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Knowledge Exchange

Framework for scaling up reproducibility practices in research organisations

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DANISH e-INFRASTRUCTURE CONSORTIUM

This framework was created to assist research institutions in understanding how reproducibility can be scaled up internally. It is an output of a project conducted by Dr Michelle Barker and Prof. Neil Chue Hong on behalf of the **Knowledge Exchange**, to expand Knowledge Exchange work on **Open Science** on how the practice of conducting research in a reproducible way can be scaled up from pioneers to the majority of researchers and research support staff. This research aims to understand what types of practices assist individual researchers, research support staff, and managers to scale up practices that improve research reproducibility.

The framework can be used by a range of internal stakeholders with differing goals, such as institutional leaders seeking to align organisational strategies, or managers wishing to provide the support that staff in their part of the organisation may be seeking.

This framework is focused on how well organised an organisation is at scaling up reproducibility practices (i.e., access and coordination), not the maturity of reproducibility practices and how well they adhere to what is commonly understood to be best practice in reproducibility.

The framework consists of three parts, with more detail available in the **Knowledge Exchange report 'Approaches to scaling up reproducibility in research organisations'**:

1. **Organisational levels**
2. **Enablers of scaling up reproducibility**
3. **Assessment worksheet**

1. Organisational levels

This details levels that an organisation may progress through (rather than these being benchmarks). The levels are focused on internal aspects of the organisation; however, it is noted in the enablers that external factors can be relevant. Note that all levels can co-exist in the same organisation, particularly in different disciplinary areas; and different levels may be seen as beneficial by different stakeholders with differing goals. Please refer to pages 33 – 34 of the report.

	Level 1: Pockets of excellence	Level 2: Partially coordinated	Level 3: Organisational-level commitment
Characteristics	Pockets of excellence exist as fragmented, small initiatives, often in research teams or across individuals with similar concerns.	There is partial coordination within the organisation, such as within some teams or faculties, or methodologies across disciplines.	Organisational strategy articulates strategic objectives for the institution as a whole, including expectations of researchers. Processes and structures are coordinated to enable scalability and sustainability.
Locus of leadership	Mostly bottom-up.	Combination of bottom up/ top down.	Significant top-down leadership exists but bottom up remains important.
Communities of practice (CoP)	Practice is disseminated by motivated individuals to their peers, but the CoP is typically reliant on these individuals and at a small scale. These may engage and be supported by external communities (e.g. the Carpentries, ReproducibiliTea, disciplinary networks) but often do not have formal support from their own organisation.	CoPs start to span departments/faculties, and career stages of participants. There may be some formal support (e.g. a department helping to pay for speakers. catering, or administrative support) but it is still typically reliant on individual effort of volunteers.	There is institutional level engagement with external communities such as the Carpentries, national reproducibility networks, and engagement with national policy of relevance. There are significant established internal CoPs, potentially both institution-specific initiatives, and local expressions of external CoPs. The value of these CoPs is recognised and support is provided as part of the organisational strategy.

Note that all levels can exist at once in the same organisation (and can allow for different types of innovation), and different levels may be seen as beneficial by different stakeholders with differing goals.
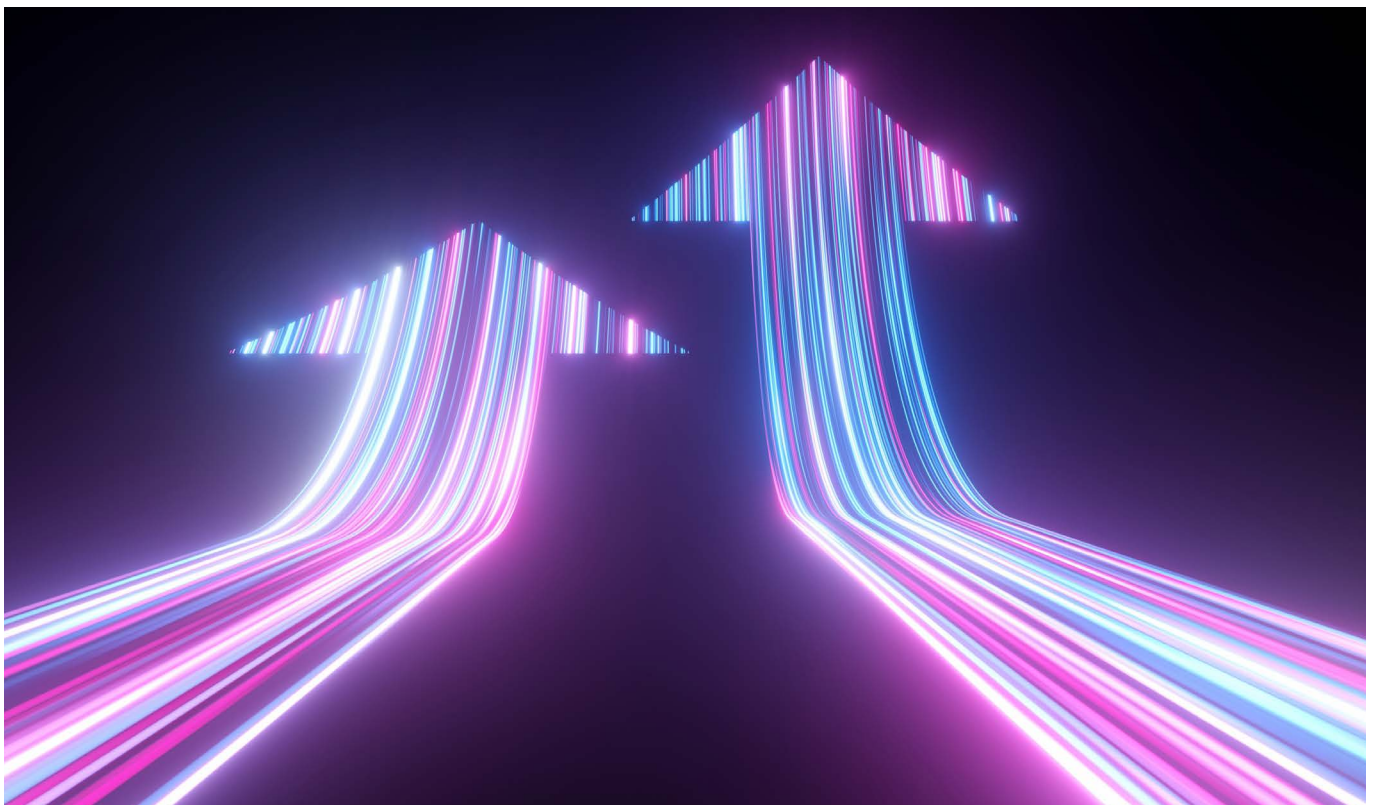
2. Enablers of scaling up reproducibility

