Pathways to National PID Strategies

Guide and Checklist to facilitate uptake and alignment

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Introduction to the Guide

The Research Data Alliance (RDA) National PID Strategies Working Group (WG) was endorsed by RDA on 10 December 2021 to explore how Persistent Identifiers (PIDs) form part of national policy and research infrastructure implementation frameworks. The Group recognises that there are systemic and network benefits from widespread and consistent PID adoption including financial and time savings benefits. Research sector stakeholders including funders, government agencies, and national research communities have created PID consortia or policies (including mandates) in pursuit of these benefits. At the establishment of the WG, National PID Strategies were beginning to emerge in the UK, Australia, the Netherlands, and Canada as a pathway to realising these benefits and an international conversation felt needed. RDA provided an umbrella for discussion and alignment between the strategies, refinement of the value proposition and sharing practical development pathways to a national PID strategy.

The findings of the 18 months of the WG (December 2021 - June 2023) have been that:

1. National PID Strategies are on the rise, evidenced in the case studies collected by the WG and the growing momentum of discussions at RDA Plenaries and other international fora.
2. The development of National PID Strategies is a relatively new phenomenon and many countries are in the very early stages. In fact, many have more of a national approach that they are seeking to transform into a strategy.
3. All national PID strategies are currently in development and therefore subject to a high degree of change. During the course of the WG, nine case studies were collected and several of these needed to be updated prior to the Group's final output due to changes that had taken place in those countries.
4. There is no single 'cookie cutter' approach to developing a national PID strategy. Critical components include:
    - A clear value proposition with use cases
    - A group or organisation that is responsible for driving strategy development
    - An open, inclusive, iterative process that involves all stakeholders
    - An accompanying roadmap that outlines practical steps for implementation
5. International PID providers such as ORCID and DataCite have begun to actively engage with national PID strategies and the RDA National PID Strategies WG provides a focal point for furthering this engagement.

An ambitious goal of the WG was to map common activities and produce a guide to help others - irrespective of geographical region - to follow a 'blueprint' to define their national PID strategy. However, given the findings listed above, a 'blueprint Guide' to national PID strategies is not possible at this stage. Instead, we provide a Guide that compares and contrasts national PID strategies based on nine case studies we have collected. A National PID Strategy Checklist is also included to summarise and highlight key considerations.

Key messages

Summary of the key messages from the RDA National PID Strategies WG:

1. National PID Strategies are on the rise
2. There is no single 'cookie cutter' approach to developing a national PID strategy
3. Critical components include:
    - A clear value proposition with use cases

    - A group or organisation that is responsible for driving strategy development
    - An open, inclusive, iterative process that involves all stakeholders
    - An accompanying roadmap that outlines practical steps for implementation
4. Engagement between national PID strategies and PID providers is important for success

The RDA National PID Strategies WG has produced a comparison guide and checklist that can be used when developing a national PID strategy.

Case studies

This Guide, to facilitate uptake and alignment of National PID Strategies, is based on comparing and contrasting case studies from the following countries and regions:

1. Australia
2. Canada
3. Czech Republic
4. Finland
5. Germany
6. Korea
7. New Zealand
8. The Netherlands
9. United Kingdom

Case studies were collected via the WG and included sections on:

- Lead organisations
- Scope
- Drivers
- Strategy development
- Key features
- Key infrastructure
- Priority PIDs
- Impact and monitoring

Case studies are included with the Guide.

How to use the Guide and Checklist

You can use the Guide, Case Studies and Checklist developed by the RDA National PID Strategies WG to:

- Inform the development of your National PID Strategy
- Develop a roadmap to accompany your strategy
- Align with international initiatives in this important area
- Facilitate stakeholder engagement with National PID Strategies
- Connect, communicate and collaborate with others developing National PID Strategies

The Guide

Lead organisation

Summary: A critical component in developing a National PID Strategy or approach is to have a group or organisation that is responsible for driving strategy development. The lead is responsible for a

variety of tasks such as: initiating the Strategy discussion; developing/refining the value proposition; bringing stakeholders together; coordinating events; coordinating input mechanisms such as focus groups; providing financial support for Strategy development; stakeholder communication; coordinating and/or drafting the Strategy itself.

