher time, and opening new opportunities.

Researcher’s pose questions to their digital research assistant, which mine and processes vast amounts of information, even running experiments and scenarios on what it finds to provide an answer.

Research is exploited to extract the maximum benefit and opportunity, for the organisation, nationally and globally. Research organisations work in a sustainable global research environment with multiple-partnerships. Ethical frameworks and collaboration are increasingly vital.

New forms of rewards and recognition have emerged for research and the activities around research, such as peer review. This has impact across the research lifecycle, from applying for grants to reviewing outputs (and the weight given to their comments).

Social machines and technology-enabled social systems have become business as usual, solving complex problems at a large scale.

Publicly available data is now disrupting our lives in ways we never expected, just as the web did before it. No longer just silos of data, now vast interconnected pools of information. Discovery tools are able to transverse and process petabytes of information almost instantly to provide customised ‘datasets’, and with a simplicity such that training is irrelevant.
Jisc will work with relevant partners from all sectors to help to develop new services that help to realise this vision. Some of our existing projects have started to address some of these areas and we will continue to develop these to meet the vision. Some areas of the vision will require new development work to be started. In all of this work Jisc will follow the same basic principles:

» Wherever possible, Jisc will seek to work with existing technology and experts rather than starting from scratch
» In all projects, Jisc will work closely with universities and researchers to scope and develop solutions
» Jisc will use a variety of approaches and innovative collaborations and partnerships to sustain and develop new services

This page of the vision will continue to change and develop as new ideas emerge or existing ones develop.

**Research**

Management
data andoutputs
discovery
collaboration

**Research**

Jisc are investigating new forms of research citation and measures that could offer more accurate and transparent methods of measuring research impact based on an open approach.

**Shared research equipment portal**
A national portal that automatically discovers, harvests and aggregates data about institutional facilities and equipment across the UK.

**Digital capability for research**
Could a transformative skills online training offer empower an emerging population of world class researchers?

**Reliable new research metrics**
Can we build the data infrastructure that underpins metrics and indicators so that UK research is at the cutting edge and supports open scholarship?

**The next generation research environment**
Could an intelligent digital research assistant become a must-have tool for academic research and open scholarship?

**Responsive interoperable research management environment**
Can we build the technical infrastructure so research systems automatically share information about research outputs, processes and data?

**Beyond the PDF**
Could a next generation scholarly communications platform enable new forms of research outputs and new channels for dissemination?

**Big data - smart research**
Could a shared big data research platform transform research?

**Intelligent system for research and publication**
Could a service largely automate the steps of article publication, easing life for authors and reducing costs?

**Reach out with research**
Could a current research outputs application uncover the value of research to all?

**Replicating research**
Could new tools and methods for sharing research enable machines to replicate experiments with ease?

**Research Data Discovery**
Jisc is working towards a UK research data discovery service that joins up with other international effort and the UK OA infrastructure.

**Research Data Manager**
Jisc are developing a service to enable researchers to easily deposit data for publication, discovery, safe storage and long term archiving.

**Research Data Usage and metrics service**
Jisc are currently building a research data usage statistics reporting tool.

**Dissemination and reuse**

**Clinical and collaborative**
Gill is the principal researcher on a number of large-scale research projects. She spends much of her time applying for funding, overseeing the activities of researchers in her group, and contributing to the writing up of publications.

1. Obtain grant funding

Success rates for grant applications overall have been going down and the competition is getting ever harder. Gill has been regularly using services that provide updates on potential sources of funding. Well established tools have automated the process of submitting applications allowing her to focus on her research. The use of open standards and identifiers have simplified the whole process, internal research information systems and funder systems use notifications to remove duplication and to ensure all stakeholders are informed.

A key trend in scientific research is the use of intelligent machine-learning tools to uncover new results from existing data. This has impacted on research grant funding which is now supporting this new generation of experimental data. Faster networks and transfer of data has removed the bottleneck that once delayed Gill’s work. Researchers have easy access to all the training they need online so they are highly digitally literate. The multiple skills of a research technologist have been recognised and supported by institutions and funders. Gill’s data and research outputs are now available according to FAIR principles of being findable, accessible, interoperable and re-useable.

