



**Enhancing Trust, Integrity, and Efficiency in Research
through Next-Level Reproducibility Impact Pathways**

Deliverable D5.2 – Tools and practices for publishers

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Table of contents

Table of contents.....	3
Executive Summary	4
List of Abbreviations	4
1. Introduction	5
2. Practical Tools and Practices for Publishers.....	5
2.1. Editorial workflow to increase data sharing.....	6
2.1.1. Scope & objectives.....	6
2.1.2. Development process & related activities	6
2.1.3. Final Outcomes	7
2.1.4. Value for Reproducibility	8
2.1.5. Stakeholder Engagement & Adoption.....	9
2.1.6. Editorial Integration & Applicability	9
2.1.7. Sustainability & Future Use	10
2.2. Editorial Reference Handbook for Reproducibility and FAIRness in practice	11
2.2.1. Scope & objectives.....	11
2.2.2. Development process & related activities	11
2.2.3. Final Outcomes	12
2.2.4. Value for Reproducibility	12
2.2.5. Stakeholder Engagement & Adoption.....	12
2.2.1. Editorial Integration & Applicability	12
2.2.2. Sustainability & Future Use	13
2.3. Research Artifact extraction tool	14
2.4. Reproducibility Monitoring Dashboard tool	14
3. Discussion.....	15
4. References.....	16

Executive Summary

D5.2 documents the tools and practices developed under Task 5.2 of TIER2 WP5 to support publishers in embedding reproducibility and FAIR principles into editorial processes. The work addresses a critical challenge: while data sharing policies are widespread in academic publishing, their implementation remains inconsistent, with only a small fraction of Data Availability Statements containing working links to data in trusted repositories (Colavizza et al., 2020; Federer et al., 2018; Graf et al., 2020).

Two key outputs were delivered through extensive co-creation with publishing partners. First, an editorial workflow to increase data sharing provides automated, “light touch” guidance to authors at the revision stage, encouraging immediate data deposition in trusted repositories rather than “available upon request” statements. Led by Know Center Research GmbH (KNOW), the workflow was developed through two co-creation workshops with 16 publishers and is currently being tested through a randomised controlled trial with Taylor & Francis. Second, the Editorial Reference Handbook supports reproducibility and FAIRness by operationalising the FAIR principles for digital research objects in the context of manuscript assessment. The Handbook is composed of a checklist, detailed guidance documentation and a flowchart. Led by University of Oxford (UOXF), the work on the Handbook engaged 35 participants from 19 journals and 11 publishers across co-creation and intervention phases, with 190 manuscripts assessed during real-world testing. Participating journals implemented an average of 9 out of 13 checks by the intervention's end, up from 4 checks pre-intervention, and reported strengthened data policies as a result.

Additionally, this deliverable references two tools developed by Athena Research Center (ARC), a research artifact extraction tool and a reproducibility monitoring dashboard, that support both publishers and funders in tracking reproducibility metrics. These are detailed in Deliverable 5.3.

Together, these outputs provide publishers with interventions at different scales and resource requirements, from automated manuscript-level guidance to comprehensive policy frameworks, enabling consistent practices that improve reproducibility across journals and disciplines.

List of Abbreviations

ARC – Athena Research Center
EU – European Union
DMP – Data Management Plan
FAIR – Findable, Accessible, Interoperable and Reusable
KIPs – Key Impact Pathways
KNOW – Know Center Research GmbH
RMP – Reproducibility Management Plan
RPOs – Research Performing Organisations
T&F – Taylor & Francis
UX – User Experience
UOXF – University of Oxford
WP – Work Package

1. Introduction

Publishers play a central role in setting standards for research dissemination, yet reproducibility is often undermined by inconsistent editorial practices and weak incentives for data sharing. To address this, Task 5.2 of Work Package 5 focused on designing and testing solutions that could be integrated directly into the publication process. The task built on scoping work from earlier WPs and engaged closely with editorial staff, and service providers to ensure usability and adoption.

This deliverable presents two key outputs developed through collaborative work with major publishing partners. First, we introduce an editorial workflow to increase data sharing that automates author guidance at the revision stage, providing practical support for depositing data in trusted repositories. Second, the Editorial Reference Handbook for Reproducibility and FAIRness offers journals a comprehensive framework of checks, workflows, and guidance to operationalise FAIR principles in manuscript assessment and strengthen data policies. Additionally, we reference two complementary tools developed by ARC under Task 5.2—a Research Artifact extraction tool that enables automated identification and annotation of research objects within publications, and a Reproducibility Monitoring Dashboard that provides funders and publishers with interactive capabilities to track reproducibility metrics across research portfolios. Both ARC tools are detailed in Deliverable 5.3.