Comparison table

Country or region	Lead organisation(s)
Australia	Australian Research Data Commons (ARDC): 1. National PID Strategy Taskforce
Canada	Canadian Research Knowledge Network (CRKN) Canadian PID Advisory Committee (CPIDAC): 1. ORCID-CA Governing Committee (OCGC) 2. DataCite Canada Governing Committee (DCCGC) Digital Research Alliance of Canada (The Alliance)
Czech Republic	National Library of Technology
Finland	CSC – IT Center for Science ● DataCite Finland Consortium lead ● ORCID Consortium Coordinator ● ePIC Consortium member National Library of Finland ● URN service provider ● Finnish ISBN, ISNI and ISSN Agencies National Land Survey ● Geodata identifiers Digital and Population Data Services Agency ● Government interoperability service provider Natural History Museum/University of Helsinki ● GBIF partner
Germany	DataCite German National Library (DNB) Helmholtz Open Science Office, Helmholtz Association German National Library of Science and Technology (TIB) Bielefeld University Library
Korea	Korea Institute of Science and Technology Information (KISTI)
New Zealand	The overarching strategy was derived as a consequence of the *2016 Research, Science and Innovation Domain Plan* which was developed in a process led by:

	Ministry of Business, Innovation and Employment (MBIE) Statistics New Zealand Ministry of Education Tertiary Education Commission
The Netherlands	NWO DANS-KNAW UKB SURF CWTS-Leiden University
United Kingdom	Jisc UK Research and Innovation (UKRI) Research England

Scope

Summary: Defining the scope of the Strategy (i.e. who it applies to) is important but is not always clear at the beginning of Strategy development and may evolve during the process. The scope of a national PID strategy varies between countries but common elements include research and government data. The Strategy may apply to the entire national research, government and innovation system. For some, an accompanying Roadmap will also be developed to ensure that the Strategy is acted upon. While the Strategy focuses on high level goals and a shared vision, the Roadmap defines the 'who, what, when and how' needed to achieve the Strategy.

Stakeholders

Summary: While a specific question on identifying stakeholders in a National PID Strategy was not included in the Case Study template, discussion within the RDA National PID Strategies WG has raised this common need. Involvement of key stakeholders are varied and include a selection of:

- PID service providers
- PID consortia
- research infrastructure and service providers
- organisations, groups or networks that advance FAIR and open research
- research funding bodies
- institutions and universities
- researchers
- research stewards
- research publishers
- government

Example: Czech Republic Case Study

Target institutions	● Public research performing organisations (RPOs): Higher Education Institutions and Research organisations ● Research funding organisations (RFOs): Ministry of Education, Youth and Sports, Czech Science Foundation, Technology Agency of the Czech Republic etc.

	● Policymakers: Ministry of Education, Youth and Sports; Research, Development and Innovation Council (R&D&I Council) ● Libraries: National library, National Library of Technology, academic libraries ● Publishers based in Czechia ● Service providers, research infrastructures
Target groups	● Researchers ● Librarians ● Open Science/Open Access managers/coordinators ● CRIS system managers ● Repository managers ● Other research support positions, e.g. data stewards, data curators

Drivers for a national PID strategy (value proposition)

Summary: Common drivers between the case studies collected include:

- National coordination, consolidation and alignment of PID investment
- Lower cost and barriers to PID adoption
- Reduce administrative burden
- Enable research to be more FAIR and Open
- Improve linking and discovery of research outputs and entities
- Improve systems interoperability
- Better research reporting including for national research assessment exercises (such as UK REF reporting)
- Better tracking of research outcomes and impact
- Support best practice

Additional and unique-to-country drivers include:

- Develop the digital research infrastructure of the future (Canada)
- Reproducibility (Finland and the Netherlands)
- Build national services to support interoperability (Finland)
- Better curation of research outputs and correct author attribution (Korea)
- Responsible management of research information (Netherlands)
- Coordinated networking and promotion of PID systems (Germany)
- A formal framework for management and access to PIDs and introduce them as a standard into the Czech R&D environment (Czech Republic)
- Enact goals of the 2021 National Research Infrastructure Roadmap (Australia)

National Strategies often need to present the value proposition for PID investment and national coordination via a combination of the drivers above, including how PID adoption supports sector-wide policy objectives (e.g. providing world class data infrastructure, maintaining competitive advantage, making research more FAIR and Open, etc.).