Enablers support or catalyse the transition from one level to another, through a variety of interventions.

Our seven enablers are based on the Taxonomy of interventions at academic institutions to improve research quality by Davidson et al. (2022):

1. Tools
2. Education and training in research reproducibility
3. Incentives to enhance awareness, accessibility and understanding
4. Modelling and mentoring to encourage research reproducibility
5. Review and feedback
6. Expert involvement and advice
7. Policies and procedures

This table gives characteristics of each enabler. Note that not all characteristics will be present at each level, but a cluster of them are likely to be. The accompanying report provides more information and examples to assist with self-assessment. Please refer to pages 34 – 50 of the report.

	Level 1: Pockets of excellence	Level 2: Partially coordinated	Level 3: Organisational-level commitment
Tools	Digital tools that support reproducibility are available internally, but the majority of researchers may struggle to understand which infrastructure to use, when and how.	Access to or development of some digital tools is supported by some teams, faculties and/or disciplines, and supported by some training.	Digital tools that support reproducibility are widely utilised, integrated with other organisational tools, highly accessible and user-friendly, and supported by programs and/or personnel that increase awareness and skills.
Education and training	Individuals take responsibility for their own education and training in reproducible practices, mostly from external sources.	Some training exists in certain faculties or across disciplines, but are not creditable or part of formal curricula.	Training is scalable to meet demand, tailored to different stakeholders, and is a creditable, compulsory part of curricula and/or generally available to all.
Incentives	Individuals are intrinsically motivated to undertake reproducibility practices and promote the benefits to their peers/team.	Research leaders in some teams or faculties encourage reproducibility practices in line with their own values and practices, and/or those of their discipline.	Organisational cultures and values incorporate and value reproducibility practices, including research assessment, and hiring and promotion criteria.
Modelling and mentoring	Individuals model reproducibility supporting behaviours to their peers and/or teams.	Small internal communities that share best practice are built in some areas, such as across disciplines or teams in a faculty.	Internal communities are built and supported across the organisation to collaboratively implement reproducibility practices.
Review and feedback	Some research teams may have peer review processes that include reproducibility practices.	Some faculties or research leaders across disciplines may support review and feedback processes that facilitate reproducibility.	Organisational strategies and processes to support reproducibility incorporate review and feedback approaches.
Expert involvement and advice	Advice on reproducibility practices is usually provided by individuals for whom this is not part of their organisational role, but who may have personal expertise.	Some areas of the organisation may have access to dedicated roles that include supporting reproducibility, in research and/or centralised teams.	Staff in dedicated roles are supported by organisational strategy and centrally coordinated, with a clear mandate to lead across faculties to achieve scalability and sustainability.
Policies and procedures	Individuals may choose to adhere to disciplinary practices related to reproducibility.	Some policies and practices at faculty and/or discipline level set expectations and/or requirements for staff on reproducibility practices.	Organisational policies and procedures set expectations and/or requirements for staff, and evaluation of their efficacy occurs regularly.

Note: Some of the examples are relevant to a number of enablers and thus could be placed in multiple parts of the table.

3. Assessment worksheet

The aim of this assessment worksheet is to allow an organisation to assess its capability to support reproducibility practices, and act as a starting point for discussions around maintaining or improving this capability.

The aim of this assessment worksheet is to allow an organisation to assess its capability to support reproducibility practices, and act as a starting point for discussions around maintaining or improving this capability. Guidelines for usage are as follows:

Decisions on target levels should also include consideration of the following four areas:

1. **Macro-level environmental factors:** Research on the efficacy of reproducibility practices; national policy; and broader changes to the research ecosystem.

2. **Meso-level organisational factors:** Organisational vision, strategy and culture; and organisational structure, operations and resources.

3. **Meso-level change management strategies:** Use of change strategies; and benefits of consultation.

4. **Micro-level stakeholders:** The role of individual staff in the change process; and the role of individual researchers in driving change.

For further information, please refer to pages 51 – 56 of the report.

The assessment worksheet is based on the Digital Preservation Coalition's Rapid Assessment Model (DPC RAM) which enables an organisation to assess its digital preservation capability

Download the assessment worksheet here.