These outputs represent different intervention points in the publication lifecycle—from individual manuscript handling to policy-level monitoring—ensuring that publishers of varying sizes and resources can find appropriate entry points for strengthening reproducibility practices. Each tool was designed with adaptability in mind, allowing customisation across disciplines while maintaining core principles (such as FAIR data) that support transparent, verifiable, and reusable research outputs.

The efforts presented in this report provide publishers with both actionable tools and a shared reference point, enabling consistent policies and practices that improve reproducibility across journals and disciplines.

2. Practical Tools and Practices for Publishers

This section presents the tools and practices developed under Task 5.2 to assist publishers in embedding reproducibility and FAIR principles into editorial workflows. Each subsection details one of the key outputs, highlighting their objectives, development approach, and final outcomes.

By structuring the section around these outputs, we demonstrate how Task 5.2 has translated collaborative work with leading publishers into concrete interventions. Together, these outputs provide both operational workflows and guidance harmonised across publishers, equipping them with new ways to foster transparency, consistency, and reproducibility across journals and disciplines.

2.1. Editorial workflow to increase data sharing

Related Pilot: Pilot 7

Responsible Organisation: KNOW

Stakeholders Addressed: Publishers

Type of tool/ practice: Workflow

2.1.1. Scope & objectives

Despite widespread adoption of policies requiring Data Availability Statements in academic publishing, only a small fraction contain working links to data in trusted repositories. Many authors state that data are "available upon request," yet such requests frequently go unanswered. Stakeholder consultations through the Research Data Alliance and TIER2's publisher stakeholder groups revealed that authors are often unfamiliar with what constitutes a useful Data Availability Statement and lack practical guidance on how to share their data effectively.

To address these problems, we developed an editorial workflow that sends authors an automated email with concise information about the benefits of data sharing alongside practical guidance on how to share data in trusted repositories. The workflow is designed to fit naturally into existing peer review processes without requiring substantial additional resources from publishers or editorial staff, although there might be additional workload for authors, depending on their current practices for data curation and sharing. By improving the transparency and accessibility of research data, this practice directly supports computational reproducibility¹, which depends fundamentally on the availability of data that others can use to verify and build upon published findings.

2.1.2. Development process & related activities

The workflow was developed through engagement with publishers and journals participating in TIER2. An initial stakeholder workshop with publisher representatives was held together with our colleagues from UOXF in May 2023. In response to questions about the current main challenges towards increasing reproducibility, the representatives mentioned that Data Availability Statements are ineffective if they allow authors to state that "data is available on request". Building on similar findings from Research Data Alliance working groups, the TIER2 team subsequently decided to develop a workflow focused on improving compliance with data sharing requirements and increasing the rate of manuscripts sharing data in trusted repositories.

To develop the workflow, we held two co-creation workshops in Spring 2024, which focused on developing a workflow that has the potential to increase rates of data sharing, but that is also easy to implement across publishers, with participants emphasising that any workflow would need to be "light touch". The workflow was thus designed to operate automatically after editorial decisions, requiring no ongoing manual effort from editors once integrated into publisher systems.

¹ Computational reproducibility being the ability of another researcher (or the original researcher in the future) to retrieve the same (or very close) numeric values from re-running the analysis code on the original data. (Kitzes et al., 2017, p. xxii)

The specific email template was finalised with input from our partners at Taylor & Francis (T&F), since T&F agreed to implement the workflow and test it within our complementary randomised controlled trial, designed to assess the workflow's effectiveness.

2.1.3. Final Outcomes

The primary outcome of this work is an editorial workflow that automatically sends guidance to authors after their manuscript receives a decision requiring revision. When editors make decisions requiring minor revision, major revision, or revise-and-resubmit, the manuscript management system triggers an automated email to the corresponding author. The email emphasises that revising the Data Availability Statement will have no impact on the editorial decision, positioning the guidance as supportive rather than evaluative.