Strategy development

Most countries/regions are in the early phases of developing a national PID strategy. A common feature is that they are not starting at ground zero. In many cases, the development of a national strategy is evolving from pre-existing PID or research infrastructure governance groups such as Finland's PID Forum Network or the Netherlands PID Advisory Group. They build on existing national PID services such as those offered via ORCID or DOI consortia or national PID providers such as Australia's ARDC.

Roadmaps are a common feature of national PID strategies as they identify key stakeholders and provide a high-level action plan for getting from start to finish. Getting to a final agreed-upon roadmap may be a long and thorough process. For example, the UK produced 'Developing a persistent identifier roadmap for open access to UK research', which first proposed the outline of a national PID strategy; in the Netherlands a working group of the PID Advisory Board first produced a document called 'towards a national PID roadmap'; Canada's approach was to develop a "roadmap to a roadmap" – *"…helping the Canadian PID community to identify the necessary actions, initiatives, and stakeholders that must be in place and on board to ensure the successful development and implementation of an eventual PID Strategy for Canada."* Germany has a DFG funded project "PID Network Germany – Network for fostering persistent identifiers in science and culture" to produce a PID roadmap by the beginning of 2026.

Key features

Key features of national PID approaches/strategies according to the case studies collected to date include:

Feature	**Description**	**Example(s)**
Lead organisation(s) or Group	Coordination and collaboration between key organisations, groups, networks. One or more 'responsible organisations' to drive the strategy forward. Coordination facilitated via national level coordination or advisory group to champion and guide the development and implementation of a national strategy.	See table under Lead Organisation section
Working group	Working group that is the forum for advancing the practical aspects of a national strategy	UK Research Identifier National Coordinating Committee (RINCC) https://rincc.org.uk/

		Australian National PID Strategy Working Groups on topics: grants; projects; organisations and facilities etc.
Value proposition	Analysis and report to provide evidence and inform strategy.	Landscape analysis (Canada, UK, Germany) PID cost-benefit analysis (UK, Australia)
Funding	One or more organisations who provide funding such as to conduct an analysis report or run workshops.	Jisc & UKRI (UK) The Alliance and collaborators (Canada) ARDC & AAF (Australia) German Research Foundation (DFG) (Germany)
Stakeholders	Involvement of key stakeholders are varied but include a selection of: ● PID service providers ● PID consortia ● research infrastructure and service providers ● organisations, groups or networks that advance FAIR and open research ● research funding bodies ● institutions and universities ● researchers ● research stewards ● research publishers ● government	See Stakeholders section

Open process	An open, consultative and inclusive process to develop the strategy and roadmap was referenced in the majority of case studies.	Canada, UK, Australia, Finland, the Netherlands and Germany
Policy or position paper	A single organisation, a collaboration between organisations that has issued a PID policy of national scope.	Canada's position paper, Australia ARDC PID policy
Roadmap	Having a roadmap to take the national PID vision from A to B.	Finland, UK, Germany, Canada, Netherlands Towards a National PID Roadmap

Key infrastructure

Summary: Key infrastructure needed to support or engage with National PID Strategies varies between case studies. Common elements include:

- National research publication / discovery portal
- Repository / repositories
- International PID providers (e.g. ORCID)

Key infrastructure comparison table

Case study	Name of infrastructure	Key purpose
Finland	Fairdata.fi	Research data publication, metadata hub and preservation service
	Research.fi	National research information hub.
	National Library	Semantic artefacts, publications
	National interoperability services (?)	Semantic artefacts
The Netherlands	SURFrepository	Repository
	ISAAC	Grant applications
	NARCIS	National Academic Research and Collaborations Information System
	Pure	CRIS
	Converis	CRIS
	Metis	CRIS
Canada	OJS	Open Publishing Platform