Gill began sketching her group’s path to the Research Excellence framework (REF) some time back, with support from her institution’s library. She had ensured all her work was REF eligible by using tools to check it was in a repository, now an automated process, and meeting other REF requirements. She has also started to pay attention to transparent impact and citation indices and she can see where the numbers come from and has ideas for how to drive improvement. So even though getting research funding was not getting any easier, Gill has plenty of opportunities to continue her excellent research and looks forward to the REF2020 outcomes with confidence.

2. Ensure research has impact and engages a wide range of people

Gill has begun collaborating with library colleagues to explore new ways of publishing academic research which are becoming common. This includes dynamic links to data and other research artefacts that can be updated in real time, alongside similar work from commercial publishers. This has led to transformations in the impact of research enabling different views to be provided on the outputs tailored to different audiences. This is all being provided as part of a new open digital library space that allows members of the public to engage as well as people working in the private sector. The government have been supporting this initiative as they can see how it promotes innovation and benefits the UK economy.
Through a research equipment sharing portal, David was able to access and hire specialist research equipment from a university in the same region. This was relatively low cost for his institution and made good use of equipment that would otherwise have been left standing idle. Some of David's research was part of a wider international collaboration which included some partners from industry. While his own university did not have high performance computing, he was able to use his partners' facilities, as well as national services, as easily as if they were on his own doorstep thanks to the university's powerful and fast network.

David's research projects are all interdisciplinary. Some of his research makes use of social machines – a decentralised process of capturing large scale interactions between humans and machines to develop new knowledge. David has become highly skilled at using text and data mining techniques on research outputs from similar disciplines around the globe, alongside his own data, to reinforce his research findings. This has led to a couple of publications that have started to establish David's reputation in his field. He used one platform that allowed him to 'publish' all of his research methods and findings as he went. Ensuring his publications and underlying data, software and tools are made openly available ensures that his work can be processed in the same way, using the same techniques by other researchers, enabling potential new discoveries.
REF2021 is going to be the most important yet in refining and focusing government research funding. The adoption of open standardised metrics has ensured open and transparent access to comparable outputs across research-intensive universities. Using an open research dashboard, Jasmin is able to see how her institution’s metrics compare to others and be confident of hitting the strategic goals her institution has set. The research office processes have become a lot smoother since the introduction of the research data management shared service and she can be confident that the anxious hand-crafting of the final REF return in 2014 was something that would not be repeated.

There has been an intensive debate again within the university as to who should be included in the REF submission, so the ability to make such decisions on the basis of new, transparent and open metrics, as well as peer review, has been a great step forward. Looking ahead, however good the REF outcome, Jasmin still faced the prospect of her university needing to do more with less. So she was planning to foster much greater use of shared equipment via neighbouring institutions or national facilities and use of centralised HPC power. As well as saving money, this approach offered the intriguing possibility of supporting cross disciplinary work using shared equipment. She has also been exploring how she can track the effectiveness of this activity via research activity analytics. So while times ahead may be tough, she feels her university is well organised and that she can spend her time on achieving strategic goals rather than intensive administrative efforts.

### 2020

**1. Ensure her institution’s research is well managed and meets strategic goals**

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### 2030

**2. Ensure her institution hits research targets**

There has been an intensive debate again within the university as to who should be included in the REF submission, so the ability to make such decisions on the basis of new, transparent and open metrics, as well as peer review, has been a great step forward. Looking ahead, however good the REF outcome, Jasmin still faced the prospect of her university needing to do more with less. So she was planning to foster much greater use of shared equipment via neighbouring institutions or national facilities and use of centralised HPC power. As well as saving money, this approach offered the intriguing possibility of supporting cross disciplinary work using shared equipment. She has also been exploring how she can track the effectiveness of this activity via research activity analytics. So while times ahead may be tough, she feels her university is well organised and that she can spend her time on achieving strategic goals rather than intensive administrative efforts.

As the majority of data is now being made available via open access, Jasmin is having to spend much less time on putting in place agreements for access to the major big datasets and new forms of data as they emerge. Access to these datasets is now seamless with tools to bring diverse datasets together as one coherent whole. International collaboration with multiple partners has become the norm, helped by faster networks, collaborative platforms, adoption of open standards and open access. Interdisciplinary research has flourished enabled by tools and techniques utilising ‘big data’. Arts and humanities are at the forefront of innovation alongside the sciences. Jasmin uses analytics tools to monitor her university’s performance in these international collaborations and the impact of the research. The Analytics available to her now include engagement with stakeholders outside traditional research, including government, businesses, and the community.