The email template includes three main sections. First, it explains the benefits of immediate data sharing in repositories: increased citation impact, enabling cumulative science, and supporting reproducibility. Second, it provides step-by-step practical guidance on identifying which data to share, selecting appropriate repositories using re3data.org, protecting sensitive data through anonymisation or controlled access platforms like Zenodo, and ensuring proper consent for human participants' data. Third, it directs authors to journal-specific guidance where available and provides contact information for questions. The template is designed to be adaptable, allowing journals to customise repository recommendations or examples while maintaining core messaging.

The template is designed for journals that already have policies requiring authors to make data available upon request. Since authors have already agreed to share their data if requested, the purpose of the template is mainly to motivate authors to share their data immediately in a trusted repository.

The full email template is as follows:

Subject: Benefits of Open Data sharing for your manuscript [manuscript ID] at [Journal name]

Dear [insert author name],

This email relates to your recent submission to [Journal name]. You should have received a separate email regarding the outcome of the peer review process for [Manuscript ID / Article Title]. If you have not received this email, or have other queries relating to your manuscript, please contact [journal editorial email address].

When submitting to [Journal name], you agreed to make available the data and materials supporting the results or analyses presented in your paper. The policy of the journal requires that data is shared upon reasonable request, when you are contacted by future readers. Because it is beneficial to you and to others, we would like to encourage you to share your data in a trusted data repository however, rather than sharing only when requested to do so by readers.

Benefits of immediate Data Sharing in Data Repositories:

- Increased Impact: Studies show that publications with shared data receive more citations.
- Cumulative Science: It enables other researchers to build on your work.
- Reproducibility: Sharing data allows others to verify and reproduce your findings (giving you more opportunity for credit and recognition).

- Easier to manage: No additional effort if a reader requests access to the data (which could be months or years after publication).

When preparing your revised manuscript, please consider sharing the data and materials supporting your results or analyses in a data repository, and indicate in your Data Availability Statement where the data can be accessed.

Note: Your choice to use a data repository, and any subsequent revisions of your Data Availability Statement will have no impact on the editorial decision regarding your submission.

How to Share Your Data:

- Identify your data: You should share all of the data and materials supporting the results or analyses in your paper, including the data used to build graphs, tables or other figures.
- Select an appropriate data repository: You can find trusted data repositories where you can upload your dataset including some descriptive information (metadata) at <https://www.re3data.org>.
- Protect sensitive data: If public sharing is not possible due to ethical concerns, consider whether it will be possible to anonymise your dataset or use repositories like Zenodo to grant access to individual researchers (if your participants have provided consent).

You can find more extensive guidance on data sharing at [Journal name] at [Insert link to publisher specific guidance if available].

If you have additional questions about how to share the data supporting your manuscript, just respond to this email.

Yours sincerely,

[insert Open Research team signature]

[insert Email address]

2.1.4. Value for Reproducibility

The editorial workflow addresses a fundamental barrier to computational reproducibility by providing practical support for data sharing at a critical decision point in the publication process. Rather than simply enforcing policies, the approach educates authors about why data sharing matters and how to do it effectively when they are already preparing revisions. This timing increases the likelihood that authors will act on the guidance while their data and materials are readily accessible.

The workflow is appropriate for domains where primary data is generated that could be in principle shared, and can be adapted to the needs of specific communities with different ways of generating knowledge (Knowledge Production Modes, see Ulpts & Schneider (2023)).

across research domains. Best practices for sharing research data vary between research fields. The template can easily be adapted to these different contexts by pointing to more specific resources for finding appropriate repositories, or by including further guidance on other aspects specific to a certain domain.

The workflow's low-cost and scalable nature makes it suitable for journals with varying levels of resources and editorial infrastructure. If proven effective through the ongoing randomised controlled trial, this approach provides journals with a validated method for strengthening data sharing without requiring major investments in new infrastructure or additional editorial staff. Beyond direct effects on data sharing rates, the practice may have secondary effects on research culture by normalising data sharing and making researchers more aware of the broader benefits of transparency.

2.1.5. Stakeholder Engagement & Adoption

Publisher engagement began with an initial stakeholder workshop in May 2023, co-organised with colleagues from the University of Oxford. When asked about current challenges to increasing reproducibility, publisher representatives identified Data Availability Statements as ineffective when they allow authors to state "data is available on request." This feedback aligned with findings from Research Data Alliance working groups and informed the decision to develop a workflow focused on improving compliance with data sharing requirements.