*in early stages of thinking this through	DSpace	Digital Repository
UK	UK ORCID Consortium	Jisc is the lead organisation for this service providing reduced cost and support for its members
	DataCite Consortium	The British Library is the UK consortium and works with organisations in the UK and Ireland to ensure that their data, software and other research items can be uniquely identified with DOIs
	RAiD	A Persistent IDentifier for research projects. Plans for a Registration Agency in the UK with the Registration Authority run by the Australian Research Data Commons
	UKRI New Funding Service (replacing Je-S from January 2024)	Grant application service
Korea (KISTI)	Korea DOI Center	Issuing DOIs to Korean research outputs, Intellectual properties, research data
	KISTI's experimental comprehensive identifier testbed (in progress)	Interlinking (literature, author, data) elements with identifiers in Korean scholarly articles.
Australia	ARDC Identifier Services ARDC DataCite DOI Consortium Global RAiD Registration Authority	ARDC provides a range of services for research organisations to create and manage persistent identifiers (PIDs).
	AAF Australian ORCID Consortium	Australia's ORCID Consortium led by the Australian Access Federation (AAF)
	ARDC Data Discovery portals including Research Data Australia, Research Vocabularies Australia, Research Link Australia, Research Grants Australia	Discovery of research data and related materials
	ARC & NHMRC Grant opportunities portal	Research grant applications
	Institutional and discipline repositories	Storing, describing, sharing research outputs
	Government data	Storing, describing, sharing government data

	repositories and portals (various)	
Germany	DataCite Consortium & ORCID Germany Consortium	TIB is the lead organisation for both services. This will definitely take into account when creating the PID roadmap for Germany
	German national bibliography https://www.dnb.de/EN/Professionell/Metadatendienste/Metadaten/Nationalbibliografie/nationalbibliografie_node.html	The aim is to offer stable and reliable bridges for the construction of a knowledge graph of culture and science
	Bielefeld Academic Search Engine (BASE) https://www.base-search.net/?l=en	Since 2004, Bielefeld University Library has been productively developing and operating the scientific search engine BASE with the aim of indexing OA content from publication infrastructures, especially repositories, as comprehensively as possible.
Czech Republic	e-infra	This large infrastructure will build the National Repository Platform in the upcoming years. That should greatly facilitate adoption of PIDs.
	National CRIS - IS VaVaI (R&D Information System)	National research information system. We plan on working with Research, Development and Innovation Council (in charge of IS VaVaI) on integrating global PIDs into their submission processes as required. Nowadays it uses mostly local identifiers.
	Institutional CRIS systems	Various institutional CRIS systems at Czech RPOs. OBD (Personal Bibliographic Database) application is an outstanding case of an institutional CRIS system in the Czech Republic developed locally by a Czech company DERS. An ORCID integration for OBD is currently in development.
	Institutional or subject repositories	There are several repositories in the Czech republic collecting different objects, some are already using PIDs but there is still enough room to improve and really integrate those PIDs, not only allow their evidence.
	Major research funders	Grant application processes
	Local publishers	Content submission processes
New Zealand	NZ ORCID Hub https://orcidhub.org.nz/	Lower burdens of integration to enable all publicly funded NZ research organisations to

		participate
	DataCite tools and infrastructure • Fabrica Web interface https://doi.datacite.org/ • REST APIs https://support.datacite.org/docs/api	Creation and management of DOIs; integration with data repository infrastructure; retrieve, query and browse DataCite DOI metadata records
	The New Zealand Research Information System (NZRIS) https://www.mbie.govt.nz/science-and-technology/science-and-innovation/research-and-data/nzris/	NZRIS will hold information about research funding and activity in New Zealand.

PIDs

Summary: Many National PID Strategies are taking the approach of looking at use cases: a description of the problem statement and how particular PIDs could address the problem. Common use cases for PIDs include:

- People - researchers, contributors
- Organisations - institutions, facilities, departments, groups, centres
- Research outputs - articles, data
- Funding - grants
- Projects and activities
- Samples, observations, instruments, specimens

Common to all of the nine case studies are the following PIDs types:

- ORCID
- DOI
- ROR

RAiD was the next most common PID type featured in five of the nine case studies (Finland, Netherlands, UK, Germany and Australia). There is a long tail of PIDs including IGSN, ISBN, RRID, ARK, Handle and more.

PIDs comparison table

Case study	Function	PID type
Finland	Researchers, persons	ORCID; ISNI
	Organisations	VAT-number (not resolvable yet) RoR ISNI

		PIC (not resolvable yet) SF-edu-ID (not resolvable yet)
	Funding decisions	URN
	Publications	CrossRef DOI, URN JuFo-id - Publication Forum publication channel ID (en) ISSN ISBN PMID
	Datasets	DataCite DOI, URN
	Specimens	doi
	Infrastructures	URN
	Concepts, data types	PURL, URN, URI, QID
	Research Activity	RAiD
The Netherlands	Identification of researcher(s) for funding and reporting	ORCID
	Identification of research output for reporting	DOI, URN, ISSN, Handle
	Identification of organisation	RoR, ISNI
	Identification of research grants	CrossRef DOI/GrantID
	Identification of research project	RAiD
	Identification of data set	Handle, DOI
	Identification of researcher(s) for findability research output	ORCID, ISNI or DAI
	Identification of research software	DOI, SWHID
	Identification of instruments	DOI, Handle, RRID, UID
	Identification of samples	IGSN, ARK, URN, HTTP URI (CETAF URI), DOI, UUID, RRID, BioSample accession number
Canada	Existing consortia support	ORCID
	Existing consortia support	DataCite DOI
	Considering use case for	Crossref DOI

	centralised support	
	Considering use case for centralised support	ROR
UK	People	ORCID iDs
	Outputs	Crossref and DataCite DOIs
	Grants	Crossref DOIs
	Organisations	ROR (Research Organization Registry) identifiers
	Projects	RAiDs (Research Activity iDs)
Korea (KISTI)	Korean R&D outputs management	DOI (literature and data), Korean research funding ID, Korean national research ID
	Issuing DOIs to Korean research outputs, Intellectual properties, research data	DOI, ISNI, ORCID, ROR, WoS and SCOPUS author ID, Korean national author ID
Australia	Research grants	PURL or DOI
	Research outputs - articles, data, software and related materials	DOI
	Researchers, contributors	ORCID
	Research projects	RAiD
	Research instruments	DOI, Handle
	Samples and specimens	IGSN, DOI
	Research organisations	ROR
Germany	Research data	DataCite DOI, URN
	Instruments	DataCite DOI
	Academic Conferences	DataCite DOI GND (The Integrated Authority File) ID
	The persistent identification of cultural objects, holdings and collections and their contexts (associated events, actors, concepts) in the context of Humanities	GND ID
	Organisations & Projects	ROR

		GND ID Gepris Crossref Funder Registry RAiD
	Persons	ORCID GND ID
	Physical Objects	RRID IGSN
	PIDs for open access publication services and research information systems	No standard established at the moment
	Software	No standard established at the moment
	Text publication	Crossref & DataCite DOI URN
Czech Republic	Identification of researchers	ORCID
	Identification of research outputs	DOI (DataCite, CrossRef)
	Identification of organisations	ROR
	Identification of books	ISBN
	Identification of serial publications	ISSN
	Identification of printed music	ISMN
New Zealand	Deduplication of researchers Linkage with awards Authoritative attribution of affiliation and works	ORCID iD
	Identification of datasets, software and other types of research outputs	DataCite DOI
	Identification of organisations	GRID/ROR
	Identification of organisations in NZRIS	NZBN

Impact and monitoring

Summary: In most cases specific impact and monitoring activities have not yet been defined.

Example: Korea case study

KISTI's curation activities are reported and monitored to the Korean Ministry of Science and Technology. KISTI plans new research projects every 3 years in all divisions. It affects even essential infrastructure works (e.g., DOI RA management)
KISTI's current key concern is to accurately identify literature, authors, institutions, references and interlink them well. In this context, one of DOI RA's roles is to track the impact of Korean research outputs. (We named it as "Comprehensive interlinking identifiers")

Example: UK case study

The UK listed the impact of the work done to establish a national PID strategy as:

- Better understanding of the state of the art and best practice in the governance and delivery of PID services
- Increased awareness of persistent identifiers across the research sector
- Five validated priority PIDs selected through community consultation - outputs (DOIs), grants (Crossref Grant ID), people (ORCID), project (RAiD), organisations (ROR)
- Address inefficiencies and administrative burden in Open Access and publication workflows

Example: Czech Republic case study

The Czech National Library of Technology will deliver a cost-benefit analysis in two phases - in 2024 and 2028 (funded by project CARDS). The first phase will capture the current status of the selected PIDs usage within the Czech R&D environment and potential financial benefits of their effective implementation. The second phase will capture the progress in use of PIDs from 2024. We will also set up regular monitoring of progress regarding adoption of ORCID, DOI (and other priority PIDs) with a set of identified key metrics as part of the National PID Centre impact assessment. There is also a monitoring mechanism embedded in the CARDS project.