Two co-creation workshops in Spring 2024 brought together publishers to develop the workflow. Participants emphasised that any solution would need to be "light touch" to be feasible across diverse journal contexts and publisher infrastructures. This requirement shaped the automated design, ensuring the workflow could operate without ongoing manual effort from editorial staff. T&F agreed to implement the workflow and test its effectiveness through a randomised controlled trial, providing early adoption and generating evidence about real-world applicability. Despite substantive efforts to onboard further publishers, we were unable to convince any other publisher to implement the workflow within our randomised controlled trial. The main reason was that despite our attempts to limit the effort required by publisher staff, implementing a randomised controlled trial still required input from multiple departments at the publishers (core team on Open Science, legal department, staff working on email templates, backend specialists), which was deemed too large a commitment.

The workflow is currently being tested across journals from T&F with varying submission volumes and disciplinary contexts. This pilot implementation provides insights into technical integration requirements, author responses, and potential barriers to adoption. The results of this testing will inform recommendations for broader rollout across publishers and help refine the email template based on empirical evidence about what messaging and timing prove most effective for encouraging data sharing. While randomisation for the trial has concluded, the study team led by Thomas Klebel is still waiting for enough manuscripts to be resubmitted to reach the target sample size. Once analysed, the results will be published in a peer-reviewed journal.

2.1.6. Editorial Integration & Applicability

The workflow integrates at the point when editors communicate their first post-peer-review decision to authors. When an editor makes a decision requiring revision (minor, major, or revise-and-resubmit) in the manuscript management system, the system automatically checks whether that manuscript should receive the data sharing guidance email based on a predefined criteria (such as only applying to research articles, but not to letters to the editor or reviews). For eligible manuscripts, the email is sent automatically to the corresponding author as a separate communication from the decision letter itself, making clear that it relates to the journal's broader support for data sharing practices rather than being tied to the specific editorial decision.

This workflow accommodates journals with varying submission volumes and technical capabilities. Integration requires adding the eligibility check and email trigger to the publisher's manuscript management system, but once implemented, it operates without ongoing manual intervention. The workflow can be adapted to journals across disciplines by customising the email template to mention discipline-appropriate repositories or adjusting data type examples to match community norms, while maintaining the core structure of explaining benefits and providing practical guidance.

2.1.7. Sustainability & Future Use

The editorial workflow is designed for long-term adoption through its minimal resource requirements once implemented. The automated email can be integrated into standard manuscript management systems as part of routine decision communications. The workflow operates independently after initial setup, with the system checking manuscript allocation and sending emails accordingly when editors make revision decisions. The template materials are openly available and adaptable, allowing publishers to customise repository recommendations or examples while maintaining core messaging.

Publishers can adopt this workflow as a standard practice after implementation. The ongoing randomised controlled trial will provide evidence about effectiveness across different journal contexts, helping publishers make informed decisions about adoption. Based on empirical results, the messaging could be refined to emphasise particular benefits or address common obstacles authors encounter.

2.2. Editorial Reference Handbook for Reproducibility and FAIRness in practice

Related Pilot: Pilot 8

Responsible Organisation: UOXF

Stakeholders Addressed: Publishers

Type of tool/practice: Handbook

2.2.1. Scope & objectives

Findable, Accessible, Interoperable, and Reusable (FAIR) data practices are increasingly recognised as fundamental to research integrity, transparency, reproducibility, and reusability. Although these principles have been widely endorsed by funders, institutions, and scholarly publishers, their consistent implementation continues to present significant challenges. In particular, there remain substantial barriers associated with the availability and sharing of datasets, software, and other digital research objects within research publications.

The Editorial Reference Handbook (<https://publishers.fairassist.org>; hereafter “the Handbook”) was developed to inform and support journals in operationalising a set of checks designed to enhance the FAIRness of data and support data-sharing practices that enhance reproducibility and facilitate reuse. Rather than prescribing a rigid process, the Handbook was conceived as a flexible framework adaptable to diverse journal contexts. The Handbook integrates structured checks, narrative guidance, and visual workflows to bridge the gap between data policy and editorial practice.

2.2.2. Development process & related activities

The Handbook activity was structured in three stages: (i) co-creation of the Handbook, (ii) intervention to test its application within real-world editorial workflows, and (iii) evaluation to assess the effectiveness of the intervention and to identify areas for improvement.