Summary

National PID Strategies are on the rise. We anticipate rapid evolution of the nature and number of these strategies in the near future. You can use the Guide, Case Studies and Checklist developed by the RDA National PID Strategies WG to:

- Inform the development of your National PID Strategy
- Develop a roadmap to accompany your strategy
- Align with international initiatives in this important area
- Facilitate stakeholder engagement with National PID Strategies
- Connect, communicate and collaborate with others developing National PID Strategies

The RDA National PID Strategies Working Group is evolving into the RDA National PID Strategies Interest Group. Please join this Interest Group to receive notices about upcoming meetings, new case studies and participate in this energetic community of practice.

Case studies

Case study	Link to case study	Date study created
Australia	Pending upload to Zenodo	
Canada		
Czech Republic		
Finland		
Germany		
Korea		
Netherlands		
New Zealand		
United Kingdom		

National PID Strategy Checklist

Instructions: National PID Strategies are on the rise but there is no single 'cookie cutter' approach to developing one. Use this checklist as a guide to starting and/or developing your national PID strategy. You do not need to complete all of the numbered points or follow the order. The checklist is designed to be used flexibly to help you think about what is needed. Simply choose which of the questions apply.

Number	Checklist
1	Have you established a clear value proposition for developing a national PID strategy? Does it speak to all stakeholders? Tip: Leverage existing value propositions such as: ● Brown, Josh, Jones, Phill, Meadows, Alice, & Murphy, Fiona. (2022). Incentives to invest in identifiers: A cost-benefit analysis of persistent identifiers in Australian research systems. Zenodo. https://doi.org/10.5281/zenodo.7100578 ● Brown, Josh, Jones, Phill, Meadows, Alice, Murphy, Fiona, & Clayton, Paul. (2021). UK PID Consortium: Cost-Benefit Analysis (1.0). Zenodo. https://doi.org/10.5281/zenodo.4772627 ● Lisa Goddard, 2021. "Persistent Identifiers as Open Research Infrastructure to Reduce Administrative Burden." Pop! Public. Open. Participatory. no. 3. https://doi.org/10.54590/pop.2021.006.
2	Have you identified your stakeholders (including their roles and responsibilities) and your approach to engaging them in the development of your strategy? Tip: conduct a landscape and stakeholder analysis; consider diversity, openness and inclusivity - how will you involve all stakeholders who want to be involved at the time they want to be involved? Stakeholders may include (but are not limited to): ● Researchers ● Publishers ● PID providers ● Research infrastructure providers ● Universities ● Research institutions ● Government ● Research funders
3	Have you developed use cases that support the strategy?
4	Have you established who (person, group) will take responsibility for coordinating (driving) strategy development? Tip: Involve key stakeholders across multiple sectors in a coordination group.
5	Have you considered the scope/coverage and/or system boundaries of the

	strategy?
6	Have you considered developing a roadmap to accompany your strategy? A roadmap can identify practical steps including roles and responsibilities of stakeholders and a timeline to implement the strategy. Tip: Identify steps for what needs to happen, what infrastructure is required, who is going to do it, how it is going to be funded (where applicable), when it needs to be done, plus any risks or dependencies.
7	Have you developed a vision for what the strategy will deliver and by when? Tip: Involve your stakeholders in a visioning exercise.
8	Have you secured funds needed to develop the strategy e.g. to run workshops?
9	Have you established an open, consultative and inclusive process to develop the strategy and/or roadmap? Will this be an iterative process with plenty of opportunities for feedback and adjustment?
10	Have you considered establishing working groups for stakeholders to explore different aspects of the strategy and include their outputs in strategy development?
11	Have you considered the mechanism by which submissions can be made into the strategy and/or roadmap? Tip: you may want to design a different submission form for general submission and another for working group submission
12	Have you developed key messages and a communications plan? Tip: build on your matrix of stakeholders, their roles and responsibilities, and add communication messages, mechanisms and timelines
13	Have you undertaken a benchmarking exercise (e.g. current levels of PID adoption) that will enable you to track progress against your strategy?
14	Have you considered how you will monitor and/or measure the success of the strategy?
15	Have you engaged with the international community (e.g. via the Research Data Alliance) to get input into the development of your strategy and to share your progress with others?