- **Stage 1: Co-creation (January–December 2024).** Engagement with project participants to assess the readiness of existing journal data policies and to identify support needs; review of good practice frameworks within publishing organisations and across communities; and, ultimately, the definition and development of the Handbook components.
- **Stage 2: Intervention (January–June 2025).** Identification and onboarding of participants; introduction to the Handbook; consensus building around realistic milestones and evaluation metrics; implementation of the intervention through the use of the Handbook to evaluate manuscripts submitted to participating journals over a three-month period; provision of ongoing support from the leadership team through biweekly check-in meetings; and administration of an exit questionnaire.
- **Stage 3: Evaluation (July–October 2025).** Review and collation of exit questionnaire results from both intervention and positive control groups; collaborative preparation of an article to disseminate the findings and formulate recommendations.

2.2.3. Final Outcomes

The Handbook establishes a shared understanding of a fundamental set of checks that help enable FAIRness, underpin reproducibility, and apply to all digital objects (e.g., datasets, code, materials) associated with a publication. The Handbook also maps these checks onto an idealised internal manuscript submission workflow. The Handbook is structured into three interlinked components (checklist, flowchart, and guidance) that may be used independently or in combination to assess individual manuscripts or, more broadly, to inform the updating of journal policies and submission workflows.

All Handbook content, including detailed information on the three Handbook components, is available at <https://publishers.fairassist.org/>. Additional material is available on OSF (<https://osf.io/4sx9q/>).

2.2.4. Value for Reproducibility

The Handbook can assist journals and publishers in two primary ways: (i) for those without internal guidance to enforce an open data sharing policy, it provides a workflow for assessing and improving individual manuscripts; and (ii) for those with existing guidance, it offers principles that can be used to validate and enhance current methodologies.

Implementing the guidance and checks provided in the Handbook within publishing workflows or updating and enhancing current practices have strong potential to foster reproducibility by enforcing best practice for sharing data. The checks in the Handbook are domain-agnostic and thus applicable for most journals.

2.2.5. Stakeholder Engagement & Adoption

In total, 35 participants contributed to the Handbook activity, representing 19 journals and 11 publishers. The co-creation phase was completed by 14 journals and eight publishers (full details at <https://publishers.fairassist.org/>) who participated in a series of workshops where iterative discussion and refinement produced the Handbook. Nine journals and three publishers participated directly in the intervention phase, with another 3 publishers engaging in an advisory capacity.

The intervention with six journals ranged in duration from approximately two to six months. Journal submission volumes varied widely, from tens to thousands of manuscripts, with the number of manuscripts assessed during the intervention ranging from 12 to 86 per journal, for a total of 190 manuscripts. Participants reported that the Handbook met their needs overall, noting that their journals had assumed a more active role in assessing the quality of digital objects and that policies had been strengthened as a result. Participants added an average of five new elements to their workflows during the intervention, from an average of four elements already implemented pre-intervention. With a total of 13 checks, this means that participants averaged 9/13 checks implemented at the end of the intervention.

2.2.1. Editorial Integration & Applicability

The processes of co-creation and intervention represent significant collaborative and practical steps toward the operationalisation of good open research practices. Journals and publishers

employ a variety of internal processes, and the successful implementation of the Handbook depends not only on the checks within it, but also on who performs it and at what point in the manuscript submission workflow it occurs. Accordingly, the co-creation phase of the Handbook focused on understanding how internal processes operate in practice and on identifying the most appropriate roles and workflow stages for each checklist element. Sessions were directed toward collecting information and experiences regarding when each check was likely to occur (or was already occurring, in the case of journals with existing practices), who would be responsible for carrying it out, and how it would be implemented.

The Handbook guidance component (<https://publishers.fairassist.org/>) is provided as a website, serving as the primary entry point for learning about and implementing the Handbook. It contains detailed documentation to support the interpretation and application of each checklist element by offering definitions, implementation advice, and procedural context. Major updates are described in a version history section and future revisions and updates are possible. Each element within the checklist and flowchart includes direct links to its corresponding guidance. The checklist can be applied in two principal ways: first, to assess manuscript compliance with the specified checks, and second, to update or validate existing internal tools or processes by aligning journal policies with the checklist elements and making modifications as needed. By offering a shared, operational resource grounded in a consensus set of small but practical checks aligned with journal roles and workflows, the Handbook addresses a critical gap and supports scalable adoption.

2.2.2. Sustainability & Future Use

Beyond its value as a practical resource, the creation of the Handbook was also a socio-technical initiative aimed at improving research culture by facilitating best practices and leading by example, thereby influencing and informing other publishers and journals. Participants in this activity were invited to share recommendations for journals and publishers seeking to adopt similar practices. They emphasised the importance of investing in training for in-house editors on good data practices and suggested using the Handbook as a practical entry point for implementation. In addition, participants stressed that each journal should maintain a clear data policy, with requirements and recommendations explicitly aligned with the checks being performed, thereby conveying a consistent and transparent message to authors and reviewers. Positive controls noted that the use of journal whitelists—mandating repositories and standards—was an effective means of strengthening policies and recommendations.

Looking ahead, the Handbook and its community have the potential to serve as a foundation for broader initiatives supporting reproducibility and FAIR data practices, policy harmonisation, and cross-publisher collaboration. Further integration with services such as FAIRsharing (<https://fairsharing.org/>) could enable the development of automated dashboards, policy audits, and metadata validation tools.

2.3. Research Artifact extraction tool

Related Pilot: Pilot 6

Responsible Organisation: ARC

Stakeholders Addressed: Publishers

Type of tool/ practice: software tool

ARC developed a research artifact extraction tool that is equally relevant to publishers and funders. The outcome of this work is reported in TIER2 D5.3.

2.4. Reproducibility Monitoring Dashboard tool

Related Pilot: Pilot 6

Responsible Organisation: ARC

Stakeholders Addressed: Publishers, Funders

Type of tool/ practice: software tool

Based on the work for the research artifact extraction tool, ARC further developed a dashboard that enables monitoring of sharing and reuse of data for publications. The outcome of this work is reported in TIER2 D5.3.



3. Discussion

D5.2 brings together two complementary tools that address different intervention points in the publication lifecycle. The editorial workflow for data sharing provides a “light touch”, automated intervention at the manuscript level, while the Editorial Reference Handbook offers comprehensive guidance for systematic policy implementation and manuscript assessment. Together, they enable publishers to strengthen reproducibility practices whether they are taking first steps toward open data or refining existing workflows. Below, we discuss learnings from across the Pilot activities that led to the creation of the tools reported above. We review engagement throughout the co-creation activities, discuss challenges in implementing the workflow and Handbook, and suggest pathways for how publishers might adopt the developed tools to support their workflows.

Evidence of engagement and adoption. The data sharing workflow was developed through two co-creation workshops (March and May 2024) with strong initial interest from 16 publishers, attracting 10 attendees from 9 publishers in the first workshop and 15 attendees from 12 publishers in the second. T&F committed to implementing the workflow in a randomised controlled trial, though broader adoption proved challenging. The Handbook engaged 35 participants representing 19 journals and 11 publishers across co-creation and intervention phases, with 190 manuscripts assessed during real-world testing. Participating journals implemented an average of 9 out of 13 checks by the intervention's end, up from 4 checks pre-intervention.

Implementation challenges. Both tools encountered barriers related to organisational complexity within publishing houses. Despite strong initial interest in the data sharing workflow, only T&F ultimately participated in the trial. The experience of implementing the workflow with T&F revealed that coordination across multiple publisher departments (open science teams, legal, technical infrastructure) was required even for tools designed to be “light touch,” likely explaining the lack of broader uptake. The randomised controlled trial requirement particularly raised implementation barriers despite publisher interest in outcomes. For the Handbook, the transition from co-creation to intervention saw reduced participation due to complex internal authorisation and prioritisation processes that are not easily adaptable to fast-moving, short-term projects. Strong internal leadership support and genuine commitment at the journal team level emerged as critical enablers. Once implemented, the most frequently cited operational barriers were time requirements, competing editorial tasks, and variability of authors' beliefs, willingness, and skills relating to key Handbook concepts such as FAIR. Publishers addressed these through educational and training-related modifications to submission workflows.

Publisher adoption pathways. Publishers should consider their current capacity and existing practices when selecting entry points. Those without established data sharing guidance could begin with the Handbook to build foundational policies and workflows, using the checklist and guidance components as primary tools while treating the flowchart as a reference for shared practice rather than a rigid template. Publishers with existing data policies but inconsistent compliance can immediately adopt the email workflow to support authors in meeting requirements. Larger publishers with dedicated open science teams can implement both tools in combination: using the Handbook to establish or validate systematic checks while deploying the workflow to provide timely author support. Smaller journals or publishers with limited technical infrastructure could prioritise the Handbook's guidance and checklist components, which can be applied

manually without system integration. Across all contexts, effective implementation requires clear data policies that align with the checks being performed, ensuring transparent and consistent messaging to authors and reviewers